LONG TERM PROJECTIONS OF AGRICULTURAL SUPPLY AND DEMAND

AUSTRALIA

1965 and 1980

F. H. GRUEN AND OTHERS
DEPARTMENT OF ECONOMICS
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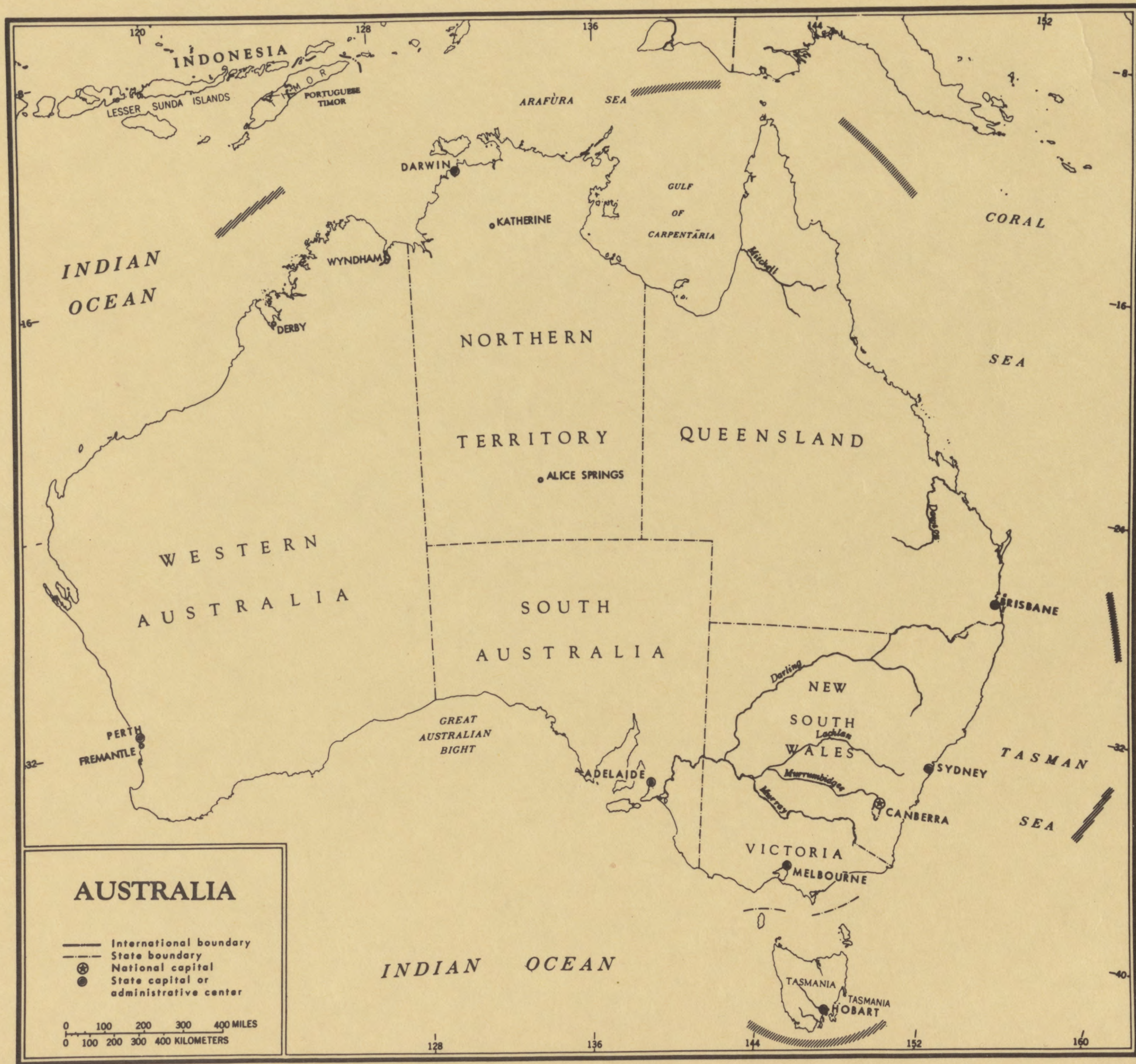
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LONG TERM AGRICULTURAL SUPPLY AND DEMAND PROJECTIONS

AUSTRALIA

1965 TO 1980

Department of Economics,
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PREFACE

This study was commissioned by the U. S. Department of Agriculture and is part of the evaluation carried out by the Department of long-term prospects for the supply of and demand for agricultural products throughout the world. Similar studies have been commissioned in many other lands including Japan, the United Kingdom, India, Austria, the Philippines, and Israel — to name but some of the country studies which have been published.

The study commenced on July 1, 1964 and was completed October 31, 1966. In many cases figures for 1965 which are quoted in the report were preliminary estimates at the time of completion. The deadline for revision of production and consumption estimates was September, 1966, and the latest estimates available to us were those found in the publication of the Bureau of Agricultural Economics, Trends in Australian Rural Production and Exports, No. 39 (Canberra, September 1966) (Mimeo). Of course, not all of our work could be modified to make use of these late figures; we have, however, taken them into account wherever possible.

Throughout the study, tons means long tons (2240 pounds) unless otherwise noted. Gallon measurements for milk are imperial gallons (10.3 pounds). The Australian dollar is equivalent to 1.12 U. S. dollars. The Australian pound £ was equivalent to US$ 2.24.

Since the publication of the Vernon Report (see p. 1 — 3) there has been a good deal of discussion in Australia about the usefulness of projections. The Vernon Report itself is somewhat ambivalent about them, drawing its — by now well-known — distinction between a "forecast" and a "projection". On the other hand the Commonwealth Treasury regards it as not only pretentious but "almost certainly harmful" to try to project the balance of payments. It goes on to argue that "the purpose of forecasting is, in the last analysis, to serve as a guide to action; but there are indeed few areas of the economy in which, to avert a feared situation 10 years hence, action is necessary now".

Since we are producing a large number of projections in the body of this report, it may be desirable to state at the outset our attitude to these projections, i. e., the conditional forecasts which they represent. No one attempting to make such conditional forecasts is likely to be under any illusion about the tentative nature of his conclusions: the number of arbitrary guesses and assumptions necessary in attempting to project such magnitudes as the world demand for wool is too great to enable those making them to have very much faith in the result.

In spite of this we believe that it is possible to justify the preparation of projections. Industry and government are constantly taking actions which have long-term consequences. The men making decisions about, e. g., whether or not to build a nitrogen fertilizer complex, must attempt, either formally or informally, to take into account likely future trends in the demand for nitrogen fertilizers — including potential demand by rural industries not at present using large quantities of artificial nitrogen. Many firms supplying production requisites to the farm sector (e. g., machinery, fertilizers, and other chemicals) are constantly attempting to make both short and long run forecasts of likely future developments. It may be of interest to quote from one confidential study of this kind which has been made available to us:

> "An outstanding finding of this study has been the paucity of reliable material devoted to the long-term evaluation of market prospects for Australia's major export earning products. Neither commodity marketing boards nor official sources inspire confidence in this area".

In other words, while our knowledge of the future is necessarily imperfect and vague, attempts will always be made to pierce the veil of the unknown. The Treasury's attitude seems to us to ignore the fact that "non-action" is also a type of decision — taken on the basis of the best facts available at the time. Thus the decision to defer the construction of the main Ord River dam implies some view of the likely future world price of cotton. Again, the decision to stimulate exports by mean of tax concessions and other incentives would not make much sense if one expected a chronic balance of payments surplus.

A final reason for publishing the actual projections is that the aim of the discipline of economics is ultimately not only to describe and explain the past and the present, but to make conditional forecasts. There is something to be learned from making such projections and finding out, in retrospect, where one has been wrong and, hopefully, why. Indeed some very useful examinations of past predictions have been made in recent years.* Because of their freedom of choice of research topics it may occasionally be a useful discipline for academic economists to try their hand at this type of exercise. While freedom is very important and beneficial, it does lead sometimes to a concentration on those aspects of an economic problem which lend themselves to interesting theoretical or statistical manipulation, and to the neglect of the less tractable but perhaps equally important problems confronting those concerned with the actual workings of the economy.

While we feel justified therefore in making our projections available to a wider audience, we want to stress most strongly their limitations. Patient readers would, no doubt, discover these themselves. However, since this is a very lengthy document, it is necessary to labour the point. First, the projections implicitly assume the maintenance of certain levels of income growth and world trade which are mentioned more fully in Chapters III and VIII. Second, they assume that no drought of the severity of the 1944—46 drought — or even of the 1965—66 level — occurs within the projection period (i.e., we have made allowance, as far as possible, for known sheep and cattle deaths to March 31st, 1966). Third, there are many areas where our basic knowledge of the underlying demand and supply relationships is still very weak. Lastly, there are still many loopholes in the basic statistics, relating both to Australian and perhaps even more to international data.

The research team consisted of members of the Department of Economics at Monash University. Most of these worked on the project part-time, while carrying on their normal full-time teaching commitments. As they are mostly younger members of the Department in the earlier stages of their academic careers, it seems desirable that, wherever possible, specific acknowledgement is made for the contribution of each member of the team. (Not that I feel their contributions should necessarily be judged by normal academic standards — the ambitious scope of the project and the need to meet deadlines meant that many areas could not be covered as thoroughly as one would normally regard as desirable).

* E.g. Henri Theil, Economic Forecasts and Policy (2nd revised edition; North-Holland, Amsterdam, 1961).

Mr. B.W. Brogan was primarily responsible for Chapters II and III; Dr. G.C. McLaren for Chapter IV (excluding sections 1 and 8); Dr. A.A. Powell for the six-sector supply model in Chapter VI, and the projections arising out of this model in Chapters VII and X. He also supplied the econometric analysis of retail demand by expenditure groups (Chapter IV, section 1). Dr. R.H. Snape was responsible for the international projections in Chapter VIII. The full-time members of the team were Messrs. L.E. Ward and T. Wachtel. Mr. Ward was mainly responsible for the supply analysis and projections for pigmeats, canned and dried fruits and poultry products (sections 4, 5, and 6 in both Chapters VI and VII); in addition he was partly responsible for the first two sections of Chapter VI, and was of general assistance to the editor in filling in numerous gaps elsewhere in the study. Mr. Wachtel was largely responsible for the sections on "Miscellaneous products" — namely cotton, tobacco, rice, tallow, hides and skins — for both the demand and supply chapters IV, V, VI, and VII.

Three computer programs were used extensively in this study: a conventional least-squares multiple regression program, a program for fitting simultaneous sets of supply equations, and a Monte-Carlo program used for projecting simultaneously the supplies of certain products. The first two of these were written by Dr. Powell; the third by our staff programmer, Mr. Tran Van Hoa.

I would like to thank the many individuals and organizations who helped us with information in the course of our study. These include our panel of consultants who made many useful suggestions in the early stages of our work. We have been given very full co-operation by both the Bureau of Agricultural Economics and the Commonwealth Bureau of Census and Statistics whenever we asked for access to unpublished statistical information. In particular I would like to thank Dr. S. Harris, Assistant Director of the Bureau of Agricultural Economics, who channelled our requests to the right sources within the Bureau and frequently provided helpful comments. Needless to say, none of these individuals or organizations is in any way responsible for those shortcomings and errors which remain in the report. Finally, I would like to thank our full-time research assistant, Mrs. T. Pez, for ther consistent and reliable help and my secretary, Miss J. Atkinson, for the exacting job of typing the manuscript and making all the necessary arrangements for reproducing the report.

F.H. GRUEN
October 31, 1966

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CHAPTER I

DETAILED FINDINGS AND CONCLUSIONS

The following quotation from the contract between U.S. D.A. and Monash University provides a summary of the aims of the study:

"The major objective of this investigation is: to obtain a rational projection of Australia's exportable supplies of agricultural products including wheat, rice, coarse grains (barley and oats), canned and dried fruits, dairy products, wool, poultry products, meats, tallow, and hides and skins and import requirements for cotton and tobacco for 1970, 1975, and 1980".

Under the terms of the contract, we agreed to provide an introduction including a discussion of the projection framework and presenting the major assumptions, limitations, and projection constraints which had a bearing upon the study. This is done in Chapter II.

Chapter III gives our projections of the Australian population, Gross National Product and Consumption Expenditure.

PROJECTION OF THE AUSTRALIAN POPULATION, 1960 TO 1980

Population growth is the net result of births, deaths, and net migration. A set of population projections is prepared by making a set of plausible assumptions about the relevant mortality, fertility, and migration parameters and then tracing out their implications over time.

Our Australian population projections take the 1960 age-sex distribution as the basic datum. Four population projection models, based on the work of W. D. Borrie and R. Rodgers, were examined and our "low" and "high" projections were built up from these. The assumptions of the models are given in footnote 27, Chapter III. The broad assumptions underlying our projections are:

(i) Both "low" and "high" projections assume the mortality rates experienced in 1957-59.

(ii) The "low" projection assumes a net annual migrant intake of 50, 000 persons, whilst the "high" projection assumes an intake of 100, 000. Under the terms of our contract we also have to specify a "most likely" level. Unless otherwise specified the "most likely" level is given by the arithmetic mean of the "low" and "high" projections—in this case 75, 000 migrants.

(iii) The "low" projection assumes that fertility is lower for native-born Australians than for migrants (and their descendants). For the first group the relatively lower 1955-57 fertility rates are assumed, while for migrants the fertility rates of 1957-59 are assumed. For the "high" projections the same fertility assumptions are made for the whole population, beginning with the 1957-59 levels of fertility and allowing for an irregular decline in the Gross Reproduction Rate from 1.68 in 1962 to 1.61 in 1970 and remaining constant after that.

In comparison with the projections recently issued by the Commonwealth Bureau of Census and Statistics, our mean population projections are conservative—they forecast a less rapid growth in Australia's population. They may nevertheless prove to be too high, though we would at present expect that some errors in our projections would counteract one another—the fertility assumptions are probably too high, whilst recent migration figures suggest that our migration assumptions may be too low. (Our population projections were originally prepared late in 1964). Mortality rates have stabilised for most developed countries and present few difficulties for the forecaster. However, both fertility and net migration are relatively unstable and cannot be forecast with the same degree of confidence.

Because of the uncertainty caused by the impact of the oral contraceptive pill on Australian attitudes to family planning, fertility trends are particularly difficult to assess at the present time. In the past the crude birth rate has fallen below 20.0 per 1,000 of mean population only in periods of extreme economic or political uncertainty—thus in the early thirties the crude birth rate fell to 17.2 and in 1940-44 it averaged 19.5. The crude birth rate fell from 22.85 in 1961 to 19.6 in 1965 and still appears to be falling. As a result, the fertility assumptions used in our projections may be too high.

Net migration is equally difficult to predict. In recent years the net flow of immigrants has been higher than the average level for the late fifties, but it seemed to us unlikely that the current high level of immigration (1964—104,000; 1965—112,000) will be maintained. This is not a marginal issue, since immigration has been a major component of Australian population growth during most of the post-war period.

Our actual population projections are given in Table 3.1.1. The "low" population projections imply an annual average (compound) growth rate of 1.8 percent; while the "high" projections imply one of 2.3 percent. In fact, for 1960-65, the annual compound growth rate averaged 2.0 percent.

PROJECTION OF AUSTRALIAN AGGREGATE OUTPUT

Even for the older Western capitalist economies it is still not clear what "causes" economic growth. The Australian economy possesses certain unique economic characteristics—it is a Western-style economy, but with relatively rapid population growth and an expanding frontier in terms of its resource base. The expanding resource base will likely lead to a rapid rise in the level of exports of a wide range of minerals.

There are some signs of broad structural changes taking place; in particular, a relatively slower rise in personal consumption expenditure than in private capital formation and Government expenditure. Within the Government sector, a shift in the direction of greater expenditure on educational services is likely and, at least in the short run, towards a buildup in Australian defence forces.

In the opinion of many writers, one important limiting factor to faster growth is the balance of payments. A recent committee of enquiry into the economy—in the so-called Vernon Report[1]—projected a deficit

1. Commonwealth of Australia, Report of the Committee of Economic Enquiry (2 volumes, Canberra, May 1965).

in the balance of payments on current account of $A million 894 to 1,394 by 1974-5—unless various counter-measures were taken. While these projections have been criticised on many grounds, no one has produced much more optimistic forecasts in terms of presently discernible trends. But the strongest critics of the Vernon projections question the value of projecting the balance of payments, arguing that Government action will—in due course—correct any imbalance, if necessary. The point remains, however, that at the existing rate of exchange the balance of payments may be an important limiting factor to faster growth of aggregate output in Australia.

In our opinion, another important restriction on the growth rate of output in Australia is the relatively low productivity of Australian capital. The reasons for Australia's apparently poor showing in terms of capital productivity are rather obscure. Australia devotes a relatively high proportion of her resources to capital formation, yet the growth rate in terms of G. N. P. per person (about 2.0 percent a year in the late fifties), is much lower than in most other countries investing a comparable proportion of their Gross National Product.

In terms of past performance, it seems unlikely that real G.N.P. in Australia will grow at a rate much in excess of 5 percent per annum; certainly higher rates than this have not before been sustained for more than a year or two. For our "low" income projection we assume a yearly growth rate in total G. N. P. of 4 percent; if past experience is any guide it is unlikely that a growth rate of less than 4 percent would persist for long.

The mid-point between the two projections provides a "most likely" G.N.P. growth rate at 4.5 percent per annum. This compares with average past growth rates of 4.2 to 4.5 percent during the post-war period (depending partly on the number of years taken and on the set of constant prices used). For a number of reasons, given briefly in Chapter III, it seemed reasonable to expect some slight improvement in future rates of growth in real G.N.P.

* * *

In Chapter IV, we discuss trends in Australian consumption in the post-war period and, in particular, the factors affecting consumpton of those agricultural products whose export-import balances we have to project.

THE ANALYSIS OF RETAIL DEMAND FOR BROAD COMMODITY GROUPS

It is usually assumed that the quantity of each good demanded is a function of an individual's income and the prices of all the various goods he can purchase; the amount demanded by the whole market being obtained simply by summing the amount demanded by each individual. Stated in this form, demand theory is unmanageable for estimating demand responses. To reduce the number of determining variables in each equation, one usual practice is to assume that all incomes vary in the same proportion and that average per capita income can be included as a variable determining per capita consumption. However there are still too many variables for each equation.

Two strands emerged in empirical demand analysis for coping with this problem. The first is based in part on Marshallian partial equilibrium analysis and in part on single equation least-squares method of estimation. With this approach, per capita consumption of a commodity is regarded as a function of per capita national income, of the price of a commodity, and possibly of the prices of important substitutes or complements. The usefulness of this technique rests upon the appropriateness of special assumptions regarding the behaviour of the omitted variables.

A second approach specifies the type of cross relations which can be expected between the change in the price of one good and the consumption of others. There are a number of different specifications of this kind which have been used in empirical work. One, which we might call the Leser model, assumes that all cross partial substitution elasticities are equal: i.e., that all indifference maps between every pair of goods have the same basic shapes. An alternative, more plausible, specification is that the indifference curves between any two goods or groups of goods, at given quantity co-ordinates, have slopes which do not depend on the level of consumption of any other good. Such an implication would follow from the postulate of directly additive preferences. This procedure corresponds to Pearce's neutral-want-association concept with one level of stratification.[2]

In the model for the analysis of retail demand for broad commodity groups adopted in this study, the latter specification has been adopted within the framework of linear expenditure functions. This model had to be modified somewhat in the analysis of a six-category classification of food expenditures.

The results are too lengthy to be reproduced here and are contained in Tables 4.1.4, 4.1.5, 4.1.6, 4.1.9, 4.1.10, and A4.1.1. Some of the results are used in Chapter V for projection purposes.[3]

2. L.F. Pearce, A Contribution to Demand Analysis (Oxford, 1964), Ch. 5.

THE DEMAND FOR INDIVIDUAL COMMODITIES

In the analyses of Australian demand for individual agricultural products, the level of per capita income is a variable often used to explain the level of per capita consumption. Income and price data used in this study were calculated from publications of the Australian Commonwealth Bureau of Census and Statistics.

There are some disadvantages in using personal disposable income as an explanatory "income" variable in the Australian context. In particular, the wool boom of 1950-51 raised real personal disposable income per person to a level which it did not achieve again until 1963-64. Since the increase in income was mainly in the hands of pastoralists forming a small proportion of the total population, we would not expect this increase to stimulate much additional expenditure on agricultural products. In many cases we prefer to assume that households and individuals make the "savings-consumption" decision first, and then make the decision regarding the allocation of total consumption expenditure to various components. In most of the following analysis, therefore, both personal disposable income and total personal consumption expenditure

3. The key tables for projection purposes are Tables 4.1.4 and 4.1.6 in the case of broad commodity groups, and Tables 4.1.9 and A4.1.1 for the detailed break-up of the food group. The price coefficients for the two models - the a_{ii}'s will be found in Tables 4.1.6 and A4.1.1 respectively and the income and shift coefficients - the b_i's and c_i's respectively - will be found in Tables 4.1.4 and 4.1.9 [columns 2 and 3 (upper section)].

have been tried as explanatory variables.[4] For some commodities, e.g., tobacco products, account was taken of possible shifts in the age-sex structure of the population by considering not per capita consumption but consumption per consumption unit.[5]

The price variables used in the single equation regressions are indices of "real" prices and were deflated by the food component of the consumer price index (cf. Chapter IV). The use of trend variables is avoided where a reasonable explanation of changes in consumption can be obtained from appropriate economic variables. Where a trend variable is included in a regression equation it frequently swamps the "economic" variables in the equation.

THE DEMAND FOR DAIRY PRODUCTS

In the face of steady per capita consumption of liquid milk it is very difficult to assign quantitative importance to specific factors. Regression equations (4.3.1) and (4.3.2) fitted to data for 1950-51 to 1962-63 gave coefficients with correct signs, but none were significantly different from zero when judged by the usual tests. In addition, the coefficients of multiple determination were very low ($R^2 = 0.25$ in each case). While little confidence can be placed on the estimated income and own price elasticities (ranging from 0.04 to 0.12 in the case of income and from -0.06 to -0.14 in the case of own price), they are not nonsense values, but tend to be similar to those obtained in other developed countries. Thus, in one survey conducted by F.A.O. it was concluded that "increases in disposable income and relatively small price changes have but little effect on liquid milk consumption".[6]

Per capita consumption of butter declined fairly steadily since 1950-51. While margarine consumption increased, the per capita consumption of table margarine and butter together has fallen steadily since 1953-54. On the other hand, per capita consumption of non-table margarine has increased since the mid 1950's. The production of table margarine is limited by Government quotas, whilst other margarine production is not restricted.

Several equations were estimated, using available time series data. Of these only two are reported here. Equation (4.3.3) attempts to explain per capita butter consumption in terms of "income" and the price of butter:

(4.3.3)

$$\log Q_b = 5.542 - \underset{(0.256)}{1.396} \log C - \underset{(0.148)}{0.282} \log P_b \qquad (R^2 = 0.784)$$

where Q_b is per capita consumption of butter, in pounds,

C per capita personal consumption expenditure at constant prices of 1953-54,

P_b real price of butter (1952-53 base).

The expenditure elasticity of demand for butter obtained from this equation, -1.396, seemed too high to represent just the preference for a different pattern of food expenditure as incomes rise. However, the other possible influences are difficult to disentangle. The most successful equation fitted (in terms of goodness of fit) is not very helpful for projection purposes. It consists of the following simple logarithmic time trend:

4. For a more detailed discussion concerning the construction of our income and consumption series, see footnote 94.

5. Where used, the consumption units are those of Colin Clark's United Kingdom study. [C. Clark et al., United Kingdom: Projected Level of Demand, Supply and Imports of Farm Products in 1965 and 1970 (U.S.D.A., ERS-Foreign 19, Washington, 1962), (Table 1, p. 90].

6. Food and Agriculture Organization of the United Nations, Means of Adjustment of Dairy Supply and Demand, Commodity Bulletin Series 37 (Rome, 1963), p. 47.

(4.3.4)

$$\log Q_b = 29.986 - \underset{(0.886)}{7.334} \log t \qquad (R^2 = 0.952)$$

where t = 1 in 1957 - 58.

The price of margarine was not very helpful as an explanatory variable.

Cheese is often regarded as a possible substitute for meat and so the price of meat has been included as an additional explanatory variable. Both income (or total consumption expenditure) and the price of meat appear to have a more significant effect on cheese consumption than does the price of cheese.

(4.3.5)

$$\log Q_c = -1.461 + \underset{(0.193)}{0.747} \log C - \underset{(0.126)}{0.0693} \log P_c + \underset{(0.204)}{0.244} \log P_m$$

$(R^2 = 0.786)$

where Q_c is per capita consumption of cheese, in pounds,

P_c real price of cheese (1952 - 53 base),

P_m real price of meat (1952-53 base)

and C is as defined above in (4.3.3).

The significant "income" (consumption) coefficient probably accounts for some increases in cheese consumption which result from other factors — the growing preference for non-cheddar varieties and the increasing proportion of migrants in the population.

Although per capita consumption of other milk products changed little from 1946-47 to 1954-55, there has been a steady increase since then. This increase seems to have occurred mainly in unsweetened condensed milk and powdered skim milk, and is probably attributable mainly to changes in tastes and technology. Condensed milk products are being increasingly used for infant feeding, while powdered milk products (per capita consumption of these rose from 1.0 lb in 1953-54 to 5.9 lbs in 1964-65) are in increasing demand for manufacture of bread and confectionary. The per capita use of powdered skim milk by these industries has probably reached a maximum, but other end uses have recently become significant — e.g., the protein fortification of infant cereals—and are helping to maintain the upward trend in consumption.

THE CONSUMPTION OF MEAT

Australian meat consumption is very high by world standards. From 1949-50 until 1958-59 beef and veal represented at least half of total meat consumption with mutton and lamb about a third. During 1958-59, consumption of beef and veal fell sharply and by 1960-61 per capita consumption was less than 70 percent of its earlier high level. The decline in local consumption was associated with the development of the U.S.A. as a market for Australian beef, with consequent high prices and short supplies in Australia. At the same time total meat consumption fell, but there was some substitution of lamb and mutton for beef. Between 1960-61 and 1963-64, consumption of beef and veal recovered, lamb was fairly steady, while consumption of mutton fell. Under the influence of higher prices, 1964-65 saw a renewed decline in beef consumption with marginal declines in the consumption of the two sheep meats. As few data exist for poultry, accurate estimates of changes in consumption are not possible.

The present Australian per capita consumption of poultry seems similar to that in the U.S.A. in the late 1920's.

An attempt was made to use a model consisting of four linear equations to describe the Australian demand for the three main types of meat.[7] Unfortunately this ambitious model was not particularly successful.

Recourse has therefore been made to single equation demand relationships of the conventional type for the four main carcass meats. Although theoretical objections may be made to such equations, they are nevertheless satisfactory for projection purposes. The results are shown below:

$$(4.4.1)\quad \log Q_B = 1.628 - \underset{(0.279)}{0.962} \log P_B + \underset{(0.382)}{0.290} \log P_L + \underset{(0.336)}{0.199} \log P_M + \underset{(0.525)}{0.551} \log C \qquad (R^2 = 0.832)$$

$$(4.4.2)\quad \log Q_L = 0.999 - \underset{(0.212)}{1.547} \log P_L + \underset{(0.155)}{0.502} \log P_B + \underset{(0.187)}{0.239} \log P_M + \underset{(0.292)}{0.827} \log C \qquad (R^2 = 0.981)$$

$$(4.4.3)\quad \log Q_M = 5.828 - \underset{(0.345)}{1.380} \log P_M + \underset{(0.287)}{1.198} \log P_B + \underset{(0.393)}{0.279} \log P_L - \underset{(0.541)}{1.729} \log C \qquad (R^2 = 0.843)$$

$$(4.4.4)\quad \log Q_P = 2.182 - \underset{(0.553)}{2.191} \log P_P + \underset{(0.457)}{0.186} \log P_{OM} + \underset{(0.489)}{2.812} \log C \qquad (R^2 = 0.895)$$

where Q_B is per capita consumption of beef, in pounds,
Q_L per capita consumption of lamb, in pounds,
Q_M per capita consumption of mutton, in pounds,
Q_P per capita consumption of pork, in pounds,
P_B real price of beef (1952-53 = 100)
P_L real price of lamb (1952-53 = 100)
P_M real price of mutton (1952-53 = 100)
P_P real price of pork (1952-53 = 100)
P_{OM} real price of meat other than pork (1952-53 = 100)
and C has the same meaning as before.

In all cases own price elasticities are significant while changes in the price of beef significantly affect consumption of both mutton and lamb. The consumption of lamb is related significantly and positively to the level of disposable income, whereas mutton consumption appears to decline as income increases. High values for the

7. This is a development of a model used by G. W. Taylor, given in "Meat Consumption in Australia", Economic Record Vol. 39, No. 85 (March 1963), pp. 81-87.

income and own price elasticities of pork were expected, since pork has long been a luxury item in Australia. However we felt that the "income" elasticity of 2.8 estimated in equation (4.4.4) seems rather too high for projection purposes. Thus we have employed an alternative (lower) estimate of 1.4.[8]

Finally, per capita consumption of meat was regressed on per capita disposable income and the real price of meat: no significant elasticities could be inferred from such an equation.[9]

THE DEMAND FOR GRAINS

Approximately 96 percent of wheat (other than that used for feed and seed) is converted into flour; the rest is converted mainly into breakfast foods. About two-thirds of flour used is consumed in the form of bread. However statistical analysis of the demand for bread is difficult because of the short period for which suitable statistics of bread production are available. Per capita consumption of flour and other wheat products has fallen substantially since the last war. The fitted demand equations are summarized in Table 4.5.2.

As in other high-income countries, there is a negative correlation between flour consumption and per capita income. However in the regression equations income has little explanatory value as a variable. While demand for flour responds to changes in the price of bread in the expected manner, little confidence can be placed in the result owing to inadequacies in the bread price index.

Very little has been written on the use of grains for stock feed and there are many gaps in the available data. Wheat is still the main component in the manufacture of prepared stock feed, but its relative importance has declined in recent years. Normal sales of wheat for stock feed have declined by approximately 50 percent over the last 15 years, though in drought years wheat sales for stock feed rise sharply. The amount of wheat retained on farms for stock feed does not show any clear trend.

The main uses of barley in Australia are malting and distilling and for stock feed. Very little is consumed directly by humans. Beer consumption per capita (or per consumption unit) increased fairly rapidly between the end of the war and 1954-55, but there is little evidence of a trend since then. There appears to be a relatively constant ratio between grain used for malting and the malt produced. Thus an estimation of future beer consumption can give a reliable estimate of future barley requirements for this purpose.

Direct human consumption of oats, maize, and rice is low, totalling less than 20 lbs per capita per annum. There has been no significant trend in the consumption of any of these grains. There appears to be a growing preference for the long- and medium-grain varieties of rice which, until recently, have not been readily available.

THE DEMAND FOR FRUIT

Canned Fruit

Consumption of canned fruit has risen substantially and in 1963-64, at 20 lbs per person, was almost double the pre-war and immediate post-war levels. This increase

8. This result was derived from regression which used personal disposable income rather than personal consumption expenditure as the explanatory variable. Whilst we would not wish to defend this estimating procedure as such, it did provide a convenient vehicle to impose our own judgements. We did not believe that an income elasticity as high as 2.8 could be maintained throughout the projection period.

9. Aggregating estimated individual meat income elasticities for beef, lamb, mutton and pork gives an income elasticity of demand for the quantity of total carcass meats purchased at +0.32 (at 1964–65 consumption levels); this can be compared with an income elasticity of expenditure on meat and fish of +0.71 (cf. Table 4.1.9).

was not spread evenly over the whole period but was concentrated in the years after 1958-59. Since that time average retail prices of canned fruits have been falling. In addition, an industry-financed promotion campaign has been undertaken since 1960. Attempts to relate canned fruit consumption to income, price, and the expenditure on sales promotion suggest that these factors could explain 80 to 90 percent of the variation in canned fruit consumption [cf. equations (4.6.1) and (4.6.2)]; however the coefficients obtained have large standard errors.

Dried Fruit

The bulk of the Australian consumption of dried fruits is in the form of dried vine fruits (some 70-80 percent of the total), the balance being made up of tree fruits: apricots, prunes and imported dates. Data concerning dried fruit consumption are not very precise and show year-to-year fluctuations which appear to be very erratic and related to movements in production rather than identifiable demand factors. To overcome these wide swings, the data used in the following equations were measured over two year periods. Since dried fruits are widely used as ingredients in cakes and other baked goods, per capita consumption of flour was used as an explanatory variable in the demand relationship for dried fruit. The results were:

$$(4.6.5)\quad \log Q_{df} = -9.091 + \underset{(0.816)}{0.717} \log P_{df} + \underset{(0.668)}{0.881} \log C + \underset{(0.876)}{2.443} \log Q_f \quad (R^2 = 0.877)$$

$$(4.6.6)\quad \log Q_{df} = 352.348 + \underset{(29.596)}{23.193} \log P_{df} + \underset{(24.228)}{33.451} \log C + \underset{(31.757)}{87.283} \log Q_f \quad (R^2 = 0.866)$$

where Q_{df} is per capita consumption of dried fruit, in pounds,

P_{df} "real" price of dried fruit (1952-53 = 100),

Q_f per capita consumption of flour, in pounds,

C personal consumption expenditure, at constant 1953-54 prices.

The price and "income" variables are not significant in either equation here, although the "flour consumption" variable is. The income elasticity of demand is 0.9 for equation (4.6.5) and 1.3 (1960-61 values) for equation (4.6.6).

THE CONSUMPTION OF EGGS

Statistical analysis of the egg industry is difficult, as an estimated 50 percent of total production has been from poultry farmers who were beyond the control of the various Egg Boards and who do not report production. Official figures suggest that per capita consumption has been lower since 1950 than before.

In fact, the equations fitted explain little of the total variation in egg consumption. There is, however, a reasonable amount of informal evidence which suggests that total demand for eggs—as opposed to demand for Egg Boards' sales of eggs—is not very responsive to price changes (cf. Chapter IV, part 7).

THE DEMAND FOR MISCELLANEOUS PRODUCTS

Cotton

The available data do not permit the estimation of income and price elasticities for demand for cotton goods in Australia.

Cotton is consumed primarily in the form of woven cotton textiles; at present the Australian textile industry supplies less than one-fifth of the total consumption of woven cotton fabrics. Between 1951-52 and 1962-63, annual consumption of raw cotton by the Australian industry was fairly stable at around 55 to 60 million lbs. Probably largely as a result of the additional tariff protection granted in late 1962 on finer counts of yarn, total raw cotton consumption rose markedly in the next 2 years to about 73 million lbs.

Tobacco

Between 1950-52 and 1963-64 total consumption of tobacco increased at an average annual compound rate of 2.8 percent. Of this growth, 70 percent can be attributed to the growth in the population over the age of 15, and the rest to an increase in per capita consumption for the relevant age group- from 7.1 lbs in 1955-56 to a peak of 8.2 lbs in 1960-61. It has since fallen slightly. The most striking feature of the Australian tobacco market in this period has been the decline in sales of cut tobacco relative to cigarettes. Consumption of cut tobacco has fallen from 3.6 lbs "per person of smoking age" in 1950-51 to 1.4 lbs in 1963-64, while consumption of cigarettes has increased from 3.5 lbs to 6.1 lbs.

Poor data means that it is difficult to analyse in a rigorous manner the determinants of the demand for tobacco products, but studies from other countries and the evidence from section 1 of this chapter suggest that the price elasticity of demand is almost certainly low. The regression equations estimated are of little use due to high standard errors for the various coefficients. The relationship between consumption per person of cigarettes and the proportion of the population in the 15-to-24 age group has been tested and found significant.

Tallow

Demand for edible tallow depends largely on the demand for margarine — in particular cooking margarine, this being the major outlet. Inedible tallow is used mainly in soap and washing powders. Per capita soap production (nearly all production is consumed within Australia) has declined almost continually since 1954-55. The decline has been particularly marked in industrial soap preparations and in soap extracts and powders. Meanwhile the manufacture of liquid detergents has increased considerably.

Hides and Skins

The use of leather products has declined in Australia partly because of the increasing use of cheaper substitutes in industrial processes, particularly in the boot and shoe and upholstery industries. In addition there has been a considerable rise in the quantity of leather goods imported into the country.

* * *

In Chapter V, projections of the likely levels of Australian consumption of these commodities are calculated, in the main, on the basis of constant real retail prices. In the case of meat consumption these should be regarded as first-round projections; the assumption of constant prices was relaxed later to allow for the influence of developments in overseas markets on Australian meat prices. "Low" and "high" projections was made for per capita consumption and these have been combined with "low" and "high" projections of total population.

Whereas total personal consumption expenditure per head is expected to rise by 39 to 51 percent between 1960 and 1980, all commodity groups related to this study are expected to rise at slower rates (food—$12\frac{1}{2}$

to 20 percent; tobacco and drink—15 to 18 percent; clothing—15 to 34 percent). A comparison of our "1965" projections of expenditure by commodity groups with actual 1964-65 figures is reasonably encouraging.

PROJECTIONS OF CONSUMPTION OF DAIRY PRODUCTS

Liquid Milk

A relatively constant per capita consumption of liquid milk is expected and low and high income elasticities of 0.0 and 0.15 have been assumed. These give 1980 projections of 290 lb and 309.6 lb per head respectively. Factors which may have an important influence on consumption in the future include the introduction of ultra-heat treatment for milk and cream. In some other high-income countries a shift of consumer preference away from milk has occurred.

Butter

Per capita consumption in the base period—1958-59 to 1961-62—averaged 25.3 lbs and 1964-65 consumption was 22.8 lbs.[10] Two sets of low projections of Australian consumption of butter have been made—one on the assumption that existing restrictions on table margarine production are maintained; the other on the assumption that they are relaxed completely. Other factors considered in the determination of likely levels of future consumption were the evidence of a decline in the consumption of total fats and of bread with rising incomes, and the health considerations which link the consumption of saturated fats with heart disease. If margarine production quotas are retained at their present level, per capita butter consumption is expected to fall further—to between 18 and 20 lbs per head in 1980. If margarine restrictions are removed completely a new "low" consumption of 12 lbs per capita is anticipated.

Cheese

It is expected that the observed upward trend in cheese consumption will continue, especially for non-cheddar varieties. An income elasticity of 0.75 (±0.2) has been used and it is assumed that the relatively high meat prices experienced since 1960 will persist. For 1980, low and high per capita consumption are projected at 8.1 and 9.7 lbs respectively (compared with 6.3 lbs in the base period and 7.2 lbs in 1964-65).

Other Milk Products

It is expected that there will be a substantial increase in the consumption of other whole milk and skim milk products, but that most of the increase will come from the latter group. In terms of milk solids, per capita consumption of total milk products in 1980 could be between 18 and 25 lbs (compared to 9.6 lbs in the base period and 12.2 lbs in 1964-65).

All Domestic Dairy Products

When the above projections are brought together, the total Australian consumption of dairy products derived from domestic milk production is projected to rise from 958.9 million gallons of whole milk in the base period to between 975 million gallons and 1,415 million gallons in 1980. The low figure is based on the assumption of no margarine restrictions; the high figure assumes retention of existing production quotas for table margarine and high population growth.

10. Our base period for purposes of all projections is the calendar year 1960. For those products where our information relates to fiscal years an average of the 4 fiscal years 1958-59 to 1961-62 has been adopted. Where information is available on a calendar year basis we have used the average of the 3 calendar years 1959-61.

PROJECTIONS OF MEAT CONSUMPTION

Much uncertainty attaches to the projected levels of consumption of poultry meats (mainly broilers). The lack of reliable data makes estimates of current consumption very hazardous, but we have projected an increase in per capita consumption from 12.0 to 12.4 lbs in 1964-65 to between 20.0 and 28.0 lbs in 1980.

For carcass meat the main factors influencing consumption are considered to be the continuance of fairly high prices, strong overseas demand, increased competition from poultry, as well as rising incomes. Low and high income elasticities have been choses as follows: beef and veal, 0.0 and 0.5; lamb 0.5 and 0.8; mutton, minus 0.9 and minus 0.6; pork, 0.9 and 1.4. These assumptions provide projected per capita consumption of carcass meat of 197.5 lb (low) to 229.3 lb (high), compared with consumption in the base period of 209.6 lbs. However the consumption projections are revised in Chapter X in the light of expected price changes.

PROJECTIONS OF GRAIN CONSUMPTION

(a) For Human Consumption

Wheat Products. Projections have been made on the basis of a negative time trend and a low positive income elasticity of demand (0.11). Both the low and high projections give a decline in per capita consumption in the projection period—from 249 lbs in the base period to between 180 and 222 lbs in 1980. Total consumption could then be between 45 and 60 million bushels.

Almost all human consumption of barley occurs in the form of beer and a constant consumption of 65.0 gallons per consumption unit is taken as the most likely projection, while a constant per capita consumption of 0.165 bushels of oats and a constant per capita consumption of 5.8 lbs of maize are used as the most likely projections.

Rice. A growing preference for long grain rice and the level of promotional activities may affect future consumption of rice. However we have used a constant per capita consumption of 6.55 lbs as the most likely projection.

(b) For Stock Feed

Projections have been based on current practice in the feeding of animals—broilers, laying hens, pigs, dairy cattle, sheep and others—and the projected stock numbers presented in Chapter VII.

THE PROJECTION OF FRUIT CONSUMPTION

(a) Canned Fruit

Although income elasticities were calculated, an examination of experience in other countries suggested that they were unrealistically high and per capita consumption has been projected on a subjective assessment of likely trends. We expect a rise from approximately 15.6 lbs in the base period to between 20 and 25 lbs in 1980.

(b) Dried Fruit

Vine Fruit. Projections have been made on the basis of an average income elasticity of 0.88 and an elasticity of 2.44 with respect to per capita flour consumption. The "most likely" per capita projection gives a slight decline in consumption between the base period and 1980, when consumption could be between 3.3 and 5.2 lbs, compared with 4.4 lbs in the base period.

Tree Fruit. A low projection has been made on the basis of a constant per capita consumption of 2 lbs and a high projection places consumption at 2.4 lbs in 1980.

PROJECTION OF EGG CONSUMPTION

In obtaining a low projection it was assumed that promotion activities will be successful in maintaining recent levels of consumption (17.5 dozen eggs per capita per annum), while the high projection assumes an income elasticity of 0.2. This projection raises per capita consumption to 19.0 dozen in 1980. Total consumption could be between 260 and 300 million dozen in 1980, compared with about 180 million in the base period.

COTTON

The high projection assumes that the Australian cotton processing industries will receive some further protection—resulting in a rise in per capita consumption of raw cotton by the Australian industry of five percent every five years. The low projection makes allowance for further competition from synthetic fibres, and estimates that replacement of cotton will reduce per capita consumption to 60 percent of its present level.

TOBACCO

Important factors influencing Australian consumption of tobacco are the age distribution of the population, rising real incomes, the level of tobacco advertising and the publicity given to the connection between smoking and lung cancer. Our low projection assumes a steady per capita consumption of 7.8 lbs per annum (the average level during 1959 to 1961), and the high projection assumes an annual increase of 0.2 lbs per head in the consumption of cigarettes, and some increase in the consumption of cut tobacco. Together these give a high per capita consumption of tobacco for 1980 of 10.8 lbs.

TALLOW

Inadequate data result in very tentative projections for tallow. We have put arbitrary lower and upper limits of 40,000 and 80,000 tons on Australian use of inedible tallow for 1980. For edible tallow, the low projection assumes that per capita consumption will remain constant. The high projection allows for the possible abolition of production quotas on table margarine production. If quotas are abolished per capita consumption of table margarine is expected to increase by 15 lbs per annum by 1980 and this may lead to an increase of 5 lbs in per capita edible tallow use.

HIDES AND SKINS

The low projections assume that Australian use will continue at the levels of 1965—2 million cattle hides, 750,000 calf skins and 2 million sheep and lamb skins. The high projections assume annual increases of 40,000, 20,000 and 40,000 in these types.

* * *

Chapter VI contains our analyses of supply— the factors influencing changes in the level of Australian farm output in the post-war period.

POST-WAR TRENDS IN AGGREGATE FARM OUTPUT

In 1946 Australian agriculture was in an unfortunate condition: depression, war, and drought had led to serious equipment shortages and to declining production of many major products. Fears of excess supply in the post-war period stimulated the introduction of a series of stabilisation plans. For many products these have since developed into price support schemes.

However, wool, beef, mutton and lamb, apples and pears have remained without such support.

In the early post-war years agricultural output increased but slowly. Following record prices during the Korean commodity boom and after the introduction of a number of government policies designed to stimulate output in the early 1950's, the index of farm output over the 10 years ended in 1963-64 grew at an average compound rate of $3\frac{1}{2}$ percent per annum—historically a very rapid rate of growth. Until the 1965-66 drought there was no evidence of a slowing down in this rate of growth; if anything it has tended to rise in the last few years. However, an index adjusted for seasonal conditions suggests that this apparent rise in the rate of growth in recent years was probably the result of seasons more favourable than average. The immediate effect of the drought has been an estimated 12 percent reduction in the index of total farm production in 1965-66. Due to heavy livestock losses, output will be affected for some years.

The post-war expansion of farm output has been achieved without any major changes in the land base, the number of farms or the total farm labour force. It has been made possible by a high level of capital formation, the use of increasing quantities of fertilisers, etc., and by technical advances. A statistical examination provided evidence of a relationship between farmers' receipts and their expenditure on fixed assets in the same year and the following year. However our attempt to estimate the relative contribution made to changes in output by changes in the quantity of labour, capital and current inputs was less successful. Very high correlation coefficients were obtained in various regression analyses, but attempts to isolate the relative contribution made by different factors failed owing to high multi-collinearity between the explanatory variables.

Despite the poor quality of the available data on farm inputs, some general conclusions can be reached concerning the nature of the Australian farm sector. It is technically dynamic and is using increasing quantities of capital—especially in the form of mechanical equipment. Furthermore, the proportionate use of non-farm produced inputs—fuel, fertiliser, etc.— is rising. In part this trend can be explained in economic terms as the gradual substitution of capital for labour in response to the rise in the relative price of farm labour. In addition, advances in technology have probably contributed to the gradual substitution of off-farm inputs for farm produced inputs. Superimposed upon this trend towards a more capital intensive agriculture, the volume of purchases of both fixed equipment and current inputs such as fertilisers has fluctuated with the changing economic position of Australian farmers.

PASTORAL PRODUCTS, CEREALS AND DAIRYING—A SIX-SECTOR SUPPLY MODEL

A detailed study has been undertaken of that sector of the economy responsible for the production of wheat, wool, dairy products, beef and veal, and coarse grains. These products account for the major part of the crop/livestock complex of Australian rural industry and are highly interdependent in that they compete in a very real way for the same resources.

Instead of looking directly at the relationship between the outputs and inputs of the various products, it was decided to take another approach well founded in economic theory, but curiously unexploited as an empirical technique. The emphasis here has been on the role of the various products in the crop/livestock sector as competitors for the inputs available for the production of such products. This approach utilizes the concept of the "elasticity of transformation"[11] which measures the responsiveness of the product mix ratio between pairs of products to changes in the marginal rate at which resources can be transformed from one product into the other. That is, the elasticity of transformation gives insights into the technical possibilities of shifting from one form of output to another, at the margin. In technical language it measures the curvature of the transformation curve between two products when resources and the levels of output of all other products are held constant.

There is considerable economy of computation involved in focusing attention on partial elasticites of transformation, since between pairs of products the two possible elasticities—one in each direction—are identical. It is shown elsewhere that, for any given numerical value of the elasticity of transformation, there exists a family of constant elasticity—CET—production possibility frontiers, which may move outwards from the original, or change their shapes so as to favour the production of one rather than the other product.[12] This CET assumption was utilized within a simultaneous linear supply system:

$$(6.3.2)\quad y_{it} = \Gamma_{it} + \sum_{j=1}^{6} a_{ij}\pi_{jt} + \epsilon_{it}, \quad (i = 1, \ldots, 6)$$

which states that planned output (y_{it}) of the ith product during time t is composed of a price-inelastic part (Γ_{it}) plus a linear combination of the prices expected to prevail during t, (π_{jt}); plus a random shock (ϵ_{it}). The price unresponsive part of supply is free to move through time as investment and technology shift the supply curves; however, the slopes (a_{ii}^{-1}) of the supply curves, as well as the parameters $\{a_{ij}\}$ $(i \neq j)$ determining the movement of the curve in response to the changes in the prices of other products, are fixed.[13]

In order to apply this model, suitable indicators of planned output and of expected prices are required. An attempt was made to remove, from the output indicators, the influences of autonomous trends in productivity (innovations not requiring substantial capital complements), and of weather conditions. The scope for experimenting with different models of price expectations was limited by the lack of suitable data and the large number of parameters already involved in the system.[14] Among the six products investigated there are 15 possible

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11. $\tau_{ij} = \dfrac{d\left[\frac{y_j}{y_i}\right]}{d\left[\frac{\partial y_i}{\partial y_j}\right]} \; \dfrac{\dfrac{\partial y_i}{\partial y_j}}{\dfrac{y_i}{y_j}}$ = elasticity of transformation, where the y's are outputs and the subscripts refer to products.

12. A proof of this appears in Alan A. Powell and F. H. Gruen, "The Constant Elasticity of Transformation Production Frontier and Linear Supply Systems", International Economic Review (forthcoming).

13. Using the above definition of the elasticity of transformation and taking account of the implications of the CET function it is shown in the paper cited in the preceding footnote that this model transforms to

$$(6.3.3)\quad y_{it} = \Gamma_{it} + \sum_{j \neq 1} \tau_{ij} x_{ijt} + \varepsilon_{it},$$

where

$$(6.3.4)\quad x_{ijt} = \bar{y}_i \left| \frac{\bar{\pi}_j \; \bar{y}_j}{\bar{\pi}_j \; \bar{y}_j + \bar{\pi}_i \; \bar{y}_i} \right| \left\{ \frac{\pi_{jt}}{\pi_j} - \frac{\pi_{it}}{\pi_i} \right\}$$

In equation (6.3.4) superscript bars indicate sample means over the observed period. Whereas equation (6.3.2) had N^2 price parameters, equation (6.3.3) has only $\frac{1}{2}N(N-1)$ price parameters, all of them being partial transformation elasticities (the τ_{ij}). The x_{ijt} are basically prices for pairs of products, scaled to take account of the relative shares in the value of the total output of the two products.

14. It was decided, therefore, to treat distributed lags parametrically, generating expected price series from the raw data for various arbitrary assumptions about Nerlove's coefficient of expectation.

$$\pi_t = \beta P_{t-1} + \beta(1-\beta) P_{t-2} + \ldots\ldots\ldots + \beta(1-\beta)^{n-1} P_{t-n}$$

where π_t is the expected price in period t.
P_{t-1} the price actually received in period t-1 (and similarly for other subscripts),
and β is a constant labelled "the coefficient of expectation".

In order to limit the range of possibilities, fixed ratios between the coefficients of expectations for the various products have been adopted—the ratios depending on the relative variabilities of the price series for the various products.

combinations of 2 products. Thus given the assumption of symmetry, there would be 15 partial transformation elasticities. However, further restraints were placed on the system, based mainly on prior belief—for example it was assumed that the partial transformation elasticity between wool and dairying is zero.

The model, then, involved fitting a linear supply model in which output was related basically to "prices" and in which there were permitted shifts due to autonomous factors such as drought and due to previous levels of output. The latter were regarded as substitute indicators for the short run capacity of the system to expand output of the various products.

A complete listing of the shift variables used in the various supply equations is set out in Chapter VI; and it would be pointless to repeat them here. Some general comments may be made however. In all equations (except that for the supply of beef), lagged outputs have been shown to be important explanations, whilst for most of the livestock equations a drought mortality variable has been added.

The empirical results obtained from the application of the model are summarised in Tables 6.3.2, 6.3.3, 6.3.4, and 6.3.5. They are too lengthy to be reproduced here; instead we shall briefly discuss some of the more important findings. The general fit of the supply equations is good—R^2's ranging from a low of 0.83 in the case of dairy products and coarse grains to 0.89 for beef and wheat and a high of 0.98 for wool. Lagged outputs were highly significant in all cases under the usual statistical tests, as was the opening inventory of non-breeding cattle as an explanator in the beef equation.[15] The two drought mortality indexes—for sheep and cattle— yield coefficients statistically significantly different from zero at the 5-percent level for the lamb and beef equations respectively. The five partial transformation elasticities have high standard errors attached to them—only beef/dairy, lamb/dairy and marginally wool/wheat reaching statistical significance at the 5-percent level. (The remaining transformation elasticities are wheat/coarse grains and lamb/wool). The estimation of 5 transformation elasticities has permitted the estimation—without further statistical computation— of 6 own and 10 cross elasticities of supply.

As is to be expected, the 1 year own price supply elasticities tend to be rather low— ranging from 0.051 in the case of wool to 0.18 for wheat, 0.20 for dairy, 0.21 for coarse grains and 0.25 for lamb. In addition, with this technique it is possible to estimate where the increments in output "come from" when a product's own price is increased. Thus in the case of wheat production, about 60 percent of the response is derived from potential wool growing foregone and 40 percent from a shift in acreage from the different coarse grains to wheat. A rather surprising finding is that most of the price-induced changes in lamb production have resulted from changes in the price of lamb relative to dairy products (rather than to wool). However, since lamb production has recently increased most rapidly outside the traditional lamb-producing areas, this finding is perhaps not as surprising as it might appear at first sight.

Although it is not our intention to use such for projections, we have also tabulated 5-year period and long-run estimates of own price elasticities of supply.[16] These are given in Table 6.3.5; the 5-year own-price supply elasticities range from a low of 0.25 for wool to 0.8 for wheat and also for coarse grains and to a high of 0.94 for lamb.

15. As pointed out in Chapter 4, the classical significance tests may be construed as an approximate guide only.

16. These are based on the Nerlovian concept of "the coefficient of adjustment", cf. Marc Nerlove, The Dynamics of Supply: Estimation of Farmers' Response to Price (Baltimore, The Johns Hopkins Press, 1958), p. 62.

THE SUPPLY OF OTHER MEATS

It was originally intended that changes in mutton production be covered within the framework of the above supply model. However attempts to derive quantitative estimates of the response of mutton production to changes in the relative price of mutton—even within the framework of a simultaneous supply/demand system for mutton—were completely unsuccessful. Mutton is essentially a by-product of wool; changes in output are best explained by the number of sheep shorn, the annual change in the number of sheep shorn, and a drought index.

Pig raising in Australia has been generally associated with dairy farming—skim milk being a major source of feed. However, recently there has been a trend towards increasing specialisation, use of more grain as pig feed and the location of some specialised pig producers in grain producing areas. There is some evidence of a response of output to changes in price.

THE SUPPLY OF FRUIT

Canned Fruit

There are two distinct sections in the industry: deciduous tree fruits and pineapples. The former group comprises, in order of importance, peaches, pears, and apricots. These fruits are produced mainly in the southern States while pineapples are grown mainly in Queensland. Canned deciduous fruit production has more than doubled over the 15-year period 1949-50 to 1964-65. The growth in the total fruit crop is attributable mainly to increase in yields per acre rather than a rise in the bearing acreage. For pears and pineapples, the proportion of the total crop canned has risen substantially over the period; however, in the case of apricots there has been a long term downward trend. Year-to-year variations in the output of deciduous canned fruit are closely related to changes in fresh fruit production. There is also some evidence of response to the minimum price laid down by the Fruit Industry Sugar Concession Committee (F.I.S.C.C.)—a Government agency which decides the minimum price for fruit to be paid by processors in order to qualify for a rebate on their sugar purchases. In the case of pears and peaches these two factors account for about 95 percent of the annual variation in canned output, whilst in the case of apricots they account for more than 60 percent (cf. Chapter VI). To predict output of canned fruit it is therefore necessary to predict the output of fresh fruit. While bearing acreage tends to remain reasonably stable from year to year, yields per bearing acre can fluctuate quite markedly as a result of changing seasonal conditions. Canned pineapple output can also be explained in terms of fresh fruit production and the minimum price specified by the F.I.S.C.C. In addition there is evidence that the non-bearing acreage responds fairly readily to changes in the prices paid by canneries, so that bearing acreage also responds, with a lag of 2 to 3 years, to changes in the prices received by growers.

Dried Fruit

Australia is the world's third largest producer of dried vine fruits. The major producing areas are the irrigation areas adjacent to the Murray River in Victoria, South Australia and New South Wales. Bearing acreage of dried vine fruits has remained fairly constant in the post-war period (between 55,000 and 65,000 acres); production has fluctuated more markedly. Variations in yields per bearing acre are again primarily a result of weather conditions, though for some varieties there may be a tendency for heavy and light yields to alternate. On average, post-war yields have risen by about 2 percent per annum.

The industry is protected by a two-price scheme and, since 1964, by a government-guaranteed minimum price scheme which has certain additional stabilisation clauses. Vine growers can channel their product to three different markets—dried fruit, wine or fresh fruit. There is some evidence to suggest that small shifts in production take place in response to changes in the relative price offered in these markets.

Prunes are produced mainly in New South Wales and there are few alternative outlets for producers. The acreage planted to prunes has remained fairly stable, but yields have risen substantially. Dried apricots are produced almost entirely in South Australia and production has responded rapidly to changes in the price obtained from canneries and dried fruit outlets respectively (cf. Ch. VI).

THE SUPPLY OF POULTRY PRODUCTS

Eggs

A two-price scheme operates, payments to producers by the State Egg Boards being the average of receipts from local sales and lower-priced overseas markets. Until 1965 a large section of the industry was beyond the control of these State Egg Boards: it has been estimated that approximately half the eggs produced in Australia were outside the control of the various State Egg Boards. Such producers were able to sell at domestic prices higher than the average payments to "controlled"—Egg-Board-registered—producers. In 1965 a new Commonwealth levy on hens was introduced which will make evasion or avoidance of Egg Board levies more difficult. There is evidence to suggest that "uncontrolled" production of eggs will decline as a result of the new legislation. This is discussed more fully in Chapter VII. Because of the large proportion of total output from "uncontrolled" sources, statistics of total egg production are probably not too reliable. "Controlled" egg production fell from 115 to 120 million dozen eggs in the late forties to 100 to 110 million dozen eggs in the fifties. Since 1959-60 production has fluctuated between 110 and 124 million dozen eggs. There is evidence of some production response to changes in the prices of both eggs and feed (i.e., wheat for stock feed).

In recent years there has been a trend towards larger poultry farms and a decline in the proportion of hens on farms with less than 2,000 birds.

The broiler industry has developed rapidly since about 1959; however Australian per capita consumption is still much lower than in many overseas countries. Judged by overseas standards, the efficiency of conversion of feed to meat is still low, though it has probably improved considerably over the years. Estimates of production are still rudimentary. While production costs have declined in recent years, it seems unlikely that costs can be lowered sufficiently to permit re-entry into the export market. (During the early post-war years a fairly substantial export trade in poultry meat developed).

THE SUPPLY OF MISCELLANEOUS PRODUCTS

Until 1959-60 commercial cotton production was restricted to Queensland, but since then New South Wales has become the largest producer. N.S.W. production has been entirely from irrigated areas; in particular from the Namoi-Gwydir region. In 1963-64 commercial cotton production commenced on the Ord River in Western Australia and has increased rapidly since. Australian production in 1965-66 was more than ten times the 1962-63 level.

Australian cotton production has been protected by a variety of methods since the early 1920's. The Raw Cotton Bounty Act of 1963 represents a considerable improvement in the method of protection. Under this Act a basic bounty rate of $A 0.13432 per lb of "white middling one inch" cotton is payable, with variations for other grades. An important provision of the Act is that the total amount of the bounty is limited to $A 4 million. With the very rapid growth of production in recent years, the bounty rate per lb is declining—in 1965-66 it will probably be about 60 percent of the basic rate.

The production of tobacco has also grown rapidly in recent years: it also receives substantial protection. Until recently this protection took the form of a duty rebate to manufacturers who used a minimum proportion of locally produced leaf. In 1965 additional regulatory measures were introduced. Under these regulations, all tobacco growers are to receive individual marketing quotas and "quota" leaf is sold under an agreed grade and minimum price schedule. The major tobacco producing areas are the Mareeba district in Queensland and the Ovens and King River valley in Victoria. Production has risen from about 6 to 8 million lbs prior to 1957-58 to a peak of 33 million lbs in 1963-64. The national marketing quota has been established at 26 million lbs. While growers are at liberty to produce quantities in excess of their individual quotas, no minimum prices are fixed for such leaf.

Commercial rice production is confined almost entirely to irrigated farms in New South Wales. Rice is produced mainly in conjunction with wool and lambs. The area sown to rice is controlled by a New South Wales Government agency which determines water allocations to individual growers. The level of output therefore depends largely on conscious administrative decisions. Average yields have risen substantially over the last ten years.

Tallow production depends largely on beef and mutton slaughterings and on the form in which beef and mutton are exported. When beef and mutton are exported in boneless form, considerably higher yields of tallow result than when they are exported in carcass form.

Production of hides and skins is recorded in three components—cattle hides, calf skins, and sheep and lamb skins. Production is obviously related to the number of stock slaughtered.

* * *

Chapter VII contains our first attempts at projecting the Australian supply of farm products. In view of our inability to estimate an aggregate production function for Australian agriculture, no attempt has been made to project total agricultural output. For the major commodities specified in our contract—wool, lamb, wheat, coarse grains, beef and veal, and dairy products— a simultaneous projection model has been developed, which tackles this problem in a manner which is novel in the Australian context. This projection technique is based on the six sector supply model of Chapter VI. It is discussed in more detail in Chapter II; here a very brief outline of the projection model will be given.

The simultaneous supply equations in Chapter VI estimate output on the basis of: (i) a variety of shift factors—in particular past output and drought variables; and (ii) the expected prices for the various products. Our projections for these six products were based essentially on a simulated extension over time of the supply model of Chapter VI.

Autonomous productivity increases (i.e., the long term rise in crop and livestock yields) were assumed to continue at the average rates obtained in the past. Before simulation was possible the starting values for past output were decided on, as was the broad trend of the expected prices. Once these major decisions were taken, the simulation programme took random samples of drought variables and 'shocks' in prices from past historical time series (though the average values of prices were specified). The programme then traced out a 15-year time path of output for each product—using the previously generated random values of drought indicators and expected prices. Sample means and standard errors were generated over 100 replicates.[17]

The supply projections for these six products in Chapter VII constitute the first round of a two-step approach to "equilibrium" projections in Chapter X. In particular, constant average prices (generally equal to those ruling in the base period) were used for these first round projections. Since these are purely preliminary projections, there is little point in reporting the results here.

Projections for mutton, tallow, and hides and skins, depend largely on sheep numbers and sheep and cattle slaughterings; hence projection of output of these products is deferred to Chapter X when the final "equilibrium" projections for wool production and beef output are made. Projection of pigmeats has been made mainly on the basis of expected changes in domestic demand since little is exported and the volume of exports is not expected to rise. Here again our projections in Chapter VII are first round projections, to be modified on the basis of expected changes in the retail prices of other meats.

PROJECTIONS OF FRUIT PRODUCTION

Projections of canned fruit production were made separately for the major products—peaches, pears, apricots and pineapples. They are built up from expected future trends in the bearing acreage for different fruits, the likely trends in yields and of the proportion of the total fresh fruit crop which may be expected to be canned. Total canned production increased from around 7 million cases in the base period to 10 million cases in 1965; a further rise of 3 million cases is projected for 1970; after that the rate of increase in production is expected to slow down. By 1980 the "most likely" total canned output is projected at 16.8 million cases. Production of mixed fruits, pineapples and pears is expected to expand most rapidly.

Over the last five years, dried vine fruit production rose by about 28 percent; this being largely the result of an increase in yields. In the next 5 years production is unlikely to increase; in fact a small (7%) decline in the "most likely" output is projected—yields being abnormally high in 1965. During the following ten years an average increase of about 2 percent is forecast.

PROJECTIONS OF SUPPLY OF POULTRY PRODUCTS

Eggs

The new Egg Marketing Plan is likely to stimulate increased egg production in Australia, mainly because it will allow "controlled" producers to increase their share of the higher-priced local market. Our projections are based on conjectures about the possible effect of the new Plan on unrecorded production, on the estimates of the size of the local market made in Chapter V, and on the supposition that the two price schemes will encourage an expansion of output to those levels where the equalised price falls again to the levels ruling before the new Marketing Plan was put into operation. "Controlled" production is therefore expected to expand by 45 percent in the next five years—compared with an increase

17. Since the programme did not prove particularly sensitive to the number of replicates, this was reduced in later Monte Carlo experiments to 60.

of 12 percent between 1964-65 and our base period (the average for 1958-59 to 1961-62). After 1970, expansion is likely to be at approximately half that rate.

Broiler production is forecast on the basis of the, admittedly crude, consumption projections given in Chapter V. It seems unlikely that any sizeable export markets could be won by local producers, but imports are not likely to be tolerated on any sizeable scale.

SUPPLY PROJECTIONS FOR MISCELLANEOUS PRODUCTS

The future level of cotton production will depend largely on the Government's bounty policy and its attitude towards the construction of additional irrigation works—in particular the main Ord River dam in Western Australia. Projections were made on the basis of possible future acreages in New South Wales, Western Australia, and Queensland, and extrapolation of yield trends. Cotton production increased from 4 1/2 million lbs (lint) in the base period to an average of 35 million during 1964-65 and 1965-66.[18]

Because of the uncertainties surrounding Government policy, 1980 production may be anywhere between 45 and 260 million lbs. Details of the argument underlying these very wide limits are given in Chapter VII. Our "most likely" 1980 projection is 65-75 million lbs.

Tobacco production will again depend largely on Federal Government policy—in particular on the minimum levels of leaf which manufacturers have to purchase to qualify for duty rebates and on the size of the annual marketing quota. Our projections are based on some conjectures regarding Government policy and on likely changes in domestic demand for tobacco. Over the 15-year period to 1980, production increases of 75-100 percent are regarded as possible.

Rice output, too, is closely controlled by a Government agency—the N S.W. Water and Irrigation Commission—which determines the areas farmers are allowed to plant to rice. At present the control is administered primarily to ensure a "reasonable" price to growers. In recent years the area sown has been increasing at a rate of about 4,000 acres per annum. This is primarily due to the increased area sown to rice on the Colleambally Irrigation Area. Additional stages of this Irrigation Area are to be opened up in the next 10 years. Unless prices decline markedly, we can expect an expansion of acreage of about the same order for the duration of that period. Our high projection allows acreages to grow at the high rate that seems possible in view of the suitable land available. Our low projection assumes that the rise in rice acreage will be limited to the growth in the size of the local market. The results are given in Table 7.7.4. The projections do not assume that a significant output will come from the northern regions of the continent, although large-scale experimental plantings are being carried out there.

* * *

Chapter VIII contains our constant price projections of world trade for grains, dairy products, and meats. For this purpose, we divided the world into 12 regions. For major products, wherever possible, both demand and supply have been projected separately for each region. Projections of demand (for food purposes) are based on projections of population and per capita income and on estimates of the relationship between per capita incomes and consumption. For our population projections, we

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18. However production in 1965-66 was twice as large as in 1964-65.

used the forecasts of the Department of Economic and Social Affairs of the United Nations. Assumptions regarding income growth rates were made in the light of three main factors: (i) the rates achieved through the 1950's, and, where available, the rates achieved over longer periods, (ii) the rates assumed by other projectors (particularly F.A.O.[19] and Bela Balassa[20]) and, occasionally, (iii) planned national growth rates. In each case high and low limits have been placed on projected growth rates.

Wherever possible the demand functions and income elasticities of demand adopted by the F.A.O.[21] have been used. However the F.A.O.'s commodity group income elasticities have been of limited use. For our purposes, it was not sufficient to have estimates of income elasticities for, e.g., cereals; instead this was broken down into income elasticities of demand for wheat, rice, etc. To this end a variety of sources were used. In general, attempts were made to reconcile the total elasticities implied by the addition of projections within a commodity grouping, with the income elasticities adopted for that group by the F.A.O.

In projecting supply, least-squares trend fitting and extrapolation was the principal tool, though national and regional plans were also considered. Our projections were also compared with those of other workers in the field, although their techniques were generally no more satisfactory than ours. While high and low limits were given, these were necessarily fairly arbitrary.

19. F. A. O., Agricultural Commodities—Projections for 1970 (Special Supplement to Commodity Review 1962, Rome 1962).

20. Bela Balassa, Trade Prospects for Developing Countries (The Economic Growth Centre, Yale University); Irwin, Illinois, 1964).

21. op. cit.

Following the projections of supply and demand, constant price trade projections are made. (The trade projections are not meant to project total world trade; since countries have been aggregated into regions, they only provide estimates of inter-regional trade). The trade projections have been designated I and II: I is to be regarded as a pessimistic projection from an exporter's point of view. The trade projection I for a region is generally derived by subtracting the low demand projection for that region from the high supply projection and thus gives the maximum level of (net) exports—or minimum level of (net) imports—to be expected from that region. It is calculated in a symmetrically opposite manner. As far as possible import projections are considered in the light of their balance of payments implications and countries' trade policies. As a result trade projections are sometimes adjusted accordingly. For regions where it has not been possible to project production and consumption separately, trade has been projected directly on the basis of past trends and general expectations.

In many cases, a relatively small proportion of production or consumption is exported or imported; hence a comparatively small variation in consumption leads to substantial changes in trade projections. Thus, for the most important products, the trade imbalances obtained from constant price supply and demand projections generally have a very wide range; in other words it is impossible to be certain whether an upward or a downward pressure on world prices will develop. The "most likely" constant price trade imbalances are given in Table 1.1. On the basis of the projected imbalances judgements about the "most likely" long-term trends in prices for the different products, are, in fact attempted in Chapter X. However the proportion of most of these products entering world trade is relatively small and it would be misleading to convey the impression that these "most likely" price trends can be

Table 1-1

PROJECTED WORLD TRADE IMBALANCES AT CONSTANT INTERNATIONAL PRICES
([-] represents net export surplus or an expected downward pressure on prices;
[+] represents an import surplus)

Product	Base Period Discrepancy (including stock changes)	1970	1975	1980
	Thousand Metric Tons			
Milk Products (whole milk equivalent)	-246	-3,750 (±9,080)	-5,030 (±10,540)	-3,780) (±12,420)
Beef and Veal	-248	+180 (+800 / -1,600)	+730 (+1,100 / -2,190)	+1,200 (-1,370 / +2,340)
Mutton	+3 (Mutton and Lamb)	+57 (±188	+120 (±217)	+222 (±273)
Lamb		+27 (±46)	+26 (±64)	+25 (±68)
Wheat	-1,323	-6,800 (±12,640)	-7,240 (±16,330)	-2,300 (±19,120)
Coarse Grains	-5,692	-7,920 (±6,920)	-7,840 (±8,700)	-7,510) (±10,250)

Sources of data: Milk products: Table 8.3.4; Beef and Veal: Table 8.4.6. Mutton and lamb: Table 8.4.9. (In the case of lamb, projected imbalances exclude the Australian constant price trade projections); Wheat: Table 8.5.5; Coarse Grains: Table 8.5.6

accepted without a great deal of caution and reservation; our ability to forecast future trends is just not very great and little point is served in disguising this fact.

* * *

Chapter IX contains a discussion of past trends and prospects for wool. World production of wool has been increasing steadily since the end of World War II. From 1948-49 to 1963-64, world wool production (clean basis) increased at an annual average rate of about 3 percent. About two thirds of this increase was the result of an expansion of sheep numbers with increases in wool cut per sheep being responsible for the remainder.

Australia is by far the largest producer, accounting for about 30 percent of world production (greasy basis) in recent years.

The second largest producer is the U.S.S.R. (about 13-14%), followed by New Zealand (10-11%), Argentina (7%), South Africa (6%), U.S.A (5%), and Uruguay (3%). While Australia has slightly increased its share of the world market, the output of the Soviet Union has increased particularly rapidly.

Wool is one of the most important internationally traded agricultural products with more than 60 percent of the total world output entering the world market. Eighty-five percent of the wool entering world trade comes from the five southern hemisphere countries—Australia, New Zealand, South Africa, Argentina, and Uruguay. Apart from the United States and Russia, the major producers are not large consumers of wool, although their per capita consumption tends to be high. During 1958-60, three-fifths of wool consumption in the non-communist world was concentrated in six countries: United States (20%), United Kingdom (12%), Western Germany (11%), Japan (8%), France (6%), and Italy (4%).

In the immediate post-war period, U.S.A. and Canada consumed approximately 600-700 million lbs of wool (clean weight) annually, but after 1950 this market declined to about 450 to 550 million lbs. Consumption in the United Kingdom has remained static at around 250 to 300 million lbs. In the European Economic Community, consumption has risen steadily from 450 million lbs in the immediate post-war years to about 650 million lbs by 1957; since then it has fallen slightly. Consumption has increased markedly in both Communist Europe and Japan in recent years.

There has been no clear trend in Australian wool prices since the decline from the high levels reached in the early 1950's. There is some evidence in recent years of a dampening of wool price fluctuations.

In the present study, a series of regression equations was estimated in an attempt to explain the differences in per capita consumption of wool in a number of countries. Various types of equations were used and the results compared with findings by other workers. While in all equations fitted, per capita income appeared to be an important explanatory variable, comparison of regressions for different time periods indicated that the proportion of the variation in wool consumption which is explained by differences in real incomes between countries has declined over time. To ascertain whether this is the result of the increasing use of synthetics, similar regressions were run with "wool plus synthetics" as a dependent variable. Here we found, no matter which of several functional forms were used, that inter-country differences in real incomes provide a better explanation of variations in the consumption of wool-type fibres than of wool only. Again, the proportion of inter-country differences explained by income declines over time, but the trend was not so marked as in the case of wool alone.

Our original projections of the demand for wool in the developed non-communist countries were made on the basis of our estimated income elasticities and per capita income growth rates for the different countries used in Chapter VIII. The growth rates implied by this projection agreed fairly closely with those arrived at by other workers. Thus, we projected the annual average compound rate of growth of wool consumption during 1960 to 1970 to be of the order of 0.9 to 1.1 percent for the United Kingdom, 3.6 to 4.7 percent for Japan, 1.7 to 2.0 percent for North America and 1.9 to 2.3 percent for Continental Europe. This implied a growth rate for total consumption of wool by all developed non-communist countries of 1.9 to 2.3 percent per annum compared, for instance, with Balassa's projected growth rate of 1.7

Recent data suggest that our projections, at least for the early years of this period, are too high. We predicted an 11 percent increase in world consumption in the first half of the 1960's whereas in fact there was an increase of not much more than one percent. Nor can we appeal to price rises since, on average, prices over this period have increased by no more than 3 percent—surely not sufficient to cause a 10 percent fall in demand. Our conclusion is that other operative factors render impotent any analysis based largely on a consideration of the influence income exerted on demand in the recent past.

Balancing all the various factors which have to be taken into account, it seemed to us most reasonable to project the demand for wool (at constant prices) on the following assumptions: (i) Total materials used by the wool textile industries in all developed countries (for consumption within these countries) will rise by 10 to 12 1/2 percent during each 5-year period (by 1.9 to 2.4 percent per annum compound). This is somewhat higher than the rate achieved during the 5-year period 1959-61 to 1965, but equivalent to the growth rate implied by our projections based on inter-country income coefficients. (ii) The average annual growth rate of man-made fibre usage in the wool textile industries will slow down—from 13.7 percent per annum during 1959-61 to 1965 — to $7\frac{1}{2}$ to 10 percent per annum in the five year period 1965—70; 5 to $7\frac{1}{2}$ percent per annum in the five year period 1970—75; $2\frac{1}{2}$ to 5 percent per annum in the last 5-year period which concerns us here. (iii) Further for the low projection, we assume that demand for fibres (other than man-made) is split between virgin wool and other fibres (non-virgin wool, cotton etc.) in the proportion of 67:33. For the high projection we assume that the proportion of virgin wool will rise to 73 percent in 1970; 75 percent in 1975 and 77 percent in 1980. This assumption was made to allow for the increasing emphasis being put on the promotion of pure wool garments by the International Wool Secretariat. (In the seven countries given in Table 9.5.2, the share of virgin wool varied between 66.7 and 71.2 percent between 1960 and 1965).

The results obtained from these assumptions are given in Table 9.5.3, which also gives estimates for the base year (1959-61) and for 1965. The assumptions imply a slight (3%) decline in "most likely" wool consumption between 1965 and 1970; a further 0.9 percent decline between 1970 and 1975, followed by a 6 percent increase in wool consumption between 1975 and 1980 as the growth in man-made fibre use tapers off. Since, as pointed out above, other projections have arrived at much more optimistic conclusions, it seems desirable to stress two points: (i) the assumptions used here are not particularly pessimistic as far as wool is concerned. In particular, the increase in the usage of total materials is somewhat more optimistic than immediate past trends would suggest and some decline in the rate of growth of man-made fibre usage is postulated. (ii) It might be argued that, as the stagnation in wool consumption between the base period (1959-61) and 1965 was accompanied by a substantial change in the relative prices of wool and synthetics, the experience of this quinquennium is unlikely to be repeated in the next 5 years. However, we are setting out at present to project likely wool use on the basis of constant wool prices. Prices of synthetic fibres have been declining substantially in the last 5 years; as shown in Table 9.4.2, U.S. list prices of Dacron and Orlon have been reduced substantially. Further substantial reductions in synthetics prices are regarded as likely, partly as a result of progressive reductions in their raw material prices and in manufacturing costs and partly from an expected reduction in profit margins. The latter are likely to be cut by the end of oligopolistic control of production for many non-cellulosic fibres (particularly the polyamides and polyesters) and the increasing competition between synthetic fibre manufacturers. According to one synthetics manufacturer, the prices of acrylics may drop to about half their present level within the next 10 years. Our constant-price wool price projections in Table 9.5.3 are based on an average price decline for all synthetics of about 25 percent over the next 10 years.

Projections for the underdeveloped countries are even more difficult. Present consumption is almost uniformly low and time series consumption data are probably unreliable. In addition, of course, wool is a fibre largely unsuited to the climatic zones in which many of the underdeveloped countries lie. In the countries of this group where wool is a commonly used fibre (for example, India and South Korea), foreign exchange shortages will probably restrict future consumption. Despite this, demand has been rising in the Asian region. For the non-communist Asian region a pair of projections has been prepared, one assuming no increase in per capita consumption, the other assuming an income elasticity of demand of 0.5 and the high per capita income growth figures for the region used in Chapter VIII.

For Latin America wool consumption has remained curiously static. Our projection assumptions have therefore been for the low, a constant total usage of 158 million lbs per annum (the base period level) and for the high constant per capita consumption, thus allowing for an increase in consumption as population grows.

For the purpose of our projections the Communist world has been divided into the Soviet Union, Communist Europe and Communist Asia. Wool consumption in Communist Europe has been rising at a rapid rate, from only one-third of the Western European per capita level in 1950 to 70 percent of the Western European levels by 1960.

Future trends in net imports of wool to the Soviet Union and Eastern Europe will depend mainly on three inter-related factors: (i) Trends in the level of demand for wool type fabrics; (ii) Likely trends in wool production in the Soviet Union and East European countries; (iii) The expansion of synthetic fibre production.

Past trends in living standards suggest that future per capita consumption of wool type fibres is likely to increase. This view is supported by the current communist attitude to the development of light industry and the gap still existing in comparative standards of consumption in the Communist and Western worlds. Recent setbacks in Russia's plans to increase domestic output of wool and synthetic fibres make it seem reasonable to expect a rise in demand for wool imports into the Soviet Union, though foreign exchange may limit the volume of imports.

When mainland China is added to the Soviet bloc it is possible to make out a case for the possibility of a net decline in future imports by the Sino Soviet bloc—if their attemps succeed to raise both wool and synthetic fibre production substantially. (1968: this assumption is no longer valid). In our "low" projections we have therefore allowed for a decline in net imports. On the other hand, if the planning authorities' intentions are not fulfilled and foreign exchange is available, there is considerable scope for further expansion of imports and our "high" projections make some (arbitrary) allowance for this. Our high and low projections of imports by communist countries and consumption in both developed and underdeveloped countries are consolidated in Table 9.5.7.

Changes in the supply of wool can be conveniently broken down into changes in sheep numbers and in average wool cut per sheep. As pointed out above, changes in sheep numbers have been responsible for about two-thirds of the increase in world wool production in the post-war period. The decline in the rate of growth of world wool production after 1956-57 has been the result of the slower rate of growth of sheep numbers; in fact world sheep numbers (and the total number of sheep in non-communist countries) have remained virtually static since 1959-60, with increases in some years being counterbalanced by declines in others.

For our projections we should therefore take account primarily of movements in sheep numbers since 1957; since then wool prices have been fluctuating around the lower level at which we want to make our constant price projections. From the point of view of making trend projections this is not a long time period; in addition, for most of the countries (or groups of countries) for which we wish to project sheep numbers, regressions of number of sheep on time do not provide a satisfactory fit. The procedure for making projections has therefore varied from country to country; according to the goodness of fit of trend estimates in the recent past and the additional information we have been able to obtain from other sources. The projections of sheep numbers for the individual countries or regions of the non-communist world are given in Table 9.6.2.

For the major producing countries a series of regressions was prepared relating fleece weight to time in order to ascertain trends in fleece weights. In most countries, fleece weight tended to increase erratically and fairly slowly after World War II. These trends plus the data referred to above on sheep numbers were used to project output by country and then for the whole world. Individual country projections are provided in Table 9.6.5.

A comparison of the "most likely" production and consumption figures—at constant base period prices — is given in Ch. IX and is reproduced here as Table 1.2. This table shows practically no difference between production and consumption estimates in either the base period or 1965. From 1965 on, our "most likely" constant price production projections fall short of the "most likely" constant price production projections; hence we would expect some downward pressure on wool prices to develop between 1965 and 1975. However all projections of production and consumption are well within the "high" and "low" limits which have been specified earlier, hence we cannot be very dogmatic about such downward pressure on prices.

Table 1.2

WOOL PRODUCTION AND CONSUMPTION
Projections at Constant Prices

	Production*	Consumption*
	(in million lbs clean wool)	
Base period	2,659	2,690
1965	2,771.5 (±235.5)	2,779.5 (±68.5)
1970	3,022 (±428)	2,771 (±204)
1975	3,188.5 (±500.5)	2,858.5 (±234.5)
1980	3,382 (±585)	3,065 (±253)

* Production is for non-communist countries; Consumption includes Sino-Soviet net imports from non-communist countries.

Source: Table 9.6.5 for Production
Table 9.5.7 for Consumption

Chapter X contains our final projections of production, consumption and exports for the selected products. Before making these final projections, the assumption of constant base period prices was dropped. Instead, on the basis of the results obtained in Chapters VIII and IX, coupled with an examination of recent trends, we selected a "most likely" future price path for the major products and revised our production and consumption projections accordingly. As pointed out above, our constant price supply and demand projections show considerable overlap; our price judgements are therefore very tentative. They appear to us as more likely than the assumption of constant base period prices. For the major products, our new price assumptions are set out in Table 10.1.2. In summary, we expect some decline in prices for wool and dairy products; because of the operation of the Wheat Stabilisation Scheme we assumed that the average price of wheat will remain stable around 150 cents (Australian) per bushel, whilst beef and mutton prices are expected to rise from the average levels reached in 1964-65 and 1965-66. As shown in Table 10.3.6, we also expect some decline in export prices of canned fruits.

In many cases, it is possible to compare our projections with those made by the Bureau of Agricultural Economics for the Vernon Committee. On average, B.A.E.'s projections were made perhaps 18 months earlier than our projections. Over this period Australia experienced a serious drought which would probably have affected their projections—it certainly affected our projections of wool, beef, and mutton production. In addition, our price assumptions differ from those made by the B.A.E. However, a comparison of the two sets of projections may be of interest.[22]

Despite differences in techniques and price assumptions (not to mention the 1965 drought), there is very little difference in the projected volume of exports for wool, mutton, beef and veal, barley, and in the projected value of total dairy product exports. We expect the volume of wool exports to rise by 18.6 percent in the next 10 years; our actual projected volume is about 1 1/2 percent higher than the B.A.E.'s projection.[23] Our 1975 beef and veal export volume projections are some 4 percent lower than those of the B.A.E.; however our projections have been reduced considerably by the 1965 cattle losses. As pointed out in Chapter X, we have particularly severe reservations about our beef projections. They are based on supply equations which account fairly adequately for past changes in output; but we may be on the threshold of major technological improvements in this industry which would make any projection based on past experience far too conservative.

Little need be said here about our mutton projections; they are based primarily on our projections of sheep numbers. We expect a growth in mutton output of about 14 percent in the next 10 years; however exports are expected to remain virtually at the 1965 level. Whilst we project an increase of almost 9 percent in lamb production over the next 10 years, consumption is expected to rise faster. If imports are allowed, our projections suggest that Australia will become a net importer of lamb after 1970. The B.A.E. projections differ—they forecast a rise of lamb exports to 35 thousand tons by 1974-75 (compared with 20 thousand tons in 1965). A crude extrapolation of trends would favour our projection.

Our wheat projections are very much above those of the B.A.E.; for 1974-75 their projection of export volume is 275 million bushels compared with ours of almost 400 million. This is largely because B.A.E. took a much more conservative view of the area which can be sown to wheat

22. One minor difference is that the B.A.E. projections all relate to the fiscal year 1974-75, whilst ours are given as the average for two fiscal years—i.e. for 1975= average of 1974-75 and 1975-76.

23. However in the absence of drought and with the B.A.E. wool price assumption, our projection would have been higher - probably by about 8 percent.

and probably also of the yields which can be attained. The large area sown to wheat in 1966-67 has been used in our judgement of the potential wheat acreage; in addition we have made allowance for the possible effect of nitrogenous fertiliser applications on the intensification of land use in wheat-sheep areas.

Total milk production is expected to remain around 1965 levels. With relatively constant per capita consumption of liquid milk, the quantity of milk available for processing into butter, cheese and condensed milk products is projected to decline slightly.

Partly because we expect some liberalisation of table margarine restrictions a further decline of per capita butter consumption is projected. Under the existing equalisation scheme this is likely to reduce the proportion of total milk for processing which is channelled into butter manufacture. As a result, we are projecting a 15 percent decline in Australian butter production over the next 10 years, coupled with a reduction in butter exports to 68 thousand tons by 1975 (1965 exports were 91 thousand tons). The 1974-75 B.A.E. butter export projection is for 80 thousand tons.[24] Exports of other dairy products, i.e., cheese, preserved milk products, and casein, are expected to continue to increase.

Canned fruit exports have increased by almost 50 percent over the last 5 years; a further growth of about 45 percent is projected over the next 10 years; exports of non-deciduous canned fruit (pineapples and tropical fruit salad) are expected to grow especially rapidly. However the entry of Britain into the Common Market could affect exports particularly severely here. A slight (9%) rise in dried vine fruit exports is projected; B.A.E.'s projections are about 25 percent lower than ours. As a result of the new Egg Marketing Scheme we have projected a more than 100 percent increase in egg exports. Here our projections are very much higher than those of the B.A.E.

A summary of our main projections of production and exports for the selected products are given in Table 1.3.

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24. Here again we may have been influenced by later developments; in particular the growth of Australian vegetable oil production in the last two years.

Table 1.3

SUMMARY OF MAIN PROJECTIONS
("most likely" magnitudes only)

Item	Unit	Historical Data and estimates		Projections		
		Base Period	1965	1970	1975	1980
Australian Population	millions	10.3	11.4	12.6	14.0	15.5
Australian "real" G. N. P.	index	100	124.7	155.5	194.0	242.2
G. N. P. per head	index	100	112.6	126.9	142.7	160.6
"Real" Consumption Expenditure, per head	index	100	109.9	120.8	132.4	145.5
Wool — Production	million lbs;	1,649	1,706	1,919	2,022	2,092
— Exports*	greasy basis	1,594	1,644	1,850	1,950	2,020
Beef and Veal — Production)	'000 tons,	770	949	935	1,082	1,177
— Exports)	all figures	262	405	347	449	496
Mutton — Production)	in terms of	354	369	395	420	434
— Exports)	carcass	60	120	110	123	125
Lamb — Production)	weight	203	210	219	228	247
— Exports)	equivalent	28	20	Nil	-27	-50
Wheat — Production)		223.6	313.4	415	501	591
— Exports**)		160.8	222.0	319	397	478
Barley — Production)	million	51.7	44.6	57.1	63.0	71.0
— Exports)	bushels	30.1	13.1	23.8	25.0	27.5
Oats — Production)		66.2	64.0	70.0	77.0	85.4
— Exports)		16.9	16.7	14.1	16.2	18.8
Rice — Exports	'000 tons milled equivalent	54.3	63.4	69	80	93
Total Milk Production	million gals.	1,390	1,512	1,475	1,496	1,512
Butter — Production)		193	204	185	174	164
— Exports)	'000 tons	75	91	76	68	53
Cheese — Production)		47.7	59.5	66	76.4	82.3
— Exports)		18.4	26.1	27.1	30.0	26.7
Wholemilk preserved products — Production)	million gals.	79.6	96	106	117	118
— Exports)	equivalent	34.3	43.3	43	46	39
Canned Fruit						
Deciduous — Exports)	'000 tons	66.7	110.5	132.2	152.3	150.0
Other — Exports)		15.7	10.0	14.1	20.8	28.3
Dried Vine Fruit — Production)		83.8	97.9	100	110	118
— Exports)	'000 tons	61.8	75.3	75	82	88
Dried Tree Fruit) — Exports)		2.5	4.4	4.2	4.6	5.1
Eggs — Exports	million dozen equivalent	19.2	15.6	29.5	37	43
Cotton — Production†	million lbs	4.5	34	60	65	70
— Imports†	(includes imports of cotton waste)	54.0	55.9	24	23	22
Tobacco —						
Australian Production)	million lbs of	13.3	26	33.2	38.3	43.7
Use of Imported Leaf)	unstemmed leaf	37.0	28	27.1	25.6	23.6
Total Tallow — Exports	'000 tons	71.9	81.2	100	113	147
Cattle Hides — Exports	million lbs	60.4	113.7	86	122	144
Sheep and Lamb skins — Exports	millions	26.0	29.3	28.7	30.3	32.0

Base period is average for the years 1958-59 to 1961-62. All other years are averages for the two fiscal years centering on the calendar year; e.g., 1975 = the average of 1974-75 and 1975-76.

Table 1.3 (Concluded)
VALUE OF EXPORTS
(all figures in $A million)

Item	Base Period	1965	1970	1975	1980
Wool	739.5	857.2	994	999	985
Beef and Veal	105	198	167	225	258
Mutton	13	33	31	36	38
Total Meat and Meat Products††	173	287	249	314	351
Wheat	205	312	447	556	669
Barley	28.9	14.8	26	28	30
Oats	12.9	13.5	13	15	17
Rice	6.2	8	9	10	12
Butter	48	63	49	43	32
Cheese	10	14	14	16	14
Other Dairy Products‡	22.2	33.1	36	40	38
Deciduous Canned Fruits	19.3	29.9	34	38	37
Other Canned Fruit	4.2	3.0	4.1	6.0	8.1
Dried Vine Fruits	19.2	24.1	25	27	30
Dried Tree Fruits	1.4	2.0	2.2	2.4	2.8
Eggs (in shell and other)	6.2	4.7	8.3	11	12
Tallow (total)	9.2	13.3	18	20	25
Hides and Skins (Cattle and calf)	10.8	17.7	15	21	24

* Includes wool exported on skins, scoured and carbonised wool, wool exported as tops and as yarn.

** Includes wheat exported as flour.

† Assuming that the main Ord scheme is not constructed; Table 10.3.10 gives alternative figures if construction of main Ord dam is commenced in 1967.

†† Includes canned meat, beef offals, pigmeats, poultry, meat extracts, sausage skins, etc.

‡ Includes exports ot whole milk preserved products, dried skim milk and casein.

CHAPTER II

INTRODUCTION

The present chapter attempts to outline the methods used for our projections.

As we interpreted it, our task was fourfold:

(a) Firstly we needed to discuss briefly the framework of the economy within which the agricultural sector operates.

(b) then an analysis of the factors underlying the demand for and the supply of the commodities specified in our contract was required;

(c) at this point a plausible set of assumptions had to be decided upon for the purpose of first round, constant price projections of demand and supply, both domestic and foreign;

(d) finally the assumption of constant prices was removed, some judgements about likely future price trends were made and our projections were adjusted to allow for the new price assumption.

These points will be considered in turn.

(a) The summary (Chapter I) gives the assumption underlying the population projections and no point would be served by repeating them here. The method used in this section of the study was the component projection technique. For the projection of aggregate income and output an essentially naive approach was adopted for three broad reasons:

(i) resources—time especially—did not permit a full scale econometric model of the economy to be developed;

(ii) other more sophisticated techniques, such as input-output analysis, did not promise sufficiently fruitful results, mainly because of the unusual character of the years for which input-output tables were available; and

(iii) because of our lack of real understanding of the growth processes underlying a complex economy, particularly one for which there are no close international analogies. A further reason was that a recent Government-sponsored survey of the economy had covered, albeit again in an unsophisticated manner, the same ground, and it was decided to avoid duplicating this material in so far as was possible.

(b) The analysis of demand for the products specified in our contract was carried out at two levels. For broad commodity groups a model was constructed essentially based on a study commissioned for the Vernon Committee, stressing the interdependencies on the demand side in the retail market. The method is fully documented in Chapter IV, and is discussed in summary form in Chapter I. Essentially, the technique involved specifying demand for a particular good as a linear function of income and all prices. A special feature of the model used here is that the marginal rate of substitution between any pair of goods is assumed to be independent of the consumption levels of all other goods. The results are fully set out in Tables 4.1.4, 4.1.5, 4.1.6, 4.1.9, and 4.1.10.

For the other goods specified in the contract, demand was analysed mainly by the use of single equation least-squares regressions. On occasions the attempt to isolate the major determinants of consumer behaviour by statistical methods failed and we confined ourselves to a description of past movements in consumption. The findings are summarised in Chapter I, and are given in more detail in Chapter IV.

It should be pointed out here that for many products "income" as such was not used as an explanatory variable. Since, in the Australian context, national income sometimes fluctuates in accordance with swings in export prices without a commensurate impact being exerted on total consumption, income was usually approximated by personal consumption expenditure.

The analysis of supply in the study is also carried out at two levels. For the core of the Australian agricultural sector—comprising pastoral products, cereals, and dairying—an integrated supply model using techniques not hitherto applied in an empirical setting has been constructed. An outline of the approach is given below. For the remaining products specified in our contract, a variety of methods of analysing supply has been used. For some products changes in output could be explained reasonably adequately with various single equation least-squares regressions; for others the data were too unreliable; or the determinants of supply were to be found in other non-quantifiable variables.

(c) On the basis of the analyses of demand and supply in Chapters IV and VI an attempt was made to project—in terms of constant prices—the future levels of demand and supply for individual commodities. This is done in Chapters V and VII, respectively. For all initial constant-price projections, high and low estimates for the relevant predictands were given, and sometimes information concerning the likely standard errors of these conditional forecasts. Where the results of our statistical analyses were clearly not reliable—for example in the case of the supply of eggs—arbitrary judgements were necessary to obtain projections. These tried to take into account the factors which clearly influenced output in the past—e.g., the policies of egg marketing authorities.

For the projections of world supply and demand little fundamental research was possible because of the enormity of the problem. Instead, projections were based largely on analyses previously carried out by international bodies such as F.A.O., tempered, where possible, by our own judgements; for example, in the case of wool. The various techniques and assumptions are clearly set out in Chapters VIII and IX and in more summary form in Chapter I.

In short, for most of the report, the methods used will be familiar to readers and conform with the approaches usual in such studies. Where the methodology is in need of explanation, however, is in the section relating to the use of the six-sector linear supply model used for projection purposes.

Projecting supply is in any case a difficult business. While changes in "tastes" affect demand in a way often difficult to cope with, changes in technology bedevil the analysis of supply even more. One problem in the analysis of agricultural output is the intractability of indentifying, let alone measuring, the inputs being used. This in turn makes it difficult to observe the impact of technological change. In the manufacturing sector, it is reasonably easy to disentangle current expenditures from capital inputs. For the agricultural sector, the same inputs (labour, fertiliser) can be used as capital or current inputs, and it is for the most part impossible to estimate the volume of capital formation which has taken place.

We were in fact unable to estimate an aggregate production function for Australian agriculture and so we had to fall back, as has already been pointed out, on a series of disaggregated supply functions.

With the exception of the six products discussed below, all constant price projections in the study are based on single equation, or even less sophisticated, methods. For some commodities, the high and low projections have been based on potential statistical variability about projected mean values. For others, limits have been set by the less formal technique of making the best possible guesses about limits to relevant trends. For the major livestock/crop complex of industries the supply model used consists basically of a set of six simultaneous linear supply equations:[25]

$$(6.3.2) \quad y_{it} = \Gamma_{it} + \sum_{j=1}^{N} a_{ij} \Pi_{jt} + \epsilon_{it} \quad (i=1, \ldots N),$$

which state that planned output (y_{it}) of commodity i during the period t is composed of a price inelastic part (Γ_{it}) plus a linear combination of the prices (Π_{jt}) expected to prevail during the year t. The equation also contains a random term (ϵ_{it}). The price unresponsive part of supply is free to move through time as investment and technology move the supply curves; however, the slopes ($a_{ij}-1$) of the supply curves, as well as the parameters a_{ij} ($i \neq j$) determining the movement of the curves in response to changes in the prices of other products are constant. The component of the supply equation which is unresponsive to current prices plays the rôle of a short-run capacity indicator, as well as incorporating an allowance for the shifts in the supply function resulting from weather.

Two features of the model are crucial to its use in prediction. The first is that producers of these six products compete in the same resource market for inputs, and that at least as between certain pairs of products—for example between wool and wheat—changes in relative product prices may make a shift from one line of output to another rational. Secondly, the model runs in terms of expected prices of "decision units" such as sheep, areas sown to wheat and other grains. Thus the prices relevant for decision-making do not correspond completely with product prices. If autonomous technological progress is taking place—e.g., if yields of wool per sheep are rising—then payoffs per decision unit are rising, even though wool prices remain constant. Hence before we prepare constant product price projections it is necessary to define a set of decision unit prices compatible with such constancy. Product prices were converted into values per decision unit by allowing for the upward autonomous productivity trends for the various products (i.e., wool, wheat, coarse grains, and dairying). The equations used are 7.2.3 to 7.2.6.

The methodology used in applying the model in the case of constant product price predictions is set out fully in Chapter VII, Section 2. However the major innovations which ought to be mentioned here are:

(1) Monte Carlo methods were used to generate the data for the projections,

(2) Probability distributions were assumed for the exogenous variables of the system—notably through the drought indexes—which were estimated from the experience of 1947-48 to 1964-65.

(3) Although our first round projections were in terms of constant average product prices, individual replicates allowed prices

25. The six product aggregates involved are: wool, wheat, beef, coarse grains, lamb and dairy products.

to vary stochastically around their specified constant averages.

(4) In projecting the time paths of quantities supplied, we began with starting data on prices and quantities for 1965-66, and then computed estimates of supplies for 1966-67. In the latter and in subsequent years, prices and drought indexes were generated in the manner described above, and the time paths of all variables (including predictands) traced out over the period 1966-67 to 1979-80. The whole procedure was then replicated, and the means and standard deviations of each variable in the system computed for every year in the projection period.

(5) For the purpose of obtaining high and low commodity projections, we tabulated the estimated sampling standard deviations of the endogenous variables for the years 1970, 1975, and 1980 in Table 7.2.4. Our computational resources precluded giving estimates of what, in classical linear regression theory, is termed "the standard error of forecast"; however, we were readily able to use classical tools to obtain estimates of the standard error of estimate of each of our supply equations. The latter measure necessarily underestimates the more appropriate concept of the standard error of forecast because it treats the estimated regression hyperplane as if it were the true underlying structure.

After some further refinements, final estimates of the conditional standard errors of our projections under the assumed price regime were obtained (Table 7.2.5). High and low bounds were placed on our projections by the simple device of adding and subtracting one sampling standard deviation from the estimated central values. On this basis our projections in terms of decision units for 1970, 1975 and 1980 have the limits indicated in Table 7.2.6.

(6) The constant price projections so calculated were then transformed into commodity unit projections. In the cases of lamb and beef, natural and decision units coincided, so that the high and low projections in commodity units in fact constitute one standard deviation above and below the projected mean values. For all other commodities this is not strictly true, for having set limits of this kind in terms of decision units, potential variability in yields also had to be allowed for.

(d) At this stage all the demand and supply forecasts were brought together on a global basis.

On the basis of the "most likely" supply/demand constant price imbalances disclosed by this approach, certain conjectures about future commodity prices were made and these were used to generate second-round supply estimates. Unfortunately the range of possible demand and supply imbalances was so great that it is necessary to treat the time paths for future commodity prices as very tentative. In the case of the six-sector model, the Monte Carlo techniques sketched above were once more employed, whilst in all other cases the revised price assumptions, where relevant, were taken into account less formally. In the case of the multi-sectoral projections, a compromise was struck between results from two competing supply models between whose prior plausibility we were unable to discriminate.

Our final projections are tabulated in Chapter X. Because of the potentially very wide range of our results—especially in the case of trade projections—our tabulations are restricted to conditional forecasts based on the "most likely" time paths of prices referred to above. Further, in the case of the final trade projections, we have not attempted to fix upon high and low values, but have only given "most likely" magnitudes.

CHAPTER III

PROJECTION OF POPULATION, AGGREGATE INCOME AND OUTPUT

1. POPULATION 1960-1980

Population change is the net result of births, deaths, and net migration. In forecasting population, it is more efficient to project these components separately on the basis of some plausible assumptions about them, than to extrapolate past trends in total population. From the outset it should be noted that the accuracy of the projections will depend entirely upon the relevance of the chosen set of assumptions to the actual experience of the time-span under consideration.

The factors underlying births and deaths tend to be fairly stable in the short run, so that the element of unreliability that enters a set of projections on this account is not likely to be great in the short run. As the period of projection lengthens, however, the assumed birth and death rates are likely to become less and less typical of current fertility and mortality patterns. A set of projections need not be based on constant mortality and fertility assumptions—indeed many of the models discussed later are not—but the entire set of assumptions must be decided at the outset of the operation, and hence the likelihood of correctly guessing the future course of such conditions diminishes as the time-span of the projection lengthens.

Net migration tends to be a highly volatile element in population change. In general, Australia experiences a net inflow of migrants, but since the rate of inflow depends not only on some set of predictable circumstances in Australia, but also on conditions abroad, assumptions concerning this component of population change are of necessity highly arbitrary. This is quite serious when it is considered that migration has been an important factor in Australian population growth since World War II.

We have worked out four population projections[26] which are presented in Appendix Tables A3.1.1 and A3.1.2. They were prepared in the following manner: The age-sex distribution for 1960 was taken as our basic datum. Births for subsequent years were arrived at by applying the selected age-specific-fertility rates to the relevant age groups of the female population. then births were divided into male and female and added to the age group 0-5 in the following time period. The age groups were allowed to 'age' over time, subject to a discounting factor determined by the mortality assumptions, and were augmented by net migration. This procedure was applied to data classified into quinquennial

26. Models 3.1(a), 3.1(c) and 3.1 (d) are projections of the total population. Model 3.1 (b) is of little interest in itself, as it merely shows the net effect of adding a constant stream of 100,000 migrants per annum over the period 1960-1980.

age groups. A consequence of this is that year by year projections are not strictly valid.[27]

W.D. Borrie and Ruth Rodgers in 1961 prepared some population projections for Australia for 1960-75. Since the period overlapped so much with that of the present study, it was decided merely to extend their estimates for a further 5 years, even though at the time of the extension (late 1964) it was apparent that some of their assumptions might not continue to be relevant.[28]

Three sets of estimates were prepared by Morrie and Rodgers (and were extended in the present study), the main difference between them being in the assumption concerning net migration.[29]

The fertility and mortality assumptions and the assumption concerning the age-sex composition of the migration intake were based on experience for the late 1950's. Since the present study was completed, the

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27. That is, with 1960 as our datum we may project to 1965, 1970, etc. However, since we also have data for 1959, 1958 etc., we are in fact able to give projections for population at annual intervals. It should be emphasised, however, that our 1964 estimates derive from the published 1959 figures, not from the 1963 estimates, etc. Further information on methods can be found in: United Nations, Department of Economic and Social Affairs, The Future Growth of World Population (United Nations, New York 1958).

28. Summary of Assumptions

(i) Masculinity of Births: 105 male to 100 female births

(ii) Survival values were based on the mortality experience of 1957-59. In the present study this 'parameter' of the model was inferred from the early years of Borrie's model. His model was then re-computed but with inferred figures, and found to give the results already predicted by him. This was considered a justification for using these inferred ratios for projection purposes for the years 1975-80.

(iii) Net migration:

(a) Model 3.1(a)- no migrants

" 3.1(b), 3.1(c)-100,000 migrants per annum

" 3.1(d)-90,000 migrants in 1960-61, falling to 50,000 by 1965 and constant at that level thereafter.

(b) all models: Age-sex composition of migrants as for the period 1955-59. In the present study this 'parameter of the model was inferred from the early years of Borrie's model. His model was then recomputed but with inferred figures, and found to give the results already predicted by him. This was considered a justification for using these inferred ratios for projection purposes for the years 1975-1980.

(iv) Fertility Rates:

Model 3.1(a)- Age-specific fertility rates for the period 1955-57.

Model 3.1(b)- Age-specific fertility rates for the period 1957-59.

Models 3.1(c)- and 3.1(d) Age-specific fertility rates for the early years as in model 3.1(b), then rising slightly, then falling slightly to 1970 to give a Gross Reproduction Rate in 1970 of 1.614 as compared with 1.682 in 1962. After 1970, fertility is assumed not to change. For the present study a set of age-specific fertility rates was constructed for the post 1971 period which gave the required gross reproduction rate, by discounting the 1957-59 figures by the appropriate rate. It was tested by re-projecting the 1975 population and performed satisfactorily.

29. W.D. Borrie and Ruth Rodgers, Australian Population Projections 1960-75 (Australian National University, Canberra 1961 paper), pages 7-9.

Commonwealth Bureau of Census and Statistics has released a set of population projections for Australia covering the same time span.[30] Quinquennial estimates were given, beginning on June Thirtieth 1961 (since that was a Census date). They differ from those presented here only slightly, mainly because different assumptions concerning fertility and mortality trends were made.

The fertility and mortality behaviour of the Borrie-Rodgers models is typical of that observed for Australia in the middle and late fifties with the exception that in models 3.1(c) and 3.1(d) the age-specific fertility rates are permitted to fall slightly over time. The fertility rates assumed for model 3.1(a) differ from those in models 3.1(c) and 3.1(d) simply because the presence of migration tends to raise slightly the fertility of the total population. This is partly due to the effect that migration has tended to have on the 'masculinity' of the population, thereby increasing the proportion of 'ever-married' women, and partly due to the fact that migrant women have tended to be more fertile than native born women.[31] The Commonwealth Bureau of Census and Statistics projections do not admit of this possibility. Although the Bureau is aware of the phenomenon, their approach to the fertility problem is to prepare three sets of projections—one assuming that the conditions of 1957-61 will remain relevant, one assuming that fertility rates will rise at a uniform rate from this base, and one assuming a uniform fall from this base (Table 3.1.2). They specifically refuse to state which of these three assumptions they consider most probable.[32] The approach here [Models 3.1(b), 3.1(c), 3.1(d)] is to say that current fertility rates will rise for a time but will probably subsequently fall slightly, although not continuously as in the last of the Bureau's models.

Figures recently to hand suggest that our fertility assumptions (and also those of the official projections) may be unduly optimistic.[33a] The crude birth rate has recently begun to decline after having been relatively stable since the early 1950's. Whether or not this fall is the start of a long term trend stemming from the recent introduction of the birth control pill is not certain at this stage. At any rate, a possible source of upward bias exists in our assumptions and should be recognised as such implicitly.

Unlike the reliance to be placed on the fertility figure, the mortality figure adopted can be expected to be fairly relevant to the experience of the next 20 years, as the crude death rate in Australia is currently among the lowest in the world, and cannot be expected to vary much in the future unless substantial progress is made in the

30. Commonwealth (Bureau of Census and Statistics, Projections of the Population of Australia 1966-1986 (Canberra, 1965).

31. Borrie and Rodgers, op. cit., p. 3-5.

32. Commonwealth Bureau of Census and Statistics, op. cit., p. 1.

33a.

	Births per 1,000 population (Australia)
1960	22.42
1961	22.85
1962	22.14
1963	21.59
1964	20.58
1965	19.61

Commonwealth Bureau of Census and Statistics, Quarterly Summary of Australian Statistics, No. 260 (June 1966), p. 4.

treatment of diseases peculiar to the higher age groups.[33b]

It is not contended that migration figures will necessarily behave as the models assume, but if they do, then it is possible to see the effect of this on total population growth. The Bureau of Census projection illustrates the effects on total population of net migration intakes of 100,000 and 70,000 per annum but they refuse to 'predict' the level of net migration.

In fact, immigration has recently risen to unprecedented levels which could hardly have been predicted as recently as 1962.[34] It is not yet clear whether this rate of inflow can be maintained in the long run, but at present it would seem rather unlikely.

The advantage of the models developed in this section is that they may be combined in different ways. For our low projection, we decided to combine model 3.1(a) which includes no migration, with half the migrant stream embodied in model 3.1(b). This implies a net migrant intake of 50,000 persons per annum, combined with a fertility assumption which is low by the standards of the late fifties. If the experience of the past 10 years is a reliable guide, it seems unlikely that immigration will fall even lower than is inherent in the model.

For our high projection, we have taken model 3.1(c) as it stands. This implies a high fertility rate and net immigration at the rate of 100,000 persons per annum. While net immigration in 1964 and 1965 has been slightly higher, we believe that it represents a reasonable upper limit on Australia's population growth in the next 15 years. Our "low" and "high" projections are set out in Table 3.1.1. According to our "low" projection, Australia's population will be slightly below 13 1/2 million in 1975; according to the "high" projection, it will be slightly below 14 1/2 million.

Table 3.1.2 compares our projections with those prepared by the Commonwealth Bureau of Census and Statistics. Our "low" projection is lower than any of the Bureau's models, whilst our "high" projection is also lower than the highest of the Bureau's models. Given the uncertainty over the future birth rates, it seems to us that most population projections prepared to date are more likely to err in overstating future population growth. Judged by this criterion, the projections in the present study are then at least as good as most.

2. AGGREGATE INCOME AND OUTPUT

In this section we briefly review the historical movements in Australia's Gross National Product,[35] its major components,

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33b. Australia:

	Crude Birth Rate	Crude Death Rate
1920-4	24.4 per 1,000 population	9.8 per 1,000 pop.
1925-29	21.6	9.4
1930-34	17.6	8.8
1935-39	17.2	9.6
1940-44	19.5	10.8
1945-49	23.1	9.9
1950-52	23.0	9.4
1954-55	22.6	8.8

United Nations, Department of Economic and Social Affairs, Provisional Report on World Population Prospects as Assessed in 1963 (United Nations, New York 1964) Table 15.2, p. 27.

34. Excess of Arrivals over Departures, Australia 1957—64

	Permanent	Total
1957	77,622	78,732
1958	64,879	65,366
1959	83,578	76,791
1960	92,776	90,135
1961	68,439	61,521
1962	64,638	62,522
1963	76,844	71,654
1964	103,999	99,342
1965	111,609	104,856

Sources: Commonwealth Bureau of Census and Statistics, Australian Demographic Review No. 213 (Canberra, April 1965).
Commonwealth Bureau of Census and Statistics, Quarterly Summary of Australian Statistics No. 260 (Canberra, 1966), p. 7.

35. Many other surveys exist. For example: Commonwealth of Australia, Report of the Committee of Economic Enquiry, (Canberra, 1965), Ch. 1—hereafter referred to as the Vernon Report.
H.W. Arndt and W.M. Corden (eds.) The Australian Economy (F.W. Cheshire, Melbourne, 1963), Part 1.

Table 3.1.1

PROJECTED POPULATION — AUSTRALIA 1960 TO 1980

Year	Low Projection[a]		High Projection[b]	
	Population 000's	Average Annual Growth Rate for Quinquennium (percent)	Population 000's	Average Annual Growth Rate for Quinquennium (percent)
1960	10,278.5		10,278.5	
		1.82		2.45
1965	11,215.1		11,536.6	
		1.87		2.39
1970	12,263.1		12,915.2	
		1.95		2.38
1975	13,458.7		14,453.5	
		1.98		2.33
1980	14,789.7		16,136.0	

(a) Low projection = Model 3.1(a) plus half Model 3.1(b); that is it assumes an immigration component of 50,000 persons per year. Fertility is as for the years 1955-57 for the domestically born sector of the population and for the foreign born and their offspring 1957-59 is assumed.

(b) High projection = Model 3.1(c). The fertility assumption is that for the years 1957-59 and 100,000 immigrants per annum are assumed.

Both projections embody the mortality experience for the years 1957-59.

Sources: W. D. Borrie and Ruth Rodgers, op. cit., Table 7, p. 10; Table A3.1.1.

Table 3.1.2

COMPARISON OF POPULATION PROJECTIONS, AUSTRALIA 1961 TO 1981
(Thousands)

	Models		Commonwealth Bureau of Census Model*						Population of Australia as at 30th June
	High Projection	Low Projection	100,000 Immigrants			70,000 Immigrants			
	3.1(c)	3.1(a) plus half 3.1(b)	A	B	C	A	B	C	
1960	10,278.6	10,278.6	-	-	-	-	-	-	10,275.0
1961	10,521.5	10,460.0	10,508.2	10.508.2	10.508.2	10.508.2	10.508.2	10,508.2	10,508.2
1966	11,802.2	11,414.3	11,731.8	11,690.5	11,649.2	11,636.1	11,595.2	11,554.2	
1971	13,208.4	12,491.5	13,300.8	13,153.0	13,005.7	13,020.3	12,875.7	12,731.0	
1976	14,784.3	13,719.2	15,152.4	14,840.6	14,528.6	14,657.4	14,354.4	14,051.3	
1980	16,136.0	14,789.7	-	-	-	-	-	-	
1981	-	-	17,267.8	16,723.1	16,178.7	16,530.0	16,004.7	15,479.7	

* Assumptions: (1) Recent but Unspecified Mortality Rates;
(2) Fertility Assumptions as Follows: (A) Rise uniformly from 5 to 15 percent above 1957-61 rates;
(B) 1957-61 rates throughout;
(C) Decline uniformly from 5 to 15 percent below the level of 1957-61.

Source: (1) Table A3.1.1.
(2) Commonwealth Bureau of Census Model: Commonwealth Bureau of Census and Statistics, Projections of the Population of Australia 1966-86 (Canberra 1965);
(3) Commonwealth Bureau of Census and Statistics, Demography Bulletin No. 80 (Canberra 1962), Table 5.

and the recent discussion in Australia of probable future growth rates. This will be followed by our judgements about the most realistic upper and lower limits of the future growth rate in both G. N. P. and real consumption expenditure per head.

The progress of both total and per capita G.N.P. is shown in Appendix Table A3.2.1. Two conclusions following from this table are: (i) During the post-war period, the rate of growth of G.N.P. has shown marked irregularities from year to year. Hence projections based on assumed average growth rates will provide smoother series than we can probably expect to prevail in the future. (ii) The "real" growth rates derived depend, in part, on the particular set of constant prices used. Thus for the 5 years ended June 30, 1960, the average annual rate of growth of G.N.P. was 4.5 percent at 1953-54 prices, but only 4.2 percent at 1959-60 prices.

Appendix Tables A3.2.2 and A3.2.3 provide some information about the long term structural changes which have taken place. In real terms, the relative importance of personal consumption expenditure has been falling slightly, whilst gross capital formation and exports have been rising. This is true irrespective of the set of constant prices chosen or the sub-period considered. For instance, for the 10 years ended 30.6.1964, and using 1959-60 prices, real consumption expenditure grew at an average annual rate of 3.9 percent, private investment in dwellings at 4.0 percent, G.N.P. at 4.2 percent, other private investment at 5.9 percent, and exports at 6.4 percent. In spite of these trends, personal consumption expenditure still accounts for more than 60 percent of G.N.P.

The Report of the Vernon Committee examined in very great detail the likely future rate of growth of the Australian Economy. The Vernon Report has been aptly described as "the greatest inquest ever conducted into the Australian Economy" and has attracted much comment and criticism.[36] Central to the report is a discussion of the rate of growth which would occur "on the basis of the continuation of the underlying trends of the past decade, interpreted and adjusted in the light of known relevant factors".[37] The first projection made by the Vernon Committee assumes that output per person employed in each of the major industries—agriculture, mining, and manufacturing — will continue to grow at the average rate estimated for 1953-54 to 1962-63. Using projections of the total labour force (based on a population projection assuming net immigration of 100,000 per annum) and after adding income from ownership of dwellings and indirect taxes, the Committee arrives at a total real G.N.P. for 1974-75 which would represent an average annual rate of growth of exactly 5 percent.[38]

The Committee makes an independent projection of aggregate demand based on the assumption that real personal consumption <u>per employed person</u> will rise at the same rate as in the past (plus a margin to allow for constant, instead of falling, terms of trade). By means of input-output analysis this total expenditure estimate is broken down into the demands which would confront the broad industry groups mentioned earlier. From a comparison of these two projections the Committee concludes (i) that aggregate demand by 1974-75 is likely to exceed aggregate supply—implying the emergence of inflationary pressure and balance of payments difficulties, and (ii) that the pattern of de-

36. Among these comments we will refer particularly to those published in the <u>Economic Record</u> (March 1966), Vol. 42, No. 97. The entire issue is devoted to a discussion of the Vernon Report.

37. Vernon Report, <u>op. cit.</u>, p. 17-4.

38. However, later comments by individual members of the Committee make it clear that the "target" growth rate of 5 percent was formulated prior to and independent of this projection.

mand by 1975 will require a larger shift of employment to tertiary industries than provided for in the first projection. Since real productivity growth is lower in the tertiary industries than in the rest of the economy, this will jeopardise the attainment of the overall rate of increase of productivity which has been postulated in the first projection.

These projections have been criticised on a number of grounds. One critic has called their approach "simple-minded", since they neglect past inter-relations between movements in labour inputs, capital inputs and technical progress.[39] In defence of the Vernon Committee it might perhaps be pointed out that more "sophisticated" discussions along these lines have not, so far, yielded any very definite conclusions about such inter-relations.[40]

Again, in a discussion on the meaning and measurement of economic growth by the Commonwealth Treasury, it is argued that a consideration of national accounting aggregates can lead to misleading conclusions about the growth in total output and in output per employed worker since the numerous approximations and assumptions implicit in estimating such aggregates as consumption and investment at constant prices are necessarily ignored.[41] Despite these warnings and the strictures of the Treasury against the use of international comparisons of growth rates, we believe that such comparisons can serve a useful purpose in providing benchmarks of the relative performance of the Australian economy. Whilst we admit the difficulties of such international comparisons, a detailed study made at the Organisation for Economic Co-operation and Development suggests that no significant difference was made to the relative rates of growth of different developed countries by: "(i) adjusting the national estimates to ensure comparability of definitions; or (ii) re-weighting the elements in national expenditure according to average European relative prices instead of national relative prices; or (iii) re-calculating the European growth rates on concepts as closely as possible to the concept of 'material product' used in Communist countries.... ; or (iv) deleting completely one of the fastest growing items of final expenditures, namely consumer durables".[42]

As background to discussion about likely future rates of growth in Australia, comparisons with other countries may be useful. Compared with other developed countries, growth in total output in Australia since World War II has been fairly impressive—around 4.3 percent per annum compared with 3.6 percent for Canada, 2.6 percent for the U.K. and about 3.0 percent for the U.S. for similar periods. Among O.E.C.D. countries, only Austria (6.0%), Italy (6.3%), The Netherlands (4.9%) and possibly France (4.4%) showed higher average rates of growth of total output.[43] However when we compare growth in output per employed worker ("productivity") or in output per head of population (growth in "living standards") a different picture emerges.

According to the Vernon Report, real output per worker increased by 2.0 to 2.3 percent per annum over the period 1953-54

39. H.F. Lydall, Economic Record, op.cit., p.155.

40. This is, in fact brought out well by Lydall at a later stage when he points out: "The fact of the matter is that economists have not yet unlocked the secret of capitalist economic growth. We know a great deal about how, when and where economic growth has occurred, but very little about the why. Somewhere in the heart of the problem seems to lie a complex inter-relationship between consumption and investment; but, in spite of an enormous amount of work on this problem, the secret has not yet been unravelled." ibid., p.161.

41. Commonwealth Treasury, The Meaning and Measurement of Economic Growth; Supplement to the Treasury Information Bulletin (Canberra, 1964), Ch. 1.

42. W. Beckerman and Associates, The British Economy in 1975, (Cambridge University Press, 1965), pp. 14-15.

43. loc.cit., Table 1.1, p.12.

to 1962-63 (at 1963-64 prices).[44] This is similar to the average annual increases in productivity attained in the U.K. and the U.S. (2.0%), Canada (1.9%) and Belgium (2.5%) over the period 1950-62; whilst the other O.E.C.D. countries (except Ireland) achieved growth rates in excess of 3.1 percent per annum.[45] If we consider "living standards" a similar picture prevails. The average annual increase in output per head in Australia has been around 1.8 to 2.0 percent per annum for the different subperiods (of 6, 10 and 11 years respectively) considered in Appendix Table A3.2.3. This is higher than the 1950-62 rates recorded for North American countries (Canada—0.9%; U.S.A.—1.3%) and roughly comparable with those European countries whose performance was lowest (Ireland—1.7%; U.K.—2.1%; and Belgium—2.2%).[46] However it is considerably lower than the rates which have been achieved in most European O.E.C.D. countries.

On the other hand the proportion of Gross National Product which Australia has devoted to gross capital formation is relatively high, compared with other countries for which we have available information.[47] Australia, then, is somewhat of a paradox: her growth rate of total G.N.P. and the proportion of resources devoted to capital formation are among the highest in the "developed" world, but her rates of growth of productivity and of living standards are relatively low.

Although in a purely arithmetical sense it may be possible to resolve this paradox by pointing to Australia's high rate of population growth, this would not appear to be a realistic economic explanation of the—by international standards—low Australian rate of growth of output per worker or per head of population. A recent United Nations study of economic growth in European countries concluded that, if there is any relationship between these variables, it tends to be in the opposite direction—i.e. high growth rates in population and employment tend to be associated with high rates of growth in "productivity" or "living standards" rather than the other way around.[48]

Beckerman and Associates have examined the differences in the rates of growth of Britain and other developed countries in terms of their Net Incremental Capital Output Ratio (I.C.O.R.).[49] It is defined as the ratio of investment (except that devoted to residential construction) net of depreciation, to Gross National Product, all divided by the average annual growth rate of Gross Domestic Product over the relevant period. It is thus a rough measure of the contribution which capital formation makes to output growth, due weight being given to depreciation and to the fact that investment in housing makes for no further growth in the output stream. On the whole they find that countries which have shown the highest per capita growth rates tend to be those with the lowest I.C.O.R.'s. Although it is difficult to obtain a comparable estimate for Australia, partly because depreciation statistics provide little real indication of capital use, it is possible to infer that for Australia in the late 1950's and early 1960's the I.C.O.R. has been in the range of 2.85 to 3.0.[50] This is on a par with the United

44. Vernon Report, op. cit., Table D-15, p. D-33.

45. W. Beckerman, op. cit., Table 1.1, p. 12.

46. loc. cit.

47. Australian data: Commonwealth Bureau of Census and Statistics, Australian National Accounts, 1948-49 to 1963-64, (Canberra, 1965), Tables 10 and 11. Other data: W. Beckerman, op. cit., Table 1.6, p. 27.

48. Secretariat of the Economic Commission for Europe, Economic Survey of Europe in 1961, Part II, Some Factors in Economic Growth in Europe During the 1950's (U.N., Geneva, 1964), Ch. II.

49. W. Beckerman, op. cit., pp. 28-43.

50. Commonwealth Bureau of Census and Statistics, op. cit., Tables 11, 12 and 74.

States, and lower than the U.K. and most of the Scandinavian countries; however most of the European countries exhibiting rapid per capita growth in the post-war period had lower I.C.O.R.'s.[51] This provides some evidence that Australian capital formation has been of less than average productivity by the standards of the developed nations.

Australia's unusual position is probably due to several factors. One possible explanation for a lower capital productivity is provided by Australia's unusually high rate of growth of the adult population. This is probably an important factor in the high proportion of total investment devoted to dwelling construction (never less than 25 percent of total capital formation since the early 1950's).[52] This could explain why Australian capital formation appeared relatively unproductive by international standards— because even after dwelling construction is netted out for purposes of calculating I.C.O.R.'s, we are still including associated investment—e.g., in public works induced by dwelling construction. This type of investment may have a lower payoff (in terms of increasing future output) than, for instance, investment in new machinery and equipment.

Before formulating our judgements as to the upper and lower limits of the likely growth in total output in Australia, it is desirable to discuss briefly the possible (likely?) developments in certain key sectors of the economy which may restrict the rate of growth which will be attained. Of these the most frequently discussed is the balance of payments. According to the Vernon Committee, in the long run "the rate of growth that can be sustained by the economy will be governed by, perhaps more than anything else, the extent of the good fortune and good management that attend the balance of payments".[53] Unless special efforts were made to promote exports, the Vernon Committee took a pessimistic view of future prospects. Given constant 1959-60 prices and their growth rate target and assuming that their recommendation that a ceiling of $300 m. be set on foreign capital inflow were accepted, their balance of payments projections for 1974-75 range from a minimum deficit on current account of $A894 million to a maximum of $A1,394 million.[54] "There has been general agreement that the Committee understate the probable growth of exports, in the light of what we can now reasonably expect about the future of mineral exports."[55] The Commonwealth Treasury itself expects these exports to double by 1970, and to continue rising, though less spectacularly, through the 1970's.[56] Granted this, however, the Committee's views on the size of the current account deficit by 1974-75 may not be too pessimistic. There seem few prospects for greatly increasing exports of non-agricultural goods other than minerals and their import projections, which include some allowance for increasing import substitution, assume a growth rate of the order 4 to 4.75 percent per annum,[57] compared with the actual growth rate for the period 1953-54 to 1963-64, at 1959-60 prices, of 5.3 percent per annum.[58]

On the other hand Lydall maintained that "there is an inevitable bias in forecasting

51. W. Beckerman, op. cit., Table 1.8, p.31.

52. Australian National Accounts, op. cit., Tables 73 and 74.

53. Vernon Report, op. cit., p.15-51.

54. ibid., Table N-10, p.N-12.

55. e.g. J.O.N. Perkins, Economic Record, op. cit., pp.124-28.

56. Commonwealth Treasury, Supplement to the Treasury Information Bulletin—The Australian Balance of Payments. E.g. for the calendar year 1964, mineral exports totalled $226.4 m., never before having exceeded $140 m. (in 1956). For the last six months of 1965 they amounted to $206 m.

57. J.O.N. Perkins, op. cit.

58. Table A3.2.3.

the balance of payments, since we can be fairly sure about our need for imports but we are quite uncertain about the possibility of selling enough exports to the rest of the world at a reasonable price. Naturally, it would be foolish to deny the possibility of balance of payments difficulties; but my own instinct would be to assume that, provided we avoid internal inflation in excess of the world average, the problem will work itself out."[59] This attitude would seem similar to that of the Commonwealth Treasury which argued that "we cannot hope to anticipate the long run future of the balance of payments now."[60]

The purpose of our discussion is somewhat different from that of the participants in this debate. They are concerned mainly with establishing or denying the desirability of taking long range economic action to avert possible or likely pressure on our international reserves. Whether it would be better to take such long range precautionary action (which may turn out to be unnecessary) or to wait until the signs of impending falls in international reserves are clearer is a question we need not resolve here. Instead we are concerned with the possibility that balance of payments difficulties will affect the future rate of growth of output. That this possibility exists is undoubted; the implications of the (plausible) assumptions made by the Vernon Committee and Perkins show this. On the other hand, the spectacular mineral discoveries made since the Vernon Committee prepared its export projections provide a salutary warning of the pitfalls of long range projections or forecasts of the balance of payments. On balance, Reddaway's guarded pessimism is perhaps the best judgement one can arrive at as of now. He expresses it in these terms: "one's best view is, therefore, that there may be a tendency for balance of payments difficulties to appear over the next twelve years, which would require some remedial action, . . . there is no reason to suppose that the difficulties will prove particularly great and certainly not that they will be insuperable. The statistical uncertainties do mean, however, that there might be a really difficult situation, particularly if external factors turn out seriously worse than has been assumed."[61]

A second area of the economy discussed as a possible limiting influence in the attainment of the 5 percent growth target by the Vernon Committee is the supply of investible funds. According to their estimates, fixed capital expenditure as a proportion of G.N.P. would need to rise from 24 1/2 percent in 1962-63 to 25.9 percent in 1974-75 to achieve the desired increase in the rate of growth of output. Several writers have commented on the surprisingly low incremental Capital Output Ratio implied.[62] However, granted the level of investment to be required, the Committee produces little convincing evidence that special efforts will be required to achieve this. In fact their conclusion about the danger of an excess of aggregate demand in 1974-75 depends on the assumption that personal consumption expenditure will rise at the same rate as G.N.P.; whilst in the past 10 years personal consumption expenditure has risen proportionately less.[63] On balance, therefore, the supply of investible funds is perhaps less likely to pose a problem than the Committee supposed,

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59. H.F. Lydall, Economic Record, op.cit., p. 159.

60. Commonwealth Treasury, Supplement to the Treasury Information Bulletin, The Balance of Payments (Canberra, February 1966), p. 49.

61. W.B. Reddaway, Economic Record, op.cit., p. 21.

62. e.g. R.I. Downing, op.cit., p. 8; H.F. Lydall, op.cit., pp. 158-59.

63. cf. p. 42 and equation 3.2.1 supra. Lydall makes a similar point in his argument that, if the Committee had assumed a constant rate of growth in real personal consumption expenditure per head of population (instead of per employed person) "this would be almost enough to bridge the gap between aggregate supply and demand which their projections suggest", Lydall, ibid., 157.

though, as pointed our earlier, the productivity of our capital investment may be a more important limiting factor.

A third area which deserves some discussion is the level of defence expenditure. Whilst it is difficult to say what exactly is, and what is not, "defence" expenditure, according to the Commonwealth Statistician's definition, expenditure on this item was $A544 million in 1964-65, compared with a planned level of $A722 million (in current prices) for 1965-66. This represents an increase of 32 percent, compared with increases of 21 percent and 8 percent respectively in the previous two years. There seems no reason to expect a reversal in this trend in the foreseeable future. As pointed out by the Commonwealth Treasury "the diversion of output to defence results both in some slowing down in the rate of growth of output and, no doubt, in living standards... not only is private consumption likely to be affected, but also the level of fixed investment, both public and private, may be lower than it would otherwise have been, probably with adverse effects upon the rate of growth."[64] In addition, defence spending abroad, both for capital purchases and to meet overseas commitments will have adverse implications for the level of Australian international reserves, though the quantitative impact is difficult to assess.

It is now possible to set some broad limits on the likely future rate of growth of total output. In terms of past performance, it seems unlikely that real G.N.P. can grow at a rate much in excess of 5 percent per annum; certainly rates in excess of this have not before been sustained for more than a year or two. Given our "high" population projections (which are similar to the "most likely" population projections of the Vernon Committee), this would imply a growth in per capita G.N.P. of 2.7 percent—compared with average rates of 1.8 to 2.0 percent which have actually been realised in the past.

For our "low" projection we shall assume a growth rate in total G.N.P. of 4 percent per annum; if past experience is any guide it is unlikely that a growth rate of less than 4 percent would persist for long. This implies a growth rate of per capita G.N.P. of 2.1 percent per annum if this low growth rate is coupled with the low population projection (or 1.8 percent if it is coupled with the "most likely" population projections which need to be specified under the terms of our contract), This gives a mid-point "most likely" annual growth rate of 4.5 percent in G.N.P., at constant prices, compared to an average past growth rate of between 4.2 and 4.5 percent during the post-war period (depending partly on the number of years taken and on whether G.N.P. is measured in 1953-54 or 1959-60 constant prices).

The considerations which make it seem reasonable to expect some slight improvement in the average growth rate are: (i) some allowance is justified for further improvement in the overall management of the economy; (ii) the substantial mineral discoveries in recent years can be expected to ease the foreign exchange problems which have plagued the Australian Economy during most of the fifties; (iii) the likelihood of more productive investments in the public sector as a result of the more critical standards which one may expect to be adopted in the future;[65] (iv) the faster growth in the work force relative to the growth in population (resulting from changes in the age distribution and expected work partici-

64. "The Meaning and Measurement of Economic Growth", op. cit., p. 19.

65. Commonwealth Treasury, Investment Analysis, Supplement to the Treasury Information Bulletin (Canberra, July 1966).

Table 3.2.1

PROJECTIONS OF GROSS NATIONAL PRODUCT AND CONSUMPTION EXPENDITURE
[all figures in 1959-60 prices — $A]

Year	Gross National Product				Personal Consumption			
	Total		Per Capita		Total		Per Capita	
	Low	High	Low	High	Low	High	Low	High
1960	13,696.4		1,332.6		8,786.0		854.8	
1965	16,664.4	17,480.8	1,485.8	1,515.2	10,460.0	10,910.0	932.6	945.6
1970	20,275.6	22,310.6	1,653.4	1,727.4	12,450.0	13,550.0	1,015.2	1,049.2
1975	24,669.4	28,475.0	1,833.0	1,970.1	14,810.0	16,820.0	1,100.4	1,163.8
1980	30,015.2	36,340.0	2,029.4	2,252.2	17,630.0	20,880.0	1,192.0	1,294.0

[Indices — 1958-59 to 1961-62 = 100]

1965	121.7	127.6	111.5	113.7	119.1	124.2	109.1	110.6
1970	148.0	162.9	124.1	129.6	141.7	154.2	118.8	122.7
1975	180.1	207.9	137.6	147.8	168.7	191.4	128.7	136.1
1980	219.1	265.3	152.2	169.0	200.7	237.7	139.5	151.6

Source: (a) 1960 G.N.P. figure is the average for the years 1958-59 to 1961-2 in average 1959-60 prices: Commonwealth Bureau of Census and Statistics, Australian National Accounts 1948-49 to 1963-64 (Canberra, 1965) Table 11.

(b) Consumption figures derived from G.N.P. by means of the following aggregate consumption function —

$$\text{Log } C = \underset{(.0479)}{0.0473} + \underset{(.0226)}{0.8876} \text{ Log } Y \qquad R^2 = 0.9936$$

where C = Consumption
and Y = G.N.P.

fitted to consumption and G.N.P. data at average 1959-60 prices for the period 1953-54 to 1964-65.

pation rates).[66] Against these considerations, considerations may be made why growth may be less rapid. Some of these were, in fact discussed earlier. However, granted the relatively small past increases in both productivity and real incomes, when Australia is compared with other developed countries, it seemed to us more reasonable to expect some improvement in the "most likely" rate of growth which will be achieved in the future.

For some purposes it has been necessary to project not only G.N.P. but also Personal Consumption Expenditure at constant 1959-60 prices. To project Personal Consumption Expenditure we used the following relationship—derived from data for 1953-54 to 1963-64.

(3.2.1)

$$\text{Log } C = \underset{(0.0479)}{0.0473} + \underset{(0.0226)}{0.8876} \log Y \quad (R^2 = 0.994)$$

where C = Personal Consumption Expenditure (in million £ at constant 1959-60 prices),

and Y = G.N.P. (in million £ at constant 1959-60 prices).

Our "high" and "low" projections of Total G.N.P. and Personal Consumption Expenditure are given in Table 3.2.1 which also gives per capita projections.

66. "These big increases will occur mainly because of natural increase rather than migration. They are mainly due to the generation born since World War II reaching working age. In point of fact, even if there were no further immigration, the annual increase in the working age group between 1961 and 1968 would average 105,000, or almost as much as the actual average of 109,000 from both natural increase and immigration recorded during the seven years before 1961". Vernon Report, op. cit., p. 4-21.

Chapter IV

TRENDS IN AUSTRALIAN CONSUMPTION IN THE POST-WAR PERIOD — THE ANALYSIS OF DEMAND

1. THE ANALYSIS OF RETAIL DEMAND FOR BROAD COMMODITY GROUPS

In this section we lean heavily on a paper originally commissioned by the Australian Government's Committee of Economic Enquiry.[67] For interpretive material we also draw on two other published papers.[68] However, the statistical results have been brought up to date, and the revised estimates are published here for the first time. The extension of the model to an analysis of the demand for six categories of food expenditure also is new.

The basic model considered here is one of linear expenditure functions,

$$(4.1.1)\quad v_{it} = \sum_{j=1}^{10} a_{ij} p_{jt} + b_i m_t + c_i t + \epsilon_{it} \qquad (i = 1, \ldots .10),$$

in which v_{it} is per capita expenditure during period t on the ith commodity, p_{jt} is the price of the jth commodity at t, $m_t \equiv \sum_{j=1}^{10} v_{jt}$ is total money outlay per capita during t, and the a_{ij}, b_i and c_i are constants. The ϵ_{it} are disturbances.

Basis of Estimation

As the technical details of the models used are given elsewhere,[69] we describe here only its main economic characteristics. Basically, the technique consists of adjusting all expenditure figures to a basis which is net of the influence of relative prices. This remaining series is then regressed on a measure of 'supernumerary' income, and on time. Supernumerary income means a measure of income 'left over' after a certain 'typical' consumption bundle has been purchased.[70] The trend term is included in order to allow for the possibility of shifts in consumers' tastes over time. For mathematical convenience we choose as our origin the centre of the series, so that $\sum_{\text{all } t} t = 0$.

In making allowance for the influence of relative prices, we subtract from each expenditure series v_{it} a term

$$(4.1.2)\quad w_{it} = p_{it}\,\bar{v}_i/\bar{p}_i - \frac{1}{\omega}\,\bar{m}\,b_i \sum_{j=1}^{10} b_j(p_{jt}/\bar{p}_j - p_{it}/\bar{p}_i),$$

in which superscript bars indicate means over the sample period and ω is Frisch's 'money flexibility'; i.e., the elasticity

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67. Alan Powell, "A Complete System of Consumer Demand Equations for the Australian Economy Fitted by a Model of Additive Preferences", Econometrica, Vol. 34, No. 3 (July 1966).

68. Alan Powell, "Postwar Consumption in Canada: A First Look at the Aggregates". Canada Journal of Economics and Political Science, Vol. 31, No. 4 (November 1965) [in press]; and J. L. Dillon and A. A. Powell, "An Econometric Model of Retail Demand in Santiago de Chile", Cuadernos di Economia (August 1965) [in press — Spanish].

69. Powell, "A Complete System of Consumer Demand Equations", op. cit.

70. The term "supernumerary income" seems to have been coined by Richard Stone. See his "Linear Expenditure Systems and Demand Analysis: An Application to the British Pattern of Demand", Economic Journal, Vol. 64, No. 255 (September 1954), pp. 511—27.

with respect to total money consumption outlay of the marginal utility of such outlay.[71] The first term on the right-hand side above ensures that the adjusted variable ($v_{it} - w_{it}$) has zero mean. The more complicated expression following it is derived from the theory of "directly additive preferences", in which substitution derivatives are directly proportional to income derivatives.[72] The postulate of directly additive preferences implies that marginal rates of substitution between any two commodities are independent of the levels of consumption of all other commodities, which is not implausible for broad categories of consumption such as are considered here. Under such conditions, the second term on the right-hand side of (4.1.2) removes the effects of relative price changes from the expenditure variables.[73]

Three features of this relative price adjustment are worthy of note. Firstly, if only one price indicator is used in the analysis, implying that p_{it}/p_{jt} is constant for all t, then the price adjustment vanishes. This is as we would require. Secondly, price adjustments are larger for commodities whose marginal value share b_i is large. Other things equal, this implies a fairly close relationship between our estimates of price and income elasticities; that is, a large income elasticity tends to be associated with large price elasticity. (But of course, other things are not equal: in particular, average value shares are not). Finally, the adjustment varies inversely with the absolute value of Frisch's money flexibility. The rationale of this is that at higher income levels, the marginal utility of income is declining faster than at low income levels. But equally at high income levels, responsiveness to price stimuli is likely to be low. An inverse relationship thus is clearly indicated.

Additive Preference Transform

The 'typical' consumption bundle mentioned earlier is $\{x_1, \ldots, x_{10}\}$, where $\bar{x}_i = \bar{v}_i / \bar{p}_i$ i.e., the typical quantity purchased is measured by the ratio of sample mean expenditure to sample mean price. Supernumerary income remaining after the purchase of such a bundle is

$$(4.1.3) \quad u_t = m_t - \sum_{j=1}^{10} p_{jt} \bar{x}_j$$

This variable has zero mean, as did our expenditure variable after the removal of price effects. The time variable is similarly chosen to have zero sample mean. Finally we regress

$$(4.1.4) \quad y_{it} \equiv v_{it} - w_{it}$$

on the variables u_t, t, in the form

$$(4.1.5) \quad y_{it} = b_i \bar{u}_t + c_i t + \epsilon_{it},$$

which is the additive preference transform of (4.1.1). As Leser has pointed out, least squares is an appropriate technique since it automatically preserves the additivity of marginal value shares to unity. Also, the least-squares trend coefficients sum to zero across commodities, thus guaranteeing that the sum of projected commodity expenditures is identically equal to our projection of total consumption outlay.[74]

71. Ragnar Frisch, "A Complete Scheme for Computing all Direct and Cross Demand Elasticities in a Model of Many Sectors," Econometrica, Vol. 27, No. 2 (April 1959), pp. 177-96.

72. H.S. Houthakker, "Additive Preferences", Econometrica, Vol. 28, No. 2 (April 1960), pp. 244-57.

73. A. Powell, "A Complete System", op. cit.

74. C.E.V. Leser makes this point in his paper "Demand Functions for Nine Commodity Groups in Australia", Australian Journal of Statistics, Vol. 2, No. 3 (November 1960), pp. 102-113. However, he does not indicate there that this useful property is a consequence of the identity

$\sum_{i=1}^{10} y_{it} \equiv u_t$ (all t), which is preserved in the transformation (4.1.5) above.

Since the regressand y_{it} is a function of the unknown parameters $\{b_i\}$ and ω, (4.1.5) cannot be fitted directly. However, an iterative procedure can be used provided an appropriate set of starting values for these parameters is available. In fact, the method of C. E. V. Leser[75] gives good first round estimates of marginal value shares, and we have use of these.[76] The money flexibility parameter, ω , is estimated within this iterative framework in such a way as to minimise the grand total of squared residuals from the ten equations.

Whilst we have noted above that additivity in this model is preserved identically, the properties of homogeneity and symmetry only hold in certain neighbourhoods. Stone investigated the unique linear system which adheres globally to this trinity of demand theory;[77] suffice it here to remark that for our purpose his model seems unduly restrictive. Our approach here was to accept the linear expenditure system (4. 1. 1); it served as a convenient approximation (over the relevant range of the data) to the analytically more difficult additive preference expenditure equations. Thus above, the additive preference specification is enforced strictly only at sample mean prices and expenditures. It is on this basis that (4.1.2) is derived.

The loss of homogeneity results from specifying an additive, rather than a multiplicative, trend in equation (4.1.1). However, homogeneity is preserved when t=0 i.e., in the middle of the sample period. Symmetry of substitution derivatives between any two commodities i and j holds only for price ratios such that $p_{it}/p_i = p_{jt}/\bar{p}_j$.

Expenditure Series

The ten commodity groups distinguished in the present study are:

(1) Food
(2) Clothing
(3) Housing
(4) Gas and Electricity
(5) Durable Household Goods
(6) Other Goods
(7) Fares
(8) Tobacco and Drink
(9) Services
(10) Motor Vehicles and Running Expenses.

Expenditure series for these ten items were compiled from Table 49 of Australian National Accounts.[78]

These ten categories form an exhaustive classification of personal consumption expenditure. The names of the categories are the same as those used in Leser's Australian study[79] save that an additional category has been added; i. e. motor vehicles and running expenses. However, the correspondence between his categories and those employed here is not perfect. In compiling his aggregates, Leser used the breakdown of personal consumption formerly shown in the National Income White Papers, a classification which has been superseded in Australian

75. Ibid.

76. In fairness, we must remark that Leser's model is quite robust with regard to the estimation of income effects. However, because of his arbitrary postulate that all cross substitution elasticities are equal, we have less confidence in his estimates of price responsiveness. This led directly to the formulation of the present model.

77. Richard Stone, op. cit.

78. Commonwealth Bureau of Census and Statistics, Australian National Account — National Income and Expenditure 1948-49 to 1962-63 (Canberra), p. 50.
Expenditure series were compiled as follows:
(1) Food: line 7
(2) Clothing: line 12
(3) Housing: line 17
(4) Gas and Electricity: line 18
(5) Durable Household Goods: line 22
(6) Other Goods: lines 13 + 23 + 24 + 25
(7) Fares: lines 26 + 27
(8) Tobacco and Drink: lines 8 + 9
(9) Services: lines 14 + 30 + 32 + 33 + 34 + 35 + 36
(10) Motor Vehicles and Running Expenses: lines 28 + 29

79. C. E. V. Leser, op. cit.

National Accounts. Nevertheless the categories bearing the same names should be broadly comparable between the two studies.

The expenditure series have been deflated throughout by mean annual population as reported in the official Demography Bulletins. The resultant per capita expenditure series are shown in Table 4.1.

Price Series

Only five major components of the Consumer Price Index are regularly published. This made it necessary, in certain cases, to assume that the individual aggregand price series within these components are sufficiently colinear to justify their use for more than one commodity. The allocation of the five components of the Consumer Price Index over the ten commodity groups is shown in Table 4.1.2.

However, our results do not depend critically upon the appropriateness or otherwise of the specific price indicators. In fact, it is possible to carry through these computations using only a single price indicator. The use of only one price indicator, would, of course, be equivalent to neglecting the influence of movements in relative prices. However, estimates of price effects in the model we adopt below emerge essentially as by-products of the estimation of income effects; consequently, price effects could be estimated even in the absence of movements in relative prices.[80] It remains true, of course, that precision can be gained by using whatever information is available about movements in relative prices. This rationale underlies the construction of Table 4.1.2. The price series themselves are recorded in Table 4.1.3.

Our final remark about these price series is no more encouraging. Below we use quantity variables x_{it} obtained simply by taking the ratios v_{it} / p_{it}. For this procedure to be entirely consistent internally, we would require price indexes (such as Fisher's "ideal" index) which satisfied the factor reversal test. The Consumer Price Index, being of the conventional fixed-weight, aggregate type, fails this test. However, we had no alternative but to use the published official series. Their limitations should be kept in mind.

Results

We fitted this model to a 14-year time series for 1949-50 to 1962-63. The principal results are summarized in Table 4.1.4. Price elasticities are not constant in this model but vary slowly around the central values tabulated. Income elasticities have values $(b_i \, m_t \, / \, v_{it})$, which are not very volatile over the sample period because of the stability of the average value shares $(v_{it} \, / \, m_t)$. The income elasticities recorded in Table 4.1.4 again correspond to mean prices and expenditures.

Some care is needed in interpreting the statistical reliability of the results. If the postulates of classical least-squares theory were apposite, then of 20 estimated income and trend coefficients, all but 5 would differ statistically from zero. Only the marginal value shares of public transportation (fares), tobacco, and drink, and the trends in per capita consumption of vice, durables, and 'Other Goods', fail this significance test. However, we hasten to add that the least-squares postulates patently are not

80. Thus elements of our model can be traced back to Pigou's early attempt to estimate price elasticities from budget data [A.C. Pigou, "A Method of Determining Numerical Values of Elasticities of Demand", Economic Journal, Vol. 20, No. 80 (December 1910), pp. 636-40]. The restrictions imposed by Pigou's procedure were worked out in elasticity terms by Milton Friedman in "Professor Pigou's Method for Measuring Elasticities of Demand from Budgetary Data", Quarterly Journal of Economics, Vol. 50 (November 1935), pp. 151-63. The equivalence of a somewhat more sophisticated (i.e. post-Slutsky) version of this procedure with a model of directly additive preferences was demonstrated by H.S. Houthakker in his "Additive Preferences", op. cit. In the absence of relative price changes, a prior estimate of ω would be necessary to make the estimation of price elasticities feasible.

Table 4.1.1

PER CAPITA PERSONAL CONSUMPTION EXPENDITURE BY COMMODITY GROUPS, AUSTRALIA
1949-50 to 1962-63
(£ per head)

Year	Food	Clothing	Housing	Gas and Electricity	Durable Household Goods	Other Goods
	v_{1t}	v_{2t}	v_{3t}	v_{4t}	v_{5t}	v_{6t}
1949-50	54.1	32.9	15.8	4.4	16.7	16.1
1950-51	62.4	39.7	17.0	5.2	22.4	19.0
1951-52	78.1	41.4	18.2	6.7	24.0	21.9
1952-53	82.4	40.8	21.2	7.9	23.1	22.2
1953-54	87.4	43.7	23.7	8.4	25.8	23.4
1954-55	89.8	46.3	26.1	8.9	27.3	24.7
1955-56	94.4	46.7	28.7	9.4	28.2	26.2
1956-57	98.1	46.4	31.2	10.2	29.0	26.8
1957-58	97.7	46.6	33.3	10.7	31.5	28.3
1958-59	99.9	46.7	35.2	11.2	33.2	29.5
1959-60	103.6	50.1	37.3	11.8	37.8	31.3
1960-61	107.9	51.0	40.4	12.6	36.6	32.8
1961-62	109.0	50.1	42.7	13.2	35.5	33.8
1962-63	110.4	50.0	44.6	13.6	36.0	34.3

Year	Fares	Tobacco and Drink	Services	Motor Vehicles and Running Expenses	Total Personal Consumption
	v_{7t}	v_{8t}	v_{9t}	v_{10t}	m_t
1949-50	9.5	22.7	28.8	13.1	214.1
1950-51	10.6	25.5	32.7	17.7	252.2
1951-52	12.3	31.4	38.2	20.4	292.5
1952-53	13.1	32.8	41.5	18.4	303.5
1953-54	13.4	34.5	44.2	22.6	327.1
1954-55	13.7	36.1	47.3	27.5	347.7
1955-56	14.2	38.0	50.2	28.7	364.9
1956-57	15.1	41.7	52.9	29.7	381.1
1957-58	14.8	42.4	54.6	31.3	391.1
1958-59	14.7	42.4	56.4	32.3	401.6
1959-60	15.3	44.4	60.0	38.1	429.7
1960-61	15.6	45.5	62.5	38.9	443.8
1961-62	15.5	45.4	64.3	38.5	448.0
1962-63	15.4	46.1	66.5	45.2	462.1

Sources: Expenditure figures from Commonwealth Bureau of Census and Statistics, Australian National Accounts—National Income and Expenditure 1948-49 to 1962-63 (Canberra), p. 50; deflated by mean annual population figures from C.B.C.S., Demography 1963, Bulletin No. 81 (Canberra), p. 7.

Table 4.1.2

PRICE INDICATORS USED FOR COMMODITY GROUPS

Commodity Group	Component of Consumer Price Index Used
(1) Food	(1) Food
(2) Clothing	(2) Clothing and Drapery
(3) Housing	(3) Housing
(4) Gas and Electricity	(4) Household Supplies and Appliances
(5) Durable Household Goods	" " " "
(6) Other Goods	" " " "
(7) Fares	(5) Miscellaneous
(8) Tobacco and Drink	"
(9) Services	"
(10) Motor Vehicles and Running Expenses	"

satisfied here, and therefore these tests should be regarded as no more than guidelines. The strong and highly 'significant" trend against clothing expenditure constitutes a pervasive puzzle which has been detected in post-war series in at least four other countries, including Canada and Chile.[81]

In Table 4.1.5, cross elasticities of demand are given. The additive preference specification and the fact that the b_i are all positive is sufficient to guarantee that all commodities are substitutes in the sense that all estimated cross substitution effects are positive. Nevertheless, in the present case, income effects are large enough to result in all commodities appearing as gross complements; that is to say, the uncompensated derivatives are uniformly negative. Again, the tabulated elasticity values correspond to mean prices and expenditures. It is highly likely that many of these cross elasticities do not differ significantly from zero.

Money Flexibility

The estimate of ω, Frish's 'money flexibility', which comes out of these computations, is -2.87. Unhappily, not even approximate confidence intervals are available for this parameter. However, in view of evidence accumulating elsewhere, this value seems on the high side.[82]

81. The remaining countries are the U.S. and the U.K. For material on Canada and Chile, see Powell, "Postwar Consumption in Canada", op. cit., and Dillon and Powell, "An Econometric Model", op. cit. For the U.K. see C.E.V. Leser, "Commodity Group Expenditure Functions for the United Kingdom, 1948-1957", Econometrica, Vol. 29, No. 1 (January 1961), pp. 24-32; and for the U.S. see James R. Donald, Frank Lowenstein, and Martin S. Simon, The Demand for Textile Fibres in the United States, U.S.D.A. Technical Bulletin No. 1301 (Washington, U.S. Superintendent of Documents, U.S. Government Printing Office, 1963), p. 99. Of these papers only the last-mentioned is based on a single equation approach; the strong negative trend against clothing in the U.S. has been confirmed by an unpublished multiple-equation study by Powell.

82. Frisch [Ragnar Frisch, "Dynamic Utility", Econometrica, Vol. 32, No. 3 (July 1964), pp. 418-424] has cited the work of Johansen, Pearce and Barten, whose estimates of ω for Norway, the U.K., and the Netherlands respectively, are of the order of -2. Values of — 1.12 and -1.55 respectively have been estimated for Chile and Canada [Dillon and Powell, "An Econometric Model", op. cit.; and Powell, "Postwar Consumption in Canada", op. cit.]. A value of ω between -1.5 and -2.4 has been estimated from U.S. data in an unpublished paper by Powell. However, Frisch has also mentioned the work of Amundsen of Norway whose estimate of ω is of the order of -3.

Table 4.1.3

FIVE PRINCIPAL COMPONENTS OF THE CONSUMER PRICE INDEX
1949-50 to 1962-63*

Year	Food	Clothing	Housing	Household Supplies and Appliances	Miscel-laneous	Total
	p_{it}	p_{2t}	p_{3t}	p_{4t}	p_{5t}	
1949-50	0.586	0.674	0.761	0.711	0.696	0.660
1950-51	0.686	0.778	0.810	0.781	0.763	0.746
1951-52	0.899	0.935	0.891	0.929	0.923	0.914
1952-53	1	1	1	1	1	1
1953-54	1.035	1.007	1.048	1.016	0.999	1.020
1954-55	1.043	1.010	1.084	1.014	0.999	1.026
1955-56	1.102	1.020	1.151	1.016	1.059	1.069
1956-57	1.153	1.039	1.221	1.058	1.180	1.131
1957-58	1.133	1.070	1.273	1.075	1.197	1.142
1958-59	1.154	1.082	1.306	1.087	1.212	1.160
1959-60	1.198	1.094	1.352	1.098	1.239	1.189
1960-61	1.277	1.116	1.448	1.112	1.273	1.238
1961-62	1.254	1.128	1.507	1.127	1.281	1.243
1962-63	1.243	1.132	1.550	1.124	1.288	1.245

* Weighted average of 6 capital cities. Figures are simple averages of 4 quarters.

Source: Commonwealth Bureau of Census and Statistics, Labour Report 1962 and 1963 No. 50 (Canberra), p. 22.

Coefficients of Predicting Equations

The price coefficients of the linear equations system (4.1.1) are obtained by suitably transforming the estimates of the parameters.[83] The estimated price coefficients are set out in Table 4.1.6. Because of the scarcity of price-series, aggregation of the a_{ij}'s has been carried out where necessary in order to reduce the number of coefficients in line with the number of distinct price indicators available. Together with the set of estimated marginal value shares $\{b_i\}$ and estimated trend coefficients $\{\hat{c}_i\}$, these estimated price coefficients constitute our basis for allocating projected total personal consumption expenditure over the 10 groups distinguished in this study.

Some Statistical Features of the Estimates

It will be clear from the values of R^2 for the 10 equations given in Table 4.1.4 that the model is very successful as an explanator, at least over the sample period, of the allocation of consumption expenditures between commodities. In terms of the variance of current expenditures v_{it}, upwards of 96 percent of variation is explained

83. Details of these transformations are given in Powell, "A Complete System of Consumer Demand Equations", op. cit.

Table 4.1.4

PRINCIPAL RESULTS: ADDITIVE PREFERENCE MODEL OF PERSONAL CONSUMPTION EXPENDITURES. AUSTRALIA: 1949-50 to 1962-63

Commodity Group	Proportion of Outlay Spent on Group		Annual Shift in Demand	Value of Student's t for (b)		Annual Shifts as Percentage of Mean Expenditure
i	'Average' (a)	Marginal $\hat{b}_i$	$\hat{c}_i$	$\hat{b}_i$	$\hat{c}_i$	
1. Food	.252	.139	-0.513	5.67	-4.26	-0.56
2. Clothing	.125	.172	-1.055	9.54	-11.85	-2.34
3. Housing	.082	.085	0.591	4.52	6.34	1.99
4. Gas and Electricity	.026	.010	0.372	2.59	19.97	3.88
5. Durable Household Goods	.081	.135	-0.050*	3.98	-0.30	-0.17
6. Other Goods	.073	.092	0.128*	6.21	1.76	0.49
7. Fares	.038	.005*	-0.171	0.61	-4.10	-1.24
8. Tobacco and Drink	.104	.027*	0.107*	1.60	1.30	0.28
9. Services	.138	.122	0.315	6.23	3.28	0.63
10. Motor Vehicles and Running Expenses	.080	.213	0.276	9.58	2.52	0.96

Elasticity of Demand with Respect to (c)			Sums of Squares "Explained" as Proportion of Total Sum of Squares for		First Serial Correlation Coefficient (d)
i	Income	Own Price	Final Regressand	Original Variable	
1.	0.55	-0.30	0.736	0.997	0.093*
2.	1.38	-0.57	0.922	0.982	-0.164*
3.	1.04	-0.42	0.971	0.995	0.011*
4.	0.37	-0.14	0.994	0.998	0.044*
5.	1.68	-0.64	0.812	0.960	0.451*
6.	1.25	-0.50	0.949	0.990	0.505*
7.	0.13	-0.05	0.800	0.972	0.621
8.	0.26	-0.11	0.707	0.993	0.498*
9.	0.88	-0.39	0.963	0.996	0.464*
10.	2.68	-0.95	0.977	0.992	-0.349*

* Not significantly different from zero at 5 percent level under classical least-squares postulates.

(a) Ratio of sample mean expenditure to sample mean price.

(b) Approximate test only, based on classical least-squares postulates.

(c) Evaluated at mean prices and expenditures.

(d) The Durbin-Watson statistic is not tabulated for fewer than 15 observations. Here we have employed the approximate test statistic

$$t_{N-4} = \frac{\hat{r}\sqrt{N-4}}{\sqrt{1-r^2}}$$ where $\hat{r}$ is the estimated first serial correlation coefficient, and N=14 is the number of observations.

Table 4.1.5

TEN COMMODITY CLASSIFICATION OF AUSTRALIAN PERSONAL CONSUMPTION: ESTIMATED CROSS ELASTICITIES OF DEMAND*

i	Food	Clothing	Housing	Gas and Electricity	Household Durables
	1	2	3	4	5
1		-.036	-.029	-.013	- 018
2	-.281		-.072	-.032	-.046
3	-.212	-.067		-.024	-.035
4	-.075	-.024	-.019		-.012
5	-.343	-.109	-.088	-.039	
6	-.256	-.081	-.066	-.029	-.042
7	-.027	-.009	-.007	-.003	-.004
8	-.052	-.017	-.013	-.006	-.009
9	-.179	-.174	-.046	-.020	-.029
10	-.546		-.140	-.062	-.089

i	Other Goods	Fares	Tobacco and Drink	Services	Motoring Expenses
	6	7	8	9	10
1	-.023	-.020	-.052	-.053	-.003
2	-.057	-.050	-.131	-.132	-.007
3	-.043	-.038	-.099	-.100	- 006
4	-.015	-.013	-.035	-.036	-.002
5	-.069	- 061	-.160	-.162	-.009
6		-.046	-.119	-.120	-.007
7	-.006		-.013	-.013	-.001
8	- 011	-.009		-.025	-.001
9	-.037	-.032	-.084		-.005
10	-.110	-.098	-.255	-.257	

* The figure in the table estimates the percentage change in the consumption of the commodity whose identity number is i , upon a one percent increase in the price of the commodity whose name is indicated at the head of the apposite column, when all other prices and nominal income are held constant. These proportional changes are estimated in the neighbourhood of sample mean prices and expenditures.

in all cases. The fit is not so good in terms of the series actually regressed, y_{it}, but even here the model explains at worst 71 percent of the observed variation (the equation for 'vice'), and more commonly a much higher proportion. 'Vice' aside, only the estimated equation for Food, Household Durables, and Fares explain less than 90 percent of the variation in their corresponding regressor series, y_{it}, the proportions of variation explained in these cases being 73, 81 and 80 percent respectively. However, too much should not be made of the empirical performance of this model since its success is based partly upon exogenous shifts in tastes or other factors for which we have tendered no explanation. The model's potential accuracy in prediction will be contingent upon these trends continuing uniformly at the rate suggested by the sample period. With the exception of the category Fares, which is relatively

Table 4.1.6

TEN COMMODITY CLASSIFICATION OF AUSTRALIAN PERSONAL CONSUMPTION: PRICE COEFFICIENTS FOR LINEAR PREDICTING EQUATIONS

Equation	Coefficient with Respect to the Price[(a)] of				
	Food	Clothing	Housing	Houshold Supplies and Appliances	Miscellaneous
1. Food	60.1563	-3.2301	-2.2378	-4.8371	-10.8069
2. Clothing	-12.0462	19.2897	-2.7858	-6.0215	-13.4533
3. Housing	-5.9628	-1.9904	14.7707	-2.9806	- 6.6594
4. Gas and Electricity	-0.6843	-0.2284	-0.1583	7.9224	- 0.7642
5. Houshold Durables	-9.4552	-3.1562	-2.1866	7.1786	-10.5597
6. Other	-6.4094	-2.1395	-1.4822	11.5342	- 7.1581
7. Fares	-0.3589	-0.1198	-0.0830	-0.1798	11.7868
8. Tobacco and Drink	-1.8710	-.6246	- .4327	-.9353	29.7904
9. Services	-8.4957	-2.8359	-1.9647	-4.2467	22.6486
10. Motoring	-14.8728	-4.9647	-3.4395	-7.4345	-14.8243
Sum[(b)]	0	0	0	0	0

(a) Price indicators shown are components of the Consumer Price index.
(b) Discrepancies are due to rounding errors.

unimportant from the viewpoint of the present study, autocorrelation in equation errors seems mercifully absent.

Analysis of the Demand for Food

Recent conjectures about the form of consumers' utility functions have led to a number of interesting hypotheses for the empirical analysis of demand. Perhaps the most ambitious attempt in this area is Pearce's 'neutral-want-association' hypothesis,[84] under which consumers' decisions are made according to a hierarchical ordering which, rather than requiring the simultaneous consideration of decisions ranging in importance from the purchase of a packet of pins to the acquisition of a new house, enables the optimizing process to be studied at successive levels of aggregation. In this study we attempted to estimate price and income elasticities for a six-category classification of 'Food' expenditures under a hypothesis broadly equivalent to neutral-want-association.[85] Unfortunately, we were unable to achieve convergence of the iterative procedure with which it was hoped to estimate the Pearce-type demand relations. Consequently, we present here estimates of the demand for six major items of food consumption, based partly on a model of the type introduced by Leser[86] and partly on a prior estimate of Frisch's 'money flexibility'. However, apart from certain unavoidable arbitrary elements, the broad principle of separability invoked here is of

84. I. F. Pearce, A Contribution to Demand Analysis (Oxford University Press, 1964).

85. The equivalence is broad, rather than exact, because we chose to work with linear expenditure systems rather than with first difference equations for quantity indexes; most of Pearce's theorems are stated in terms of the latter.

86. C. E. V. Leser, "Demand Functions for Nine Commodity Groups in Australia", op. cit. It is a great advantage of the Leser-type estimates that they exist under very general conditions, and may be found by computing an explicit algebraic formula rather than by iterative means.

the same genre as that proposed by Pearce; i.e., we suppose that:

(1) Relative prices of goods within the food group affect only the allocation of expenditures within that group, having no effect upon the total amount spent on 'Food', and no effect upon the consumption of items external to the food group. Absolute prices of goods within the food group affect the consumption of goods outside the group only to the extent that they affect the level of the price of 'Food' in general.

(2) Expenditure on "food' is fully determined by the scale of total consumption expenditures and by the relative ratios borne to an index number representing the price of 'Food' by index numbers representing the prices of the nine competing consumption groups discussed at the beginning of this chapter.

From (2) it follows that the allocation of expenditures within the food group in only dependent on income to the extent that such expenditures depend upon the scale of spending upon the food group in general (which in turn depends upon total consumer spending and thence upon income). Moreover, should the price of some competing group rise ('Clothing', say), the only response occurring in the consumption of a good within the food category ('Meat and fish' say) will occur via the induced effect of curtailing the consumption of food in general. Cross price elasticities involving the consumption of a good within the food group and the price of another major group hence consist entirely of an income effect, substitution effects by assumption being absent. Cross elasticities between the consumption of another major group and the price of an individual food item, however, involve both an income and a substitution effect, both of which will be damped in greater or lesser degree depending upon the importance within the price index for 'Food' of the particular food item in question.

Again we have fitted linear expenditure functions

$$(4.1.6)\quad f_{it} = \Sigma_{j=1}^{6} \alpha_{ij} \pi_{jt} + \beta_i v_{1t} + \gamma_i t + e_{it} \qquad (i = 1, \ldots, 6)$$

in which f_{it} is current money expenditure at time t on the i^{th} food category; π_{jt} is a price index for the j^{th} food item at t; $v_{1t} \equiv \Sigma_{j=1}^{6} f_{it}$, as before, is total expenditure on food during t; α_{ij}, β_i and γ_i are constants, and the e_{it} are disturbances. As mentioned we attempted to estimate (4.1.6) by making use of its 'neutral-want-association' transform, which is analogous to equation (4.1.5). When this attempt failed, we were faced with essentially two alternatives. The first was to attempt to fit a model with rather less drastic prior specification. In particular, we had in mind a model basically not too different from the supply model of Chapter VI which would allow us to estimate as parameters the $\binom{6}{2}$ (i.e., 15) cross elasticities of substitution. This course was made doubly attractive in view of the doubts expressed by Pearce himself on the plausibility of the neutral-want-association hypothesis for estimating demand relations among major items of food consumption.[87] The difficulty was that new computer programs needed to be written, and our time had ample competing demands with higher potential pay-offs in terms of the overall aims of our study. The second, but less satisfactory alternative, was to adopt Leser's specification that all cross elasticities of substitution between our six food items were equal, and to estimate income responses under these conditions. Since Leser's method is quite robust with regard to the estimation of income elasticities, the result could then be modified ex post to obtain estimates of price responsiveness based on Pearce's specification by using the estimate for the elasticity of the marginal

87. Pearce, op. cit., p. 248.

Table 4.1.7

PER CAPITA EXPENDITURES ON FOOD BY BROAD GROUPS, AUSTRALIA: 1948-49 to 1961-62
(£per head)

Year	Bread and Cereals	Meat and Fish	Dairy and Eggs	Sugar, Preserves, and Confectionery	Fruit and Vegetables	Other	Total
	f_{1t}	f_{2t}	f_{3t}	f_{4t}	f_{5t}	f_{6t}	v_{1t}
1948-49	7.17	13.79	10.53	7.50	8.32	2.14	49.46
1949-50	7.53	15.14	11.28	7.97	9.58	2.56	54.07
1950-51	8.85	17.54	12.96	8.54	11.18	3.34	62.40
1951-52	11.04	21.29	16.78	10.35	14.95	3.71	78.12
1952-53	12.01	22.25	19.69	11.08	13.65	3.76	82.44
1953-54	12.58	23.35	20.60	11.70	14.89	4.33	87.44
1954-55	13.09	25.05	20.39	11.79	14.50	5.02	89.83
1955-56	13.71	26.43	20.81	12.23	15.94	5.30	94.43
1956-57	14.78	27.00	21.22	12.81	16.53	5.75	98.09
1957-58	15.13	27.05	21.36	12.86	15.73	5.53	97.66
1958-59	15.54	27.68	21.26	13.43	16.17	5.83	99.92
1959-60	16.25	29.49	21.79	13.80	16.09	6.21	103.63
1960-61	16.81	31.09	22.02	14.31	17.48	6.21	107.92
1961-62	17.07	31.12	21.78	14.71	17.54	6.32	108.54

Sources: Expenditure figures from Commonwealth Bureau of Census and Statistics, Australian National Accounts—National Income and Expenditure 1948-49 to 1963-64 (Canberra, 1965), p. 51.
Mean annual population statistics from C.B.C.S., Demography 1963, Bulletin No. 81 (Canberra), p. 7.

Table 4.1.8

PRICE INDEXES FOR SIX MAJOR CATEGORIES OF FOOD CONSUMPTION, AUSTRALIA: 1948-49 to 1961-62

Year	Bread and Cereals	Meat and Fish	Dairy Products and Eggs	Sugar Preserves and Confectionery	Fruit and Vegetables	Other
	$\pi 1t$	$\pi 2t$	$\pi 3t$	$\pi 4t$	$\pi 5t$	$\pi 6t$
1948-49	0.55	0.45	0.52	0.61	0.52	0.66
1949-50	0.59	0.52	0.56	0.62	0.59	0.67
1950-51	0.68	0.68	0.62	0.67	0.74	0.79
1951-52	0.85	0.97	0.82	0.84	1.01	0.92
1952-53	1	1	1	1	1	1
1953-54	1.02	1.01	1.04	1.03	1.15	1.03
1954-55	1.07	1.05	1.05	1.04	0.98	1.16
1955-56	1.11	1.10	1.11	1.04	1.39	1.16
1956-57	1.17	1.13	1.12	1.12	1.58	1.18
1957-58	1.24	1.13	1.16	1.13	1.08	1.17
1958-59	1.25	1.17	1.14	1.15	1.12	1.17
1959-60	1.29	1.28	1.18	1.18	1.13	1.16
1960-61	1.37	1.47	1.18	1.22	1.29	1.14
1961-62	1.43	1.36	1.18	1.22	1.33	1.14

Sources: Commonwealth Bureau of Census and Statistics, Labour Report, 1962 and 1963, No. 50 (Canberra), p. 22.
Based partly also on retail price material supplied by the Bureau of Census and Statistics.

utility of money which we obtained in the more aggregative study. In this case a computer program was immediately available, and our choice was influenced by this consideration.

Price and Expenditure Series for 'Food'

A six-commodity classification of food expenditures for the fiscal years 1948-49 to 1962—63 is given by the Commonwealth Bureau of Census and Statistics in its National Accounts statistics.[88] These figures have been deflated by the official estimates of mean annual population[89] and the resultant per capita series are given in Table 4.1.7.

There are no official price series for these six groupings of food items. We compiled the series shown in Table 4.1.8, using the series of average retail prices of food items published by the Commonwealth Bureau of Census and Statistics and some data for additional items which was made available by the Bureau.

88. Commonwealth Bureau of Census and Statistics, Australian National Accounts—National Income and Expenditure 1948-49 to 1963-64 (Canberra 1965), p. 51.

89. Commonwealth Bureau of Census and Statistics, Demography 1963 (Bulletin No. 81, Canberra), p. 7.

Table 4.1.9

SIX-COMMODITY CLASSIFICATION OF FOOD CONSUMPTION EXPENDITURE, AUSTRALIA PRINCIPAL RESULTS: DATA FITTED BY LESER'S MODEL 1948—49 TO 1961—62*

Food Sub-Commodity Group	Proportion of Outlay Spent on Group		Annual Shift in Demand	Value of Student's t for (b)		Annual Shifts as Percentage of Mean Expenditure
	'Average' (a)	Marginal β_i	$\hat{\gamma}_i$	$\hat{\beta}_i$	$\hat{\gamma}_i$	$100\hat{\gamma}_i / \bar{f}_i$
1. Bread and Cereals	0.1496	0.1636	0.0986	7.98	6.37	0.760
2. Meat and Fish	0.2787	0.3592	0.0551(n)	7.13	1.45	0.228
3. Dairy and Eggs	0.2162	−0.0211(n)	−0.2018	−0.34	−4.32	−1.077
4. Sugar, Preserves and Confectionery	0.1343	0.1857	−0.0038(n)	7.46	−0.20	−0.033
5. Fruit and Vegetables	0.1669	0.2299	−0.0731(n)	4.00	−1.69	−0.505
6. Other	0.0544	0.0826	0.1251	3.65	7.32	2.654

Elasticity of Demand with Respect to (c)			Sums of Squares "Explained" as Proportion of Total Sum of Squares for		First Serial Correlation Coefficient (d)
i	Food Expenditure (e)	Income (f)	Final Regressand	Original Variable	
1	1.094	0.60	0.847	0.997	0.129(n)
2	1.289	0.71	0.850	0.994	0.421(n)
3	−0.097	−0.05	0.706	0.984	0.397(n)
4	1.382	0.76	0.892	0.992	0.246(n)
5	1.378	0.76	0.797	0.972	0.099(n)
6	1.520	0.84	0.822	0.982	0.256(n)

* All expenditure equations based on an estimated value of 0.7254 for the common cross elasticity of substitution.

(a) Ratio of sample mean expenditure on i^{th} group to sample mean total food expenditure.

(b) Approximate test only, based on classical least-squares postulates.

(c) Evaluated at mean prices and expenditures.

(d) The Durbin-Watson statistic is not tabulated for fewer than 15 observations. Here we have employed the approximate test statistic.

$$t_{N-4} = \frac{\hat{r}\sqrt{N-4}}{\sqrt{1-\hat{r}^2}},$$ where $\hat{r}$ is the estimated first serial

correlation coefficient, and N=14 is the number of observations.

(e) $\beta_i \bar{v}_i / \bar{f}_i$

(f) 0.55 × [expression (e) above].

(n) Not significantly different from zero under classical postulates at 5 percent significance level.

Table 4.1.10

SIX COMMODITY CLASSIFICATION OF AUSTRALIAN FOOD CONSUMPTION: ESTIMATED PRICE ELASTICITIES OF DEMAND*

$\{(\hat{\eta}_{ij})\}$

i	Bread and Cereals	Meat and Fish	Dairy Products and Eggs	Sugar, Preserves and Confectionery	Fruit and Vegetables	Other	Row Total = Negative of Total Food Expenditure Elasticity for i
	1	2	3	4	5	6	
1. Bread and Cereals	—0.482	—0.168	—0.245	—0.076	—0.095	—0.028	—1.094
2. Meat and Fish	—0.119	—0.647	—0.288	—0.090	—0.112	—0.033	—1.289
3. Dairy Products and Eggs	+0.009	+0.015	+0.055	+0.006	+0.009	+0.003	+0.097
4. Sugar, Preserves, and Confectionery	—0.128	—0.212	—0.309	—0.578	—0.120	—0.035	—1.382
5. Fruit and Vegetables	—0.128	—0.212	—0.308	—0.096	—0.599	—0.035	—1.378
6. Other	—0.141	—0.233	—0.340	—0.106	—0.132	—0.568	—1.520

* Based on Leser-type estimates of marginal value shares, and on a prior estimate of -2.87 for Frish's "money flexibility" (see text). Elasticities are measured at mean prices and expenditures. The figure in the table estimates the percentage change in the consumption of commodity i when the price of j rises by one percent, total money food expenditure and all other prices remaining constant.

Results

Marginal value shares, trend coefficients and income elasticities,[90] together with measures of goodness of fit, autocorrelation in residuals, etc., are given in Table 4.1.9. These results have been obtained by using Leser's method.[91]

We have expressed some concern about the probable quality of price elasticity estimates obtainable by Leser's method. Whilst in the current application (as distinct from the previous application to broad commodity groups) we also have some reservations about Pearce's 'neutral-want-association' specification, we nevertheless believe that it represents an improvement. We recall that a vital parameter of the more aggregative ten-sector model was Frisch's money flexibility, ω, defined by

$$(4.1.7) \qquad \omega = \frac{\partial \upsilon}{\partial m} \frac{m}{\upsilon}$$

where υ is the marginal utility of total consumption outlay, m. Within our hierarchial framework of decision-making, this parameter, together with the marginal value shares β_i, determines all direct and cross demand. In fact, it can be shown that if η_{ij} is the elasticity of consumption of sub-commodity i with respect to the price of sub-commodity j, then the η_{ij} (evaluated at mean prices and expenditures) are given by

$$(4.1.8) \qquad \mathring{\eta}_{ij} = \frac{\beta}{\bar{f}_i} \left[\dot{\lambda}(\beta_j - \delta_{ij}) - \bar{f}_j\right]$$

in which $\mathring{\lambda} \equiv \bar{v}_1{}^{1}/\omega$, δ_{ij} is Kronecker's delta and the $\{\bar{f}_i\}$ are mean expenditures on the various food sub-commodities. From the ten-sector study reported above, our estimate of ω is -2.87. We have used this value and the estimates of the βi in Table 4.1.9 to compute the price elasticities of Table 4.1.10. We emphasise once again that this procedure lacks internal consistency to the extent that the ω value used has been imposed from outside, having no necessary connection with that ω which would be suggested on criteria of 'best fit' by the food consumption data themselves.

Finally, we give estimates of the price coefficients $\{\alpha_{ij}\}$ for predictive purposes in Table A4.1.1.[92]

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90. Since $\frac{\partial f_i}{\partial m} \frac{\bar{m}}{\bar{f}_i} = \left[\frac{\partial f_i}{\partial v_1} \frac{\bar{v}_1}{\bar{f}_i}\right] \cdot \left[\frac{\partial v_1}{\partial m} \frac{\bar{m}}{\bar{v}_1}\right]$,

the income elasticity for a particular food sub-group is obtained by multiplying the sub-group's estimated elasticity with respect to total food expenditure by the estimated income elasticity for Food as a whole.

91. C.E.V. Leser, op. cit. Our goodness of fit criterion for the common cross substitution elasticity of this model has been to select that value which minimises the grand total of residual sums of squares from the six fitted equations.

92. These estimates are based on the Leser model; however, they do not correspond exactly with the β_i and $\hat{\gamma}_i$ of Table 4.1.9. The difference—which, at all events is trivial—is due to the fact that Table A4.1.1 is based on an estimate of the common cross elasticity of substitution which maximises the sum of R^2s of the six fitted equations. Table 4.1.9, on the other hand, is based on an estimate of this parameter which minimises the grand total residual sum of squares from the six fitted equations.

2. THE DEMAND FOR INDIVIDUAL COMMODITIES — INTRODUCTION

(a) Real Personal Disposable Income per Head and Real Personal Consumption Expenditure per Head

In the following analysis of Australian demand for individual agricultural products, the level of per capita income is a variable often used to explain the level of per capita consumption. Since the same income data are used for all commodities, we discuss here the principles used in the construction of the income series.

The Australian National Accounts include tables of the main aggregates of National Income at 1953-54 prices (for the years 1948-49 to 1959-60) and at 1959-60 prices (for 1953-54 to 1963-64).[93] However, Personal Disposable Income at constant prices must be estimated from these main aggregates.[94] Aggregate income is divided by the mean population at 31 December to obtain per capita income figures.

There are some disadvantages in using Personal Disposable Income as an explanatory "income" variable in the Australian context. In particular the wool boom of 1950-51 raised the Real Personal Disposable Income per head to a level which it did not achieve again until 1963-64. Since the increase in income was mainly in the hands of pastoralists, forming a small proportion of the total population, we would not expect this increase to stimulate much additional expenditure on agricultural products. In many cases we prefer to assume that households and individuals make the savings-consumption decision first and then make the decisions regarding the allocation of total consumption expenditure to various components. Hence most of the equations have also been estimated with Personal Consumption Expenditure per head as an explanatory variable.

Personal Consumption Expenditure at constant prices is available in two series as noted above—at 1953-54 and 1959-60 prices. The two series have been linked at 1959-60, and for the years 1946-47 and 1947-48, the same method was employed as was used in obtaining Real Personal Disposable Income per head. Table 4.1.2 presents data for both Personal Disposable Income and Personal Consumption Expenditure.

(b) 'Real' Prices

The Labour Report[95] contains average retail prices of several food commodities for each month and for each capital city. A general method has been employed for calculating an index of the Australian average annual price of each commodity and this method is discussed here.

(i) For each city a simple average of monthly prices in each fiscal year is calculated for the commodity.

(ii) An average annual price for Australia as a whole is calculated by weighting each of the six city prices ac-

93. Commonwealth Bureau of Census and Statistics, Australian National Accounts, National Income and Expenditure, 1948-49 to 1963-64, (Canberra, 1965).

94. Personal Disposable Income comprises all Personal Current Receipts less Income Tax and estate and gift duties payable. For each year 1948-49 to 1959-60, the ratio of Personal Consumption Expenditure at 1953-54 prices to Personal Consumption Expenditure at current prices is calculated. This ratio is then applied to Personal Disposable Income in order to obtain Personal Disposable Income at 1953-54 prices. For the years 1959-60 to 1963-64, the same technique is applied giving a series of Personal Disposable Income at 1959-60 prices. The two series are linked at 1959-60 in order to give a single series of Personal Disposable Income at constant prices. For the two years 1946-47 and 1947-48, the Commonwealth Statistician does not publish National Income at constant prices and various price indexes have been used to adjust the published data.

95. Commonwealth Bureau of Census and Statistics, Labour Report, (Canberra, published annually).

cording to the following scheme:

Sydney	0.4
Melbourne	0.3
Brisbane	0.1
Adelaide	0.1
Perth	0.07
Hobart	0.03

This weighting system corresponds closely to that used in the calculation of the Consumer Price Index, the weights being derived from the populations of the cities at the 1954 Census.

(iii) Using 1952-53 as a base year and giving it the value of 100, the weighted average annual price is expressed as an index.

(iv) 'Real' price is calculated by dividng the index of the commodity's price by the Food component of the combined Six State Capital Cities Consumer Price Index.

(v) In some cases the prices of several commodities are combined to form a single price index. Meat prices are derived in this way. The Commonwealth Statistician published retail prices of various cuts of each major meat type. To obtain a price for each of these types—beef, lamb, mutton and pork—the prices of the several cuts were combined, on the basis of the weights in the regimen of the Consumer Price Index, Labour Report 1961.

(c) Consumption Units

If the age structure of a population is changing, the analysis and projection of demand for individual products should possibly be considered in terms of consumption per consumption unit rather than consumption per person. With most food items, some variation exists in the average levels of consumption of different age groups. In our calculation of the growth of the number of consumption units we took the indices reported in U.S. Department of Agriculture, Economic Research Service and Foreign Agricultural Service, United Kingdom: Projected Level of Demand, Supply and Imports of Farm Products, in 1965 and 1975. ERS-Foreign 19 (Washington, D.C., 1962), Table 1, p. 90. We reproduce the relevant section of the table here as Table A4.2.1.

In the determination of the number of consumption units in the economy, individuals are given a weight according to their age and sex, and on the particular food group being considered. Some analysis of the comparative growth of population and of the number of consumption units was carried out for various food groups. In our analysis, the basic consumption unit is a male aged 20-64 years. For each commodity group, other members of the population are given a weight according to the manner in which their consumption of that commodity differs from the consumption of the basic unit. For instance, males aged 10-14 years are given a weight of .70 for meat, but a weight of 1.20 for cereal and potatoes.

Table 4.2.2 shows that with regard to growth in the number of consumption units in the commodity, the age and sex distribution of the population projected for 1980 is little different from the distribution in 1960. It is apparent that the projection model used does not affect this result in any significant way. There was a greater diversity in the growth of population and consumption units for certain commodities (notably alcoholic beverages) in 1950 to 1960 than in the projection period 1960 to 1980. The concept of consumption units may be more valuable in the analysis of existing data than in the projection of future consumption.

(d) Trend Variables

The use of trend variables is avoided wherever a reasonable explanation of changes in consumption can be obtained from appropriate economic variables. Where a trend variable is included in a regression equation. it is often found that its relation with the dependent variable is so strong that it swamps the economic variables in the equation. The trend variable may give a satisfactory 'explanation' of past changes in consumption, but it is seldom that it can be used

Table 4.2.1

PERSONAL DISPOSABLE INCOME PER HEAD AND PERSONAL CONSUMPTION EXPENDITURE PER HEAD, AUSTRALIA: 1946-47 TO 1963-64

	Real Personal Disposable Income £ per head (1953-54 prices)	Real Personal Consumption Expenditure £ per head (1953-54 prices)
1946-47	322.2	294.9
1947-48	344.5	295.0
1948-49	354.4	317.5
1949-50	378.8	326.6
1950-51	426.0	338.3
1951-52	361.1	325.7
1952-53	363.6	310.6
1953-54	367.3	326.2
1954-55	383.1	342.1
1955-56	390.8	343.9
1956-57	384.7	339.5
1957-58	371.2	344.1
1958-59	385.6	348.4
1959-60	403.5	365.2
1960-61	401.7	363.7
1961-62	401.4	365.9
1962-63	415.8	379.3
1963-64	447.9	389.0

Source: Commonwealth Bureau of Census and Statistics, Australian National Accounts National Income and Expenditure, 1948-49 to 1963-64 (Canberra), pp. 22-23.

confidently in projecting consumption. In the analysis of the demand for dairy products and wheat, discussed later in this chapter, trend variables have been used. In each case an explanation of the form of the variable is given when it is introduced.

3. THE DEMAND FOR DAIRY PRODUCTS

Our analysis of post-war trends in the consumption of dairy products starts with the year 1950—51, after butter rationing had been discontinued. A detailed study of the Australian dairy industry was made under the direction of N T. Drane and H.R. Edwards, and we make considerable use of the chapter dealing with the demand for dairy products.[96]

The Consumption of Liquid Milk

Available data on liquid milk consumption include the milk used in the production of ice cream and confectionary. In fact the data represent a residual after the total whole

96. N.T. Drane and H.R. Edwards ed., The Australian Dairy Industry (F.W. Cheshire, Melbourne, 1961). R.S.G. Rutherford was the author of the chapter on demand and we shall use his name when referring to the book.

Table 4.2.2

ESTIMATED GROWTH OF POPULATION AND CONSUMPTION UNITS
AUSTRALIA, 1960 TO 1980
Figures expressed as a percentage of 1960 levels

	1960	1970			1975			1980		
	All models	3.1(a)	3.1(c)	3.1(d)	3.1(a)	3.1(c)	3.1(d)	3.1(a)	3.1(c)	3.1(d)
Population	100	113.6	125.6	121.1	121.8	140.6	132.8	131.0	157.0	145.8
General Consumption Units	100	113.6	125.5	121.0	121.6	140.3	132.5	130.3	156.3	145.1
Consumption Units for:										
Milk	100	113.6	125.6	121.1	123.6	140.7	132.9	131.4	157.2	146.0
Meat	100	114.1	125.8	121.3	121.4	140.1	132.4	129.5	155.6	144.5
Fats	100	113.8	125.7	121.2	121.4	140.3	132.5	130.1	156.2	145.0
Cheese and Eggs	100	113.7	125.6	121.1	121.5	140.3	132.5	130.3	156.4	145.2
Cereal and Potatoes	100	113.7	125.7	121.2	121.4	140.4	132.6	130.3	156.6	145.3
Fruit	100	114.1	125.7	121.2	121.7	140.1	132.4	130.0	155.7	144.7
Beer	100	114.4	126.0	121.5	121.8	140.2	132.3	128.7	154.6	143.7
Wine	100	115.0	126.0	121.7	122.6	140.1	132.6	129.8	154.8	144.2
Spirits	100	114.8	126.0	121.6	122.4	140.1	132.6	129.5	154.8	144.1

Source: Based on data of Table A3.1.1 and Table A4.2.1.

milk production has been allocated to other forms of utilisation.

Table 4.3.1 shows that since 1950-51 per capita consumption has remained fairly constant with only slight variations from the annual figure of 289 lb to 294 lb per capita (28-28.5 gallons). In the post-war period of butter rationing, consumption of liquid milk was somewhat higher—an average 30.8 gallons per capita. This was due perhaps, to the limited availability of butter and a generally freer supply of other dairy products to the civilian population. When considering pre-war consumption Rutherford found a steady increase in the per capita consumption of liquid milk through the 1930's with a peak in 1946-47. The crude birth rate, used as a measure of the proportion of the population under 1 year, was rising during the 1930's and was considered by Rutherford to be the most useful explanatory variable.[97] However, the crude birth rate was not a very useful variable when looking at the post-war period.

Two regression equations were fitted to the data for 1950-51 to 1962-63. While they gave coefficients with correct signs, none were significantly different from zero when judged by the usual tests.

$$(4.3.1)\quad \log Q_m = \underset{}{2.445} + \underset{(0.078)}{0.040} \log Y \underset{(0.109)}{-0.139} \log P_1 + \underset{(0.250)}{0.142} \log B \quad (R^2 = 0.253)$$

$$(4.3.2)\quad \log Q_m = 1.768 + \underset{(0.147)}{0.118} \log C \underset{(0.143)}{-0.0566} \log P_1 + \underset{(0.411)}{0.375} \log B \quad (R^2 = 0.253)$$

where Q_m is per capita consumption, in pounds,

Y personal disposable income, at constant (1952—53) prices,

C total consumption expenditure at constant (1952-53) prices,

P_1 real price of liquid milk (1952-53 base) at constant (1952-53) prices,

B crude birth rate.

The coefficients of multiple determination, R^2, have a value of only 0.253—that is, only 25 percent of the variation in per capita consumption is accounted for by the income, price, and birth rate variables used. Since the coefficients are not statistically significant we should not exaggerate the low values of the resulting elasticities.[98] However, our estimated elasticities are not nonsense values but are similar to those obtained in other developed countries. Thus, one group of research workers has calculated the income elasticity of demand for milk and milk products (excluding butter) for Canada as 0.10 and for the United States as 0.05, both measures being related to the income levels of 1957-59.[99] According to another survey conducted by F.A.O. "In summary, it appears that in the developed countries increases in disposable income and relatively small price changes have but little effect upon liquid milk consumption. On the basis of the information available, such factors as food habits, availability and quality of milk seem to have a greater impact upon milk consumption levels" [100]

97. Rutherford, op. cit., pp. 62-64.

98. We also fitted semi-logarithmic equations to the data. When calculated for income and price levels of 1962—63, the income and price elasticities of demand for liquid milk were 0.024 and -0.127 respectively. The value of R^2 was 0.229.

99. Food and Agriculture Organization of the United Nations, Agricultural Commodities—Projections for 1970 (Special Supplement to Commodity Review, 1962, Rome), p. A-14.

100. Food and Agriculture Organization of the United Nations, Means of Adjustment of Dairy Supply and Demand, Commodity Bulletin Series 37 (Rome, 1963), p. 47.

Table 4.3.1

COMSUMPTION AND PRICES OF DAIRY PRODUCTS AND MARGARINE
AUSTRALIA, 1946-47 TO 1964-65

Year	Consumption Per Head Per Annum					Index of 'Real' Prices (1952-53 = 100)					Crude Birth Rate (a)
	Liquid Milk (b) (lb)	Butter (lb)	Table Margarine (lb)	Other Margarine (lb)	Cheese (lb)	Liquid Milk	Butter	Cheese	Condensed Milk	Table Margarine (c)	
1946-47	303.9	25.3	0.7	5.0	6.1	95.97	98.76	117.39	107.73	110.59	23.84
1947-48	315.2	24.8	1.2	5.4	5.5	94.95	98.42	110.28	109.03	136.78	23.58
1948-49	320.3	24.3	0.7	5.9	5.1	96.99	91.68	162.48	106.54	117.06	23.01
1949-50	308.0	25.3	0.6	6.5	6.3	99.47	84.68	96.04	106.31	122.30	23.11
1950-51	292.5	30.9	0.5	6.0	6.0	97.22	72.36	82.96	98.53	104.48	23.07
1951-52	289.4	31.2	1.4	6.5	6.0	96.27	80.29	83.52	98.76	96.41	23.15
1952-53	285.3	29.3	1.6	5.6	5.9	100.00	100.00	100.00	100.00	100.00	23.14
1953-54	292.5	30.6	2.1	5.6	5.9	98.47	98.24	96.68	101.64	96.62	22.72
1954-55	292.5	30.2	2.3	5.4	5.9	100.04	97.33	96.05	101.08	100.67	22.53
1955-56	293.6	29.0	3.0	4.6	5.9	97.81	98.89	98.50	95.22	95.28	22.53
1956-57	293.6	28.0	3.6	4.7	5.9	93.96	97.25	101.81	93.54	98.29	22.63
1957-58	290.5	27.8	3.6	4.8	5.9	98.77	98.37	105.57	94.50	100.03	22.72
1958-59	290.5	25.9	3.5	5.1	6.0	96.93	99.11	106.38	95.08	98.21	22.58
1959-60	294.6	26.2	3.5	5.7	6.2	93.23	95.63	105.75	92.88	105.73	22.50
1960-61	295.6	25.1	3.5	5.8	6.4	88.97	93.30	101.53	93.57	99.19	22.64
1961-62	293.6	24.0	3.2	6.0	6.6	91.87	94.77	103.31	92.30	106.24	22.50
1962-63	286.3	23.8	3.3	6.2	6.8	93.26	95.49	103.68	91.32	112.63	21.87
1963-64	311.0	23.4	3.2	6.7	7.0	93.44	93.95	102.05	88.38	n.a.	21.08
1964-65		22.6			7.5						

(a) Number of births per 1,000 of mean population.
(b) Estimated weight of a gallon of milk—10.3 lb.
(c) The 'real' price of margarine was calculated as follows: For the years 1950-51 to 1959-60 we used the series of the actual price of margarine presented by A.D. Ross. [See, "The Problems of Australia's Butter Consumption", Quarterly Review of Agricultural Economics, Vol. 15, No. 3 (July 1962) p. 114]. For the years 1960-61 to 1963-64, an estimate of the actual price was made on the basis of recommended retail prices for various brands of margarine.

Sources: Consumption estimates from Commonwealth Bureau of Census and Statistics, Report on Food Production and the Apparent Consumption of Foodstuffs and Nutrients in Australia (published annually, Canberra).
For cheese consumption adjusted estimates were made available by M. Singh, Director of Marketing Research, Australian Dairy Produce Board.
Prices—Commonwealth Bureau of Census and Statistics, Labour Report (published annually, Canberra).
Birth Rate—Commonwealth Bureau of Census and Statistics, Demography, Bulletin No. 79 (Canberra); and Commonwealth Bureau of Census and Statistics, Australian Demographic Review No. 215 (Canberra, 1965).

The Commonwealth Statistician estimates the annual per capita consumption of cream but has set his estimate at 2.0 lb per head for the past 10 years. It seems that the Statistician's estimate is to be taken more as an expression of the lack of reliable data than as a genuine estimate.[1]

The Consumption of Butter[2]

After June 1950 when the regulations limiting the domestic consumption of butter were lifted , per capita consumption rose to 31 lb—1.5 lb below the average for the 5 pre-war years. Consumption never returned to the pre-war levels, but apart from increases in 1953-54 and 1959-60, it has shown a fairly steady decline over the whole period since 1950-51. Factors suggested as contributing to this decline in consumption are:

(i) competition from margarine;
(ii) changes in consumer tastes, associated with higher incomes;
(iii) changes in the structure of the population.

(i) Margarine

There has certainly been a marked increase in the consumption of margarine in Australia (Table 4.3.1). It received a boost during the war years when butter was rationed, and during the early 1950's per capita consumption of table margarine increased strongly. The price of margarine has always been below that of butter, and generally has been no more than 70 percent of the butter price. Improvements in the quality of margarine, taken together with its lower price, have encouraged consumption. However, the State Governments have placed quotas on the production of table margarine. Thus it is impossible to judge the extent to which substitution would take place under free conditions of margarine production. The annual quota of table margarine for Australia of 16,072 tons has remained unchanged since 1957-58. Annual production has been reported for approximately this figure until 1964-65 and consequently reported consumption per capita has been falling in recent years. For 1964-65 reported production was 22,500 tons.[4] The higher reported production of 1964-65 results from open defiance of the quotas by one company which is at present challenging their constitutional validity. It is interesting to note that the per capita consumption of butter and table margarine combined has fallen steadily since 1953-54, and that in spite of the margarine quotas, the per capita consumption of butter has continued to fall.

The fall in the consumption of butter and table margarine is offset to some extent by the rise in the consumption of other (i.e. non-table) margarine. Its production is not subject to quotas, and since 1955-56 there has been a steady increase in per capita consumption. It is used mainly in bakeries and by large-scale pastrycooks, and has mainly replaced lard, dripping, and copra, but there may have been some small replacement of butter.

1. Thus, in the last ten years, Sydney and Canberra experienced an increase in consumption after a switch to a lower price and these changes would have affected the Australian average consumption per capita. Where consumption in other parts of the country is low, it is probably a result of the relatively high price of cream. A change in pricing policy in the future may have a marked effect on the level of consumption.

2. For this section we have also relied on: A. D. Ross, "The Problem of Australia's Butter Consumption", Quarterly Review of Agricultural Economics, Vol. 15, No. 3 (July 1962), pp. 114-121.

4. One difficulty associated with the data is the unreliability of the figures reporting margarine production. Some industry observers suggest that margarine manufacturers exceeded production quotas; that there was no sudden jump in production in 1964-65; and that consumption is higher than the figures record.

(ii) Tastes and Preferences

There is some evidence from overseas and from Australian studies that rising incomes are associated with a decline in the consumption of butter. Rutherford reports on a small sample survey conducted in Sydney, showing a substantial decline in the use of butter for 'spread' and of some increase in its use for cooking as incomes increase.[5] The total effect is a net decline in the per capita consumption of butter. As income levels rise there may also be some substitution of meat for the two commodities bread and butter. The greater emphasis given to diet by the medical profession and the limited consumption of butter allowed to many people who are overweight may also have affected butter consumption.

(iii) Structure of the Population

Rutherford investigated the effect on consumption habits of the birthplaces of the housewife and the head of the household. The conclusion reached was that 'migrant' households tend to have a somewhat lower consumption of butter than Australian households and a similar consumption of margarine. There are no accurate data available to examine the migrant household effect as part of our examination of time series, but Table 4.3.2 shows that migrant households are gradually forming a larger proportion of total households in Australia.[6]

The other aspect of household composition—its age distribution—will also have its effect on the consumption of butter, since the commodity has its highest level of per capita consumption among working adults. However, during the 1950's total population and the total consumption units for fats seem to have grown at approximately the same rate.[7] Using a base of 100 for 1950, total population had grown to 130.70 by 1962 and the total number of consumption units to 130.79.

Several equations have been estimated, using available time series data. Confining ourselves first of all to the use of income and the price of butter to explain butter consumption, we obtain the result:

$$(4.3.3)\quad \log Q_b = 5.542 - \underset{(0.256)}{1.396} \log C - \underset{(0.148)}{0.282} \log P_b \qquad (R^2 = 0.784)$$

where Q_b is per capita consumption in pounds,
C consumption expenditure (as before),
P_b real price of butter (1952-53 base).

The expenditure elasticity of demand for butter obtained from this equation, -1.396, seems too high to represent just the preference for a different pattern of food expenditure as incomes rise. The underlying upward trend in personal consumption expenditure per capita matches the downward trend in consumption, but we would hesitate to assign an "income" effect as strong as this to the explanation of changes in butter consumption. However, the other major influences are hard to disentangle.[8] Nor did we achieve any more reasonable results when price of table margarine was introduced.

The other method of allowing for changes in tastes—the introduction of a separate trend variable—is not entirely satisfactory.

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5. Rutherford, op. cit., pp. 71-81.

6. We would be wrong in assuming that all 'migrant' households were alike in this regard. Migrants from Northern Europe might well be more like Australians than they are like migrants from Southern Europe. Certainly the effect of migration on butter consumption is hard to measure.

7. See section 4.2 for a discussion of consumption units.

8. The semi-logarithmic function fitted to the data gave income and price elasticities of demand of -1.389 and -0.687 respectively. Income and prices of 1962-63 were used to calculate the elasticities.

Table 4.3.2

PROPORTION OF AUSTRALIAN POPULATION BORN OUTSIDE AUSTRALIA

Census at 30th June	Percent
1947	9.82
1954	14.31
1961	16.93

Source: Commonwealth Burea of Census and Statistics, Official Yearbook of the Commonwealth of Australia No. 47, p. 306; No. 50, p.286 (Canberra, 1961).

Although there is a very strong simple correlation between consumption of butter and the trend, its introduction does obscure the influence of the other variables. When we look at the linear trend in butter consumption we find a simple correlation coefficient of -0.967 between per capita consumption and trend. Consumption declines on average by 0.64 lb per annum. Of course this result is not very suitable for the purpose of projection. In addition, there is some evidence of a slackening in the rate of decline of consumption. If it is desired to use these estimated relationships as a basis for projection, then it would be preferable to use a functional form where the annual decline in per capita consumption tapers off. This is given by:

$$(4.3.4) \quad \log Q_b = 29.986 - \underset{(0.886)}{7.334} \log t \qquad (R^2 = 0.954)$$

where t = 1 in 1957-58 and the period used is 1957-58 to 1964-65.

We would then treat the true income elasticity of demand as indeterminate with regard to the available data, and would not use any measure of it in projecting demand for butter. Available evidence for other advanced countries suggests that the income elasticity of demand for fats and oils, including butter, is low, and sometimes negative. The F.A.O. bulletin reports a value of zero for the United States and New Zealand, 0.03 for Canada and low values for Western Europe.[9]

The Consumption of Cheese

Figures recorded by the Commonwealth Statistician show that annual consumption of cheese in Australia has varied around an average of 6.1 lb per capita between 1950-51 and 1962-63. However it is believed that the erratic movement of the annual consumption figures is due to inaccuracies in the recording of changes in stocks of cheese, and not to changes in consumption. Mr. Singh, Director of Marketing Research of the Australian Dairy Produce Board, has provided adjusted data for cheese consumption. His figures show that from 1950-51 to 1958-59, per capita consumption remained steady at 5.9 to 6.0 lb per annum, and that more recently, there has been a marked increase in consumption. In part, the increase can be accounted for by the rise in per capita consumption of imported cheese which has recently become available in greater variety, in better condition, and at more competitive prices than before. By 1962-63, per capita consumption of cheese had reached a level of 0.5 lb per annum—only 7 percent of total cheese consumption—but still a substantial increase when compared with the negligible amounts consumed prior to 1953-54.

Cheese is often regarded as a possible substitute for meat in the Australian diet and we have included the price of meat as an explanatory variable in the equation fitted to the data.[10] Mr. Singh's adjusted consumption

9. F.A.O., Agricultural Commodities, Projections for 1970, op.cit., p. A-14.

10. The price of meat is a weighted average of the prices of the four major types of meat. The data are presented in Table 4.1.8.

figures have been used.[11] While both the prices of meat and cheese have the expected signs, they do not differ significantly from zero.

$$(4.3.5) \quad \log Q_c = 1.461 + \underset{(0.193)}{0.747} \log C - \underset{(0.126)}{0.0693} \log P_c + \underset{(0.204)}{0.244} \log P_M \quad (R^2 = 0.786)$$

where Q_c = per capita cheese consumption, in pounds,
C = total consumption expenditure, in constant 1952-53 prices,
P_c = real price of cheese (1952-53 = 100),
P_M = real price of meat (1952-53 = 100).

The significant "income" (i.e. consumption) coefficient probably includes some increases in cheese consumption which result from other factors—the growing preference for non-cheddar varieties and the changing composition of the population.[12]

The Consumption of Other Milk Products

These products fall into two distinct categories; those produced from whole milk (condensed and evaporated full cream milk, powdered milk and infants' and invalids' foods) and those derived from skim milk as by-products of the butter and cheese industries (including powdered skim milk, and condensed skim milk and casein).

As shown in Table 4.3.3, the domestic consumption of whole milk products in Australia changed very little in the decade to 1962-63. In 1963-64 however, there was a significant rise in the consumption of unsweetened evaporated milk. This was probably due to the increasing popularity of this type of product for infant feeding. Commenced in many hospitals, the practice is usually continued by mothers on their return home. There has also been a slow increase over a number of years in the consumption of "infants and invalids" milk products, but for most other whole milk products the consumption level continues to remain fairly stable.[13]

Consumption of skim milk products on the other hand, has risen considerably since 1953-54 (Table 4.3.3). The major change has been in powdered skim milk, consumption having risen from 1.0 lb per head in 1953-54 to 5.9 lb per head in 1964-65. Two outlets initially responsible for this rise were the increased use of powdered skim milk in bread making and in confectionary manufacture. The per capita use of powdered skim milk in these industries has approached a maximum, but other end-uses have recently become significant and are helping to maintain the upward trend in consumption. For example, it is being increasingly used in the protein fortification of infant cereals and is becoming more widely used as a non-fat milk in slimming diets. Another important outlet is the increasing use of powdered skim milk in the preparation of stock feeds—particularly for vealers and pigs.

11. Before we obtained Singh's estimates of adjusted cheese consumption an equation was fitted to the unadjusted data. This gave the following results:

$$\log Q_c = -0.883 + \underset{(0.507)}{0.303} \log Y - \underset{(0.293)}{0.153} \log P_c + \underset{(0.481)}{0.590} \log P_r \quad (R^2 = 0.254)$$

where Q_c is unadjusted per capita consumption, and other symbols have the same meaning as earlier equations in this section.

12. According to a small sample survey, per capita consumption among Italian migrants of Italian type cheeses is about 30 percent higher than average Australian per capita consumption of all cheeses. (The Australian Dairy Produce Board—private communication).

13. Small year to year fluctuations in apparent consumption are probably due to changes in stocks.

Table 4.3.3

PER CAPITA CONSUMPTION OF PROCESSED WHOLE MILK AND SKIM MILK PRODUCTS, AUSTRALIA, 1953-54 TO 1964-65

Milk Product	Unit	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65(a)
Whole Milk:													
Condensed, etc.													
Sweetened	lb/head	2.7	2.4	2.6	2.6	1.4	2.2	2.7	2.4	2.5	2.2	2.5	2.5
Unsweetened	"	6.1	4.2	5.7	6.2	6.8	6.4	6.6	6.4	6.9	6.6	7.6	7.6
Powdered	"	2.6	2.4	2.3	2.2	2.9	2.4	2.7	2.5	2.7	2.5	2.4	2.5
Infants and Invalids	"	2.4	1.9	2.6	2.0	2.3	2.2	2.9	2.5	2.4	2.6	2.9	2.7
Total Wholemilk as Milk Solids (b)	"	5.59	4.44	5.20	5.13	5.68	5.30	5.94	5.51	5.87	5.53	5.89	5.94
as percent of all Milk Products	%	84.31	71.38	69.61	66.27	70.73	63.17	61.49	55.15	57.10	56.54	52.87	48.53
Skim Milk:													
Condensed, etc.	lb/head	0.3	1.5	0.9	1.1	1.5	1.1	1.0	1.0	1.0	1.8	2.3	2.3
Powdered Skim	"	1.0	1.4	2.1	2.4	2.0	2.9	3.6	4.4	4.3	3.9	4.8	5.9
Total Skim Milk as Milk Solids (b)	"	1.04	1.78	2.27	2.61	2.35	3.09	3.72	4.48	4.41	4.25	5.25	6.30
as percent of all Milk Products	%	15.69	28.62	30.39	33.73	29.27	36.83	38.51	44.85	42.90	43.46	47.13	51.47
Total Milk Products as Milk Solids	lb/head	6.63	6.22	7.47	7.74	8.03	8.39	9.66	9.99	10.28	9.78	11.14	12.24

(a) Preliminary estimates.
(b) Conversion factors were obtained from: Technical Conversion Factors for Agricultural Commodities, FAO (Rome 1962), p. 29.

Sources: Commonwealth Bureau of Census and Statistics, Primary Industries, Part I—Rural Industries (Canberra), 1953-54 to 1962-63
Commonwealth Bureau of Census and Statistics, private communication.

More modest increases have occurred in the per capita consumption of condensed and evaporated skim milk. These are mainly used by food processors; for example, in the manufacture of soups. Domestic consumption of casein has been very small, primarily for industrial purposes. Its present use as a food protein source is negligible.

The several milk products can be aggregated on the basis of their milk solids constant.[14] As shown in Table 4.3.3, between 1953-54 and 1964-65, the per capita consumption of these milk products as a group nearly doubled. In general, this has been brought about by price considerations, dietary reasons, and the convenience to industry of purchasing non-fat powders and butter fat as separate components.

4. THE DEMAND FOR MEAT

In Australia per capita consumption of meat is very high. Table 4.4.1 presents a comparison of meat consumption in a number of selected countries. For the 3-year period 1957-58 to 1959-60, Australian consumption was higher than in any other country listed. The analysis of past consumption data as a basis for projection must start after 1948. The rationing of the domestic consumption of meat, introduced during World War II, continued until June 1948, and so the relationship between prices, income and demand for meat is obscured in data for the years prior to 1949.

Until 1958-59 beef and veal represented at least half of the meat consumption of Australians, mutton and lamb represented a third, and the remainder was made up of pigmeats, offal, and canned meat.[15] For three years after 1958-59 the consumption of beef and veal fell sharply and by 1960-61 per capita consumption was less than 70 percent of the earlier high level. In this year only 39 percent of meat consumption was provided by beef and veal. The decline in local consumption was associated with the development of the United States as an export market for Australian beef, with consequent high prices and short supplies on the Australian retail market. At the same time total meat consumption per capita fell, but there was some substitution of lamb and mutton for beef on the part of Australian consumers. The share of sheepmeats in total consumption rose from around 33 percent to 40-45 percent, and per capita consumption of both mutton and lamb rose. The increase was more marked in the case of lamb.

Table 4.4.1

MEAT CONSUMPTION PER CAPITA, SELECTED COUNTRIES AVERAGE 1957-58 TO 1959-60

	Percent of Australian Consumption
New Zealand	92
Canada	68
United States	80
France	64
Germany, Federal Republic	47
United Kingdom	62
Argentina	95
Uruguay	97

Source: Food and Agriculture Organization of the United Nations, Production Yearbook 1963, Vol. 17 (Rome, 1964).

14. Conversion factors used were obtained from: Food and Agriculture Organization of the United Nations, Technical Conversion Factors for Agricultural Commodities, (Rome, 1960), p. 29.

15. See Table 4.4.2. In this table total meat consumption does not include consumption of poultry and rabbits.

Table 4.4.2

CONSUMPTION AND PRICES OF BEEF AND VEAL, LAMB AND MUTTON
AUSTRALIA, 1949-50 TO 1964-65

Year	Consumption Per Head Per Annum					Index of Real Prices (1952-53 = 100)			Index of Export Prices (1952-53 = 100)	
	Beef and Veal	Lamb lb	Mutton lb	Total lb	Total Meat Consumption[a]	Beef and Veal	Lamb	Mutton	Beef[b]	Lamb[c]
1949-50	124.3	27.4	45.7	197.4	232.9	84.01	97.10	98.32	63.9	67.4
1950-51	131.6	24.6	38.4	194.6	226.6	93.7	116.03	105.80	74.8	88.4
1951-52	121.8	24.0	41.0	186.8	216.5	102.68	115.68	118.33	113.4	101.2
1952-53	119.7	28.8	49.5	198.0	227.7	100.00	100.00	100.00	100.0	100.0
1953-54	114.6	26.9	51.4	192.9	223.5	95.94	105.22	89.29	111.8	114.0
1954-55	116.5	26.0	52.1	194.6	231.6	101.51	107.96	91.41	121.0	112.8
1955-56	119.1	26.2	49.1	194.4	231.6	100.01	106.44	93.89	105.9	124.4
1956-57	128.9	27.7	46.8	203.4	237.4	97.12	100.43	93.89	103.4	116.3
1957-58	125.1	28.4	50.7	204.2	244.6	102.19	104.24	89.45	122.7	105.8
1958-59	117.6	31.9	55.1	204.6	245.0	106.60	96.27	86.50	146.2	98.8
1959-60	98.4	39.0	63.8	201.2	238.6	116.62	90.40	85.92	168.1	90.7
1960-61	85.4	38.2	63.2	186.8	224.2	128.22	94.99	91.57	167.2	108.1
1961-62	93.3	42.8	55.3	191.4	232.3	121.90	86.13	84.85	133.6	88.4
1962-63	100.4	42.1	51.6	194.1	235.1	124.58	91.16	86.89	142.9	101.2
1963-64	104.9	41.7	48.3	194.9	235.3	121.69	92.97	90.33	152.9	107.0
1964-65	98.8	39.4	47.2	185.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

(a) Total meat consumption does not include consumption of poultry and rabbits.
(b) An index of average annual price of 1st and 2nd Export Quality Beef at Brisbane market.
(c) An index of average annual price of 1st and 2nd Export Quality Lamb at Melbourne market.

Sources: Consumption — Commonwealth Bureau of Census and Statistics, Report on Food Production and the Apparent Consumption of Foodstuffs and Nutrients in Australia, No. 19, 1963—64 (Canberra) and earlier issues.
Retail Prices — Commonwealth Bureau of Census and Statistics, Labour Report (Canberra, published annually).
Export Prices — Commonwealth of Australia, Annual Report of the Australian Meat Board, various issues (Sydney).

The three years from 1961-62 saw a recovery in the consumption of beef and veal and increases in total meat consumption. There was a fairly steady consumption of lamb and further declines in the consumption of mutton. However consumption of each of the three major types of meat declined again in 1964-65.

With regard to the Australian consumption of poultry, few official statistics are available. Unofficial estimates of production give per capita figures of 3.6 lb and 4.3 lb for 1960 and 1961. In May 1965, in a talk at Sydney University, the service manager of one of Victoria's largest poultry producers stated that annual Australian consumption per capita was in the range of 12 to 14 lb. The rise in consumption suggested by these figures does not seem out of line with general observation of the retail meat market in Melbourne. As new methods of broiler production were introduced, the price of broilers relative to the prices of red meat declined. Consumption increased with the greater availability of broilers at a lower price.

The present Australian consumption of poultry seems to be similar to consumption in the U.S. in 1925—29.[16] However because of the relatively higher consumption and lower prices of carcass meats, it is not certain that one should project future Australian consumption on the assumption that there will be an increase similar to that experienced by the U.S. over the past 40 years. Thus for Australia any growth in poultry consumption is likely to be as a substitute for red meat. In the past poultry has been relatively highly priced in Australia and the extent to which substitution will take place depends on the size of the cross-elasticity of demand. No data on retail prices of broilers are available and so no estimate of the cross-elasticity can be made. It is likely that further substitution of poultry for red meat will take place if the price of poultry relative to other meats continues to fall.

16. Rex F. Daly, "The Long-Run Demand for Farm Products", Agricultural Economics Research, Vol. VIII, No. 3 (July 1956), pp. 73-91.

Empirical Analysis

We consider now the factors influencing the consumption of beef and veal, lamb, mutton, and pork.

From the practical point of view there are two approaches to the estimation of the relationships. The researcher can estimate the parameters of a structural model of the Australian retail meat market. The model would consist of several interdependent equations and ideally a method of estimation suitable for a system of over-identified equations should be used. The second alternative is to estimate single equations, each expressing consumption of a certain type of meat as a function of meat prices, income (or total consumption expenditure), and any other relevant variables. Both methods have been used by other researchers in Australia and both will be used here. Before reporting on the results which will be used for the purposes of projection, it is desirable to refer to the results achieved by other workers with alternative methods of estimation.[17]

17. A. Fletcher, "The Australian Market for Lamb", Quarterly Review of Agricultural Economics, Vol. XIII, No. 4 (October 1960), pp. 173-81.
G. W. Taylor, "Beef Consumption in Australia", Quarterly Review of Agricultural Economics, Vol. XIX, No. 3 (July 1961), pp. 128-37.
G. W. Taylor, "Meat Consumption in Australia", Economic Record, Vol. 39, No. 85 (March 1963), pp. 81-7.
J. H. Duloy and J. Van der Meulen, "Meat Consumption in Australia—A Comment", Economic Record, Vol. 39, No. 87 (September 1963), pp. 366—7.
G. W. Taylor, "A Reply", Economic Record, Vol. 40, No. 89 (March 1964), p. 127.
I. W. Marceau, "Factors Affecting the Demand and Price Structure in the New South Wales Meat Market", unpublished M.Sc. (Ag.) thesis, University of Sydney, August 1965. (A summary of Marceau's thesis is to be published in the Australian Journal of Agricultural Economics in 1967.)

In his article in the Economic Record (March 1963), Taylor uses the model:

$$C_B : P_B , C_L , C_M$$
$$P_L : C_L , C_M , P_B$$
$$P_M : C_M , C_L , P_B$$

where C stands for consumption, P for price and the subscripts denote beef, lamb, and mutton respectively. C_B , P_L , P_M are the endogenous variables, whose values are considered to be determined within the model; and P_B , C_L , C_M are exogenous variables whose values are determined elsewhere. His model makes it unnecessary to estimate the parameters of the model by a method designed to handle a set of simultaneous equations. Each endogenous variable occurs in one equation only.

The rationale of the Taylor model can be summarised briefly. The local price of beef is determined largely by the export price, and the export market for Australian beef is one in which supplies coming from Australia do not have a marked effect on the price determined. The amount of beef available for consumption in Australia is thus influenced by the export price and by the availability of other meat. With lamb and mutton, Taylor considers that the Australian price adjusts itself to the quantities available, and is affected by the price of beef.

Taylor's final results, published in March 1964, yield the following price elasticities of demand:

Beef	-1.0
Mutton	-1.2
Lamb	-2.0

Taylor fitted logarithmic equations to the data and so the estimated elasticities are independent of the particular levels of the consumption and price variables.

We have estimated the parameters of a model similar to that of Taylor but have included P_B as an endogenous variable, determined by the export price of beef and by the quantities of other meat available. Here we have a model as a set of four simultaneous equations.

A model consisting of four linear equations was used to describe the Australian demand for the three main types of meats, and the data were used in two forms—natural and logarithmic. The exogenous variables of the model are the export prices of beef and lamb, Australian per capita consumption of mutton and lamb, and the level of per capita disposable income. Variables endogenous to the model are the domestic price levels of the three types of meat and Australian per capita consumption of beef. The model chosen is one in which the parameters of the structural equations are not all identified. Equation (2) is over-identified, and the method of Two-stage Least Squares has been used to estimate all parameters.[18] The structural model is as follows:

$$P = \beta_{10} + \gamma_{11} EP_B + \gamma_{13} C_M + \gamma_{14} C_L \quad (1)$$

$$C_B = \beta_{20} + \beta_{21} P_B + \beta_{22} P_M \beta_{23} P_L \quad \gamma_{25} Y \quad (2)$$

$$P_L = \beta_{30} + \beta_{31} P_B + \beta_{32} P_M + \gamma_{32} EP_L \quad \gamma_{34} C_L + \gamma_{35} Y \quad (3)$$

$$P_M = \beta_{40} + \beta_{41} P_B + \beta_{43} P_L + \gamma_{43} C_M + \gamma_{44} C_L + \gamma_{45} Y \quad (4)$$

where EP_B is export price of beef (1952-53 = 100)

EP_L export price of lamb (1952-53 = 100)

Y real personal disposable income in £ per capita,

18. The method is described clearly in J. Johnston, Econometric Methods (McGraw-Hill, New York, 1963), pp. 258-260.

and the remaining notation is identical with Taylors.

Apart from equation (4) the overall fit was satisfactory, but the performance of individual variables was disappointing. Only in the case of equation (3) was income (Y) a significant variable and, in several cases, signs of coefficients were opposite to expectations.

As a result, we reverted to the estimation of single equations. Despite their theoretical weaknesses in providing unbiassed structural estimates, single equation estimates can be used for purposes of prediction. With the data expressed in logarithmic form, the results obtained were as follows:

(4.4.1) $\log Q_B = 1.628 - \underset{(0.279)}{0.962} \log P_B^{**} + \underset{(0.382)}{0.290} \log P_L + \underset{(0.336)}{0.199} \log P_M + \underset{(0.525)}{0.551} \log C \quad (R^2=0.832)$

(4.4.2) $\log Q_L = 0.999 - \underset{(0.212)}{1.547} \log P_L^{**} + \underset{(0.155)}{0.502} \log P_B + \underset{(0.187)}{0.239} \log P_M + \underset{(0.292)}{0.827} \log C^{*} \quad (R^2=0.981)$

(4.4.3) $\log Q_M = 5.828 - \underset{(0.345)}{1.381} \log P_M^{**} + \underset{(0.287)}{1.198} \log P_B^{**} + \underset{(0.393)}{0.279} \log P_L - \underset{(0.541)}{1.729} \log C^{**} \quad (R^2=0.843)$

(4.4.4) $\log Q_P = -2.182 + \underset{(0.489)}{2.812} \log C^{**} - \underset{(0.553)}{2.191} \log P_P^{**} + \underset{(0.457)}{0.186} \log P_{OM} \quad (R^2=0.895)$

where Q_B is per capita consumption of beef, in pounds,

Q_L per capita consumption of lamb, in pounds,

Q_M per capita consumption of mutton, in pounds,

Q_P per capita consumption of pork, in pounds,

P_B real retail price of beef (1952-53 = 100)

P_L real retail price of lamb (1952-53 = 100)

P_M real retail price of mutton (1952-53 = 100)

P_P real retail price of pork (1952-53 = 100)

P_{OM} real retail price of meat other than pork (1952-53 = 100)

C real total consumption expenditure, in £ per capita.[19]

(a) The Demand for Beef and Veal

The price of beef (P_B) is the only significant variable obtained in equation 4.4.1. The total consumption expenditure variable (C) has the expected sign but is not significant. One possible explanation of this is that Australian consumption is already high by international standards. The price elasticity of -0.96 is in line with estimates obtained in other studies (ref. Table 4.4.2 source). The other two price variables have estimated parameters of the expected sign, but they are not significantly different from zero.

19. We report here as a footnote, the results of estimated equations which included Y (personal disposable income per capita) as a variable, rather than C. The comparative results may be of interest.

$\log C_B = 3.03 - \underset{(0.207)}{0.791} \log P_B + \underset{(0.360)}{0.389} \log P_L + \underset{(0.305)}{0.038} \log P_M - \underset{(0.401)}{0.090} \log Y \quad (R^2 = 0.841)$

$\log C_L = 1.78 - \underset{(0.159)}{1.395} \log P_L + \underset{(0.091)}{0.626} \log P_B + \underset{(0.135)}{0.031} \log P_M + \underset{(0.177)}{0.451} \log Y \quad (R^2 = 0.986)$

$\log C_M = 3.40 - \underset{(0.269)}{1.021} \log P_M + \underset{(0.183)}{0.818} \log P_B + \underset{(0.317)}{0.095} \log P_L - \underset{(0.353)}{0.590} \log Y \quad (R^2 = 0.902)$

(b) The Demand for Lamb

Three variables gave significant results. The price of beef is highly significant and we find also with the equation estimating the demand for mutton that the price of beef is significant. Prices of sheepmeats however do not have a significant influence on the demand for beef. Total consumption expenditure gives an elasticity of 0.83, and the price elasticity of demand is -1.5. This is somewhat lower than the estimates obtained by Taylor and Marceau.

(c) The Demand for Mutton

Mutton shows the properties of an inferior good, with a negative relationship between consumption and income. The prices of mutton and beef are also significant as explanatory variables. The income elasticity of demand of -1.73 seems to be more negative than one would expect and with regard to projection of demand, it may be more realistic to use a lower figure. With this possibility in mind we draw attention to the results obtained when per capita disposable income was used as an explanatory variable:

$$(4.4.5)\quad \log C_M = 3.40 - \underset{(0.269)}{1.021} \log P_M + \underset{(0.183)}{0.818} \log P_B + \underset{(0.317)}{0.095} \log P_L - \underset{(0.353)}{0.590} \log Y \qquad (R^2 = 0.902)$$

where Y is real personal disposable income, in £ per capita.

The negative income elasticity of demand of -0.59 is probably a more useful result.

(d) The Demand for Pigmeats

As shown in Table 4.4.3, per capita consumption of pork (i.e. carcass pigmeat) has almost doubled in the last 10 years. On the other hand there has been comparatively little change in the consumption of bacon and ham. Over the last 15 years this has usually been between 7 and 8 lbs per head per annum—compared to an estimated prewar level of 10.2 lbs.

The demand for pork was analysed in terms of a single equation, in which the consumption of pork was considered to depend on income, the pork price and the price of other meats. Equation 4.4.4 suggests income and own price elasticities of 2.81 and -2.19 respectively. High values were not unexpected since pork has been a luxury item in the Australian diet; we would expect pork consumption to respond to both price and income changes. However the result of 2.81 for the income elasticity may well be unrealistic from the point of view of projections. A linear regression was also fitted to the data, using disposable income as an explanatory variable. The results were:

$$(4.4.6)\quad C_P = 13.937 + \underset{(0.0145)}{0.0337}\, Y - (0.076)\, P_P + \underset{(0.055)}{0.113}\, P_{OM} \qquad (R^2 = 0.076)$$

When 1963-64 values are used, the elasticities of demand implied by this equation are—Income: +1.4; Own price: -2.8; Price of other meats: +1.1.

An attempt was made to estimate the income elasticity of demand for meat as a whole. Per capita consumption of all meat was regressed on per capita disposable income and the real price of meat. However no satisfactory estimate was obtained. The elasticities estimated by the logarithmic equation used were 0.2 for income and -0.2 for price, but neither of these was significantly different from zero. The FAO published an estimate of the income elasticity of demand for meat in Australia, based on a semi-logarithmic equation. The result obtained was 0.1, but it is not certain whether this is a reliable estimate or a best guess.

Table 4.4.3

CONSUMPTION AND PRICES OF PIGMEATS
AUSTRALIA 1949-50 TO 1963-64

	Consumption per capita		3-year Moving average for Carcass Pigmeat	Index of 'Real' Prices	
	Carcass Pigmeat	Bacon and Ham		Carcass Pigmeat	Bacon
	lb.	lb.	lb.	(1952-53 = 100)	
1949-50	7.2	9.6		98.02	100.29
1950-51	6.8	8.3	7.1	102.97	102.67
1951-52	7.3	7.2	6.6	101.35	105.83
1952-53	5.8	7.0	6.9	100.00	100.00
1953-54	7.7	7.2	7.9	106.08	109.66
1954-55	10.2	7.9	9.2	92.90	98.77
1955-56	9.7	7.5	9.5	98.27	103.92
1956-57	8.6	6.8	9.7	101.56	111.78
1957-58	10.8	7.0	10.0	94.35	108.44
1958-59	10.6	7.2	10.6	93.58	103.19
1959-60	10.3	7.1	10.8	101.25	110.41
1960-61	11.4	6.8	11.8	97.80	107.27
1961-62	13.6	7.0	12.3	89.56	106.47
1962-63	12.0	7.4	12.3	95.83	107.44
1963-64	11.4	7.4		101.55	112.69

Sources: Consumption—Commonwealth Bureau of Census and Statistics, Report on Food Production and the Apparent Consumption of Foodstuffs and Nutrients in Australia, No. 19, 1963-64 (Canberra), and earlier issues.
Retail Prices—Commonwealth Bureau of Census and Statistics, Labour Report (Canberra, published annually).
Export Prices—Commonwealth of Australia, Annual Report of the Australian Meat Board, various issues (Sydney).

5. THE DEMAND FOR GRAINS

(a) Wheat

Domestic consumption of wheat is classified according to its use for human consumption, for stock feed or for seed. The use for seed is directly dependent on the area sown, and in fact, the Commonwealth Statistician estimates the amount of seed used on the basis of the filed returns on the acreage sown. Future demand for wheat for seed will depend on future planned production of wheat. Here we shall concern ourselves first with human consumption of wheat. Its domestic use for stock feed will be discussed with the other feed grains.

Human Consumption

As a first step wheat is converted into two products—flour and breakfast foods. As can be seen from Table 4.5.1, breakfast foods comprised only about 4 percent of the total in recent years. The table also presents data on consumption of flour in its various forms. The post-war years showed a fairly steady decline in per capita consumption—from 201.8 lb, the average for 1946-47 to 1948-49, to 169.5 lb, the average for 1960-61 to 1962-63. This decline is very similar to that experienced in the United States, where annual consumption of wheat fell from an average of 201 lb during 1946-48 to 167 lb for 1958 to 1960.[20] However it should be noted that there is a much higher consumption of corn and corn products in the United States than in Australia, where per capita consumption is negligible.

The most important use of flour is in the manufacture of bread.[21] Since 1954-55 the ratio of flour used in bakeries to total flour consumption has been about 65 percent. According to the published statistics this represents an increase from 58 percent in 1948-49. However the data on bread consumption are of doubtful reliability.

Although two-thirds of flour consumed in Australia is consumed in the form of bread, a statistical analysis of the factors influencing bread consumption is difficult because of the very short period for which suitable statistics on bread production are available. More reliable results can be obtained if data on flour consumption or wheat products consumption are used.

Factors Affecting Bread and Flour Consumption

Income. We find a fairly strong negative correlation between flour consumption and per capita income. This relationship has been a common experience in the world's more affluent economies. Food habits change as income rises and wheat products, particularly bread, are consumed less as the community's income level rises. However, where a trend variable is included in the regression equation, this variable rather than income or consumption expenditure accounts for most of the change in flour consumption.

Price. The real price of bread fell from 1946-47 to the period 1951-52 to 1953-54, and subsequently rose in 1962-63. Honan draws attention to the weaknesses of the index of the retail prices of bread which can be constructed from published data of retail prices. "Prices are collected only for the 2-lb loaf and no account is taken of the increased number of

20. Hans H. Landsberg, L. L. Fischman, and J. L. Fisher, Resources in America's Future (Johns Hopkins Press, Baltimore, 1963), Appendix Table A2-1, pp. 588-9.

21. For this discussion, we have drawn heavily on an article by N D. Honan, "Wheat Consumption in Australia", Quarterly Review of Agricultural Economics, Vol. 25, No. 4 (October 1962), pp. 153-159.

22. Small factories of manufacturing establishments (employing less than 4 persons) submit production returns to the Commonwealth Statistician only if power other than manual power is used in the manufacturing process. One could attribute some of the rise in per capita consumption of bread to a change in consumer preference—a shift towards the consumption of factory-baked bread and away from home-baking. However it seems that most of the increase can be attributed to a shift from the use of manual methods in small bakeries to the use of power. Factory statistics show that the number of small bakeries rose from 1294 to 2446 between 1948-49 and 1958-59, and that the number declined to 2126 by 1962-63. The shift to power operation accounted for much of the increase in 1958-59.

Table 4.5.1

CONSUMPTION OF WHEAT, WHEAT PRODUCTS AND SOME RELEVANT PRICES
AUSTRALIA, 1946-47 TO 1964-65

Per Capita Consumption (1b)					Index of Real Prices 1952—53 = 100
Year	Flour	Bread	Breakfast Foods and Other Uses (a)	Total Wheat Products (a)	Bread
1946-47	202.5	-	33.7	291.7	110.43
1947-48	199.4	-	33.2	281.8	112.31
1948-49	203.7	143.8	32.7	276.6	109.61
1949-50	198.9	148.4	22.8	282.0	108.36
1950-51	196.4	150.0	31.6	287.5	104.66
1951-52	201.5	152.3	18.1	284.8	96.89
1952-53	192.7	153.7	15.0	276.6	100.00
1953-54	190.0	155.0	10.7	265.8	98.55
1954-55	185.5	156.9	13.0	265.8	101.82
1955-56	182.3	155.3	10.8	268.5	100.64
1956-57	185.9	152.6	11.8	271.2	101.65
1957-58	181.2	152.8	11.6	253.0	109.62
1958-59	177.2	153.2	11.3	253.8	107.97
1959-60	177.2	149.1	11.1	254.9	107.18
1960-61	170.0	146.6	10.9	248.9	107.20
1961-62	171.1	143.6	9.0	239.3	118.41
1962-63	167.4	142.4	9.3	233.7	120.92
1963-64	172.1	141.4	10.3	243.2	120.42
1964-65	168.3	140.4	9.6	241.6	117.00

(a) Figures for year ended 30th November.

Sources: Consumption: Bureau of Agricultural Economics, The Wheat Situation (Canberra), No. 17, February 1961; No. 22, December 1963.
Commonwealth Bureau of Census and Statistics, Report on Food Production and Apparent Consumption of Foodstuffs and Nutrients in Australia (Canberra) various issues.

Prices: Commonwealth Bureau of Census and Statistics, Labour Report (Canberra), various issues.

varieties of bread now available, the 1 1/2 lb and other loaf sizes, which are included in the statistics of consumption. These loaves, usually associated with special varieties of bread, comprised 33 percent of bread manufacture in 1960-61, the only year for which detailed statistics are available.[23]

Age Composition of Population. Other changes in the habits and structures of Australian households may influence the consumption of bread. Age composition of the population affects per capita consumption of bread since the younger and more active members of the population consume more bread than others. The Australian population is changing in the direction of a younger population. We would expect an increasing consumption of cereal and potatoes due to this factor. However the difference in the growth of total population and the growth of the number of consumption units in the post-war period has not been sufficiently well marked to leave us with a clear preference for one method of calculating unit consumption figures. Total population increased by 30.70 percent between 1950 and 1962; total consumption units for cereal and potatoes increased by 31.46 percent over the same period. Consequently, consumption of wheat products per consumption unit has changed in much the same way as consumption per capita over these 11 years. The distinction between population and consumption units may be important for projection over a longer period.

Immigration. It has been suggested that immigration to Australia is changing the population in a manner which affects the consumption of wheat. We have noted already the post-war increase in the proportion of the population born outside Australia.[24] "Many of the immigrants come from countries where the diet contains a large amount of starchy foods and relatively little of the high protein foods such as meat and dairy products".[25] The migrants contributed to an increase in the use of flour for macaroni, vermicelli, and similar products. Per capita production of these products increased in the post-war period. By 1961-62, production of macaroni, vermicelli, and spaghetti amounted to 3.68 lbs, compared with 1.54 lbs in 1948-49. Only 1.0 percent to 1.5 percent of production is exported, so the data give a good indication of per capita consumption.

Urbanization. Household surveys in the United Kingdom have shown that per capita consumption of bread is lower in cities and towns than in rural areas. Increasing urbanization in Australia may have contributed to the decline in the consumption of wheat products. The 1961 Census results show a further decline in the proportion of population living in rural areas—18 percent in 1961 compared with 21 percent in 1954 and 31 percent in 1947.

Occupation of the Work Force. Overseas studies have found, also, that high consumption of cereals tends to be associated with groups engaged in heavy manual work. Changes in technology have led to a small proportion of the work force being engaged in such work, and so we would expect a lowering in the demand for wheat products as a source of calories needed for manual work.

Finally, just as the medical profession's interest in diet and weight may have affected the demand for dairy products in recent years, so this interest, directed towards the influence of starchy foods on health, may have influenced the demand for wheat products.

23. N.D. Honan, op. cit., p. 155.

24. Table 4.3.2.

25 N.D. Honan, op. cit., p. 158.

Regression Analyses of Demand for Wheat for Human Consumption

When the data are used to estimate demand functions for flour and for wheat products, a high proportion of variation in consumption can be accounted for, but the regression coefficients obtained are not always of the order one would expect on the basis of economic theory. Income has little explanatory value as a variable except in equations considering the consumption of wheat products. Total consumption expenditure is not a useful explanatory variable. Although the simple correlation coefficient linking per capita consumption of flour and per capita income is -0.63, when other variables besides income are used in the equations and in general play a larger part in 'explaining' variation in consumption. If no trend variable is used in the equation, the relationship between the real price of bread and the consumption of flour or of wheat products is seen to be significant.

The trend variables and the price of bread have the greatest 'explanatory' power Inclusion of trend in the equation raises the coefficient of multiple determination (R^2) to 0.95 or above. Before making an analysis of the data, one would probably attribute the decline in flour consumption to the rise in income and general living standards. However one would consider also that this was a response to the long-term movement in income and that the response to short-term fluctuations in income would be small. Hence the trend variable is a better measure of long-term change in income than is the income variable itself.

Between 1946-47 and 1962-63 per capita consumption of flour declined, on average, to 2.2 lb per annum. This is almost the same as the coefficient of -2.3 obtained in a linear regression equation.[26] Thus the computed decline, under the assumption of holding all other influences constant, is much the same as the observed average annual decline. The net effect of other influences is approximately zero.

The various functional forms fitted to the data yield much the same results. Without the trend variable, R^2 is 0.72 to 0.77 in each case; with the trend variable R^2 is 0.95 to 0.96. The results for equations including the trend variable are presented in Table 4.5.2. The trend variable was introduced into the equations in two alternative forms—one expressing consumption as an exponential function of t, the other as a power function of t. The first of these forms yields the result that per capita consumption of flour is reduced at a yearly average rate of 1.2 percent; consumption of wheat products is reduced at an average of 1.3 percent. The second form gives consumption a constant elasticity with respect to time. The two forms gave similar results and only the first form is reported here. When fitting the equations, the annual trend values used were integers 0, 1, ... 16.

(b) Coarse Grains—Human Consumption

Barley

The main domestic uses of barley are for malting and distilling, and for stockfeed (Table 4.5.3). A small amount is used for the preparation of pearl barley but in recent years this has comprised less than 1 percent of the total amount of barley used in Australia. Some additional barley is exported in the form of barley malt. A study of trends in the domestic use of barley for malting is best made through an examination of trends in the consumption of beer in Australia (Table 4.5.4).

26. This regression estimated per capita consumption of flour as a linear function of income, real prices of bread and meat and a trend variable. (This gave an R^2 of 0.953).

Table 4.5.2

EXPLANATORY EQUATIONS FOR CONSUMPTION OF FLOUR AND WHEAT PRODUCTS - AUSTRALIA

Equation No.	Type of Equation	Variables Used	Constant	Coefficients, Standard Errors†† and Elasticities				
				Consumption Expenditure	Price of Bread	Price of Meat	Trend	R^2
				C	P_B	P_M	t	
Consumption of Flour								
4.5.1	Semi-logarithmic	Q_F : log C, log P_B, log P_M, log t	686.336	14.938 (103.304) [0.0387]†	-180.258** (54.870) [-0.468]†	-75.418 (52.763) [-0.196]†	-24.459** (8.857) [-0.0634]†	0.901
4.5.2	Logarithmic (with t in natural form)	log Q_F : log C, log P_B, log P_M, t	2.403	0.0879 (0.1376)	-0.136 (0.080)	-0.0134 (0.0885)	-0.0056** (0.00098)	0.959
Consumption of Wheat Products								
4.5.3	Semi-logarithmic	Q_{WP} : log C, log P_B, log P_M, log t	766.108	122.755 (127.724) [0.226]†	-354.224** (67.841) [-0.654]†	-24.963 (65.236) [-0.0461]†	-48.256** (10.951) [0.0890]†	0.925
4.5.4	Logarithmic (with t in natural form)	log Q_{WP} : log C, log P_B log P_M, t	2.452	0.112 (0.153)	-0.232* (0.089)	0.109 (0.098)	-0.0062** (0.0011)	0.951

† Elasticities at 1962-63 incomes, prices and trend values.

†† Estimated standard errors shown in round brackets.

* Differs significantly from zero at 10 percent level.

** Differs significantly from zero at 5 percent level.

Two series of consumption figures have been set out—consumption per capita and consumption per consumption unit. Whereas for most categories of food the percentage increase in the number of consumption units since 1950 has approximated closely the percentage increase in total population, for the three beverages—beer, wine, and spirits—the rate of increase in consumption units has been slower. A relatively high birth rate is giving Australia an increasing proportion of its population in the younger age groups. When considering consumption units for beer, males over the age of 14 years are the only persons included, and all such males are given equal weight in the calculation. Consequently consumption of beer per consumption unit shows a more pronounced rate of change than does per capita consumption.

In both series the two years 1954-55 and 1955-56 appear as years of high consumption but we have not found any satisfactory explanation of this. In the part of the project reported in Chapter 4.1 there is evidence that even when price and income effects have been allowed for, there remain unexplained high levels of consumption in these years.

Table 4.5.4 suggests that there has been a slight increase in per capita consumption over the whole period. The figures show a much sharper increase between 1946-47 and 1950-51 than in more recent years. Data for the last 10 years show little evidence of a real trend.

There appears to be a relatively constant ratio between grain used for malting and the malt produced. Thus an estimation of future beer consumption can give a reliable estimate of future barley requirements for this purpose.

Oats

Human consumption of oats occurs in the form of oatmeal and rolled oats (Table 4.5.5). Since 1954-55, total Australian consumption has varied between 1.6 and 1.8 million bushels per year, and annual per capita consumption has averaged 2.95 lb over the 10 years from 1953-54. Published data show high per capita consumption in 1956-57, but it would seem that this is more likely due to an error in the collection of the statistics than to a change in consumption patterns.

Consumption of oatmeal and rolled oats used to be considerably higher—an average of 5.0 lb per capita per annum for 1936-37 to 1938-39, and of 4.0 lb for 1946-47 to 1948-49. The decline in consumption is associated with the replacement of oats as a standard breakfast cereal. Wheat products have increased in popularity in recent years.

Maize

Little maize is used for human consumption in Australia. Between 1946-47 and 1962-63, factories' use of maize varied between 3.9 lb and 8.4 lb per capita. Consumption takes place mainly in the form of breakfast foods, but in the data available the only grain distinguished from the others used in the manufacture of breakfast foods is oats. Products using maize or wheat are combined.

Since 1951-52 per capita use has been generally lower than in the early part of the post-war period, but the available data do not suggest a trend in domestic human consumption of maize.

(c) Rice

During the war and immediate post-war years, domestic supply of rice was rationed; annual consumption averaged less than 1 lb

27. A distinction is made here between sweet corn consumed as a vegetable and maize grown for grain and converted into factory products. We discuss only the latter.

Table 4.5.3

UTILIZATION OF BARLEY : AUSTRALIA

Year ended 30th November	Apparent Domestic Utilization			
	In Factories[a]	Seed[b]	Stock Feed	Total
	million bushels			
1946	4.184	1.010	n.a.	n.a.
1947	5.626	1.118	n.a.	n.a.
1948	6.179	1.359	2.416	9.954
1949	5.586	1.397	0.962	7.945
1950	5.740	1.446	1.612	8.798
1951	5.975	1.501	2.906	10.382
1952	6.578	1.808	1.748	10.134
1953	6.840	2.375	1.360	10.575
1954	7.365	2.281	3.542	13.188
1955	7.851	2.545	3.849	14.245
1956	8.035	2.616	2.657	13.308
1957	8.206	2.915	6.880	18.001
1958	8.653	2.797	7.273	18.723
1959	8.318	2.974	10.723	22.015
1960	8.791	3.572	5.228	17.591
1961	9.195	3.191	11.084	23.470
1962	10.444	2.764	9.087	22.295
1963	9.650	3.000	13.088	25.738

n.a. not available.

(a) Barley used for malting, distilling and pearl barley for export and consumption in Australia; excludes barley used for processed stock foods.

(b) Estimated on the basis of $1\frac{1}{4}$ bushels per acre of barley sown in the succeeding year.

Source: Commonwealth Bureau of Census and Statistics, Primary Industries, Part I - Rural Industries (Canberra), annual bulletins.

per head. These restrictions were removed in October 1950, and large quantities were released from stocks in subsequent years, lifting per capita consumption to approximately pre-war levels (estimated by the Commonwealth Statistician at 3.5 lb per year). However, since the early 1950's, estimates of total domestic consumption published by the Commonwealth Statistician[28] seem to be based on a static per capita consumption of 4.6 lb

28. Commonwealth Bureau of Census and Statistics, Canberra, Statistical Bulletin: Report on Food Production and the Apparent Consumption of Foodstuffs and Nutrients in Australia (annual; 1950-51 to 1964-65).

Table 4.5.4

BEER CONSUMPTION
AUSTRALIA : 1946-47 — 1963-64*

Year ended 30th June	Consumption per capita		Consumption per consumption unit	
	Actual gallons	Index 1952-53 = 100	Actual gallons	Index 1952-53 = 100
1947	15.9	72.9	n.a.	n.a.
1948	15.5	71.1	(41.4)	(69.2)
1949	17.9	82.1	(48.0)	(80.3)
1950	18.2	83.5	49.3	82.4
1951	20.4	93.6	55.4	92.6
1952	21.2	97.2	57.8	96.6
1953	21.8	100.0	59.9	100.0
1954	23.1	106.0	63.7	106.4
1955	24.3	111.4	66.8	111.6
1956	24.2	111.0	67.6	113.0
1957	22.9	105.0	64.2	107.3
1958	23.0	105.5	65.0	108.5
1959	22.2	101.8	63.0	105.2
1960	22.6	103.7	64.4	107.5
1961	22.6	103.7	64.3	107.4
1962	22.5	103.2	64.0	107.0
1963	22.7	104.1	64.7	108.1
1964	23.5	107.8	66.8	111.6

* Figures in brackets are estimates only.

n.a. not available.

Source: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Bulletins Nos. 41-56, 1946-47 to 1961-62 (Canberra)
Commonwealth Bureau of Census and Statistics, Report on Food Production and the Apparent Consumption of Foodstuffs and Nutrients in Australia, No. 19, 1963-64 (Canberra).
Table 4.2.1.

Table 4.5.5

UTILIZATION OF OATS : AUSTRALIA

Year ended 30th November	Apparent Domestic Utilization				Per Capita Consumption of Oatmeal and Rolled Oats[b]
	In Factories[a]	Seed	Stock Feed	Total	
	million bushels				lb
1946	3.158	5.074	n.a.	n.a.	n.a.
1947	2.541	5.767	n.a.	n.a.	n.a.
1948	3.535	5.364	16.513	25.412	n.a.
1949	2.326	5.471	7.769	15.566	n.a.
1950	2.514	5.383	10.830	18.727	n.a.
1951	2.218	6.603	7.811	16.632	3.3
1952	1.968	7.154	11.863	20.985	3.0
1953	2.253	6.380	24.494	33.127	3.3
1954	2.035	7.313	21.228	30.576	2.9
1955	1.754	8.273	18.659	28.686	2.8
1956	1.701	6.803	36.505	45.009	2.8
1957	1.648	7.954	18.498	28.100	4.0
1958	1.617	9.708	17.139	28.464	2.9
1959	1.656	8.130	55.315	65.101	2.2
1960	1.684	9.150	23.455	34.289	2.8
1961	1.738	8.282	46.132	56.152	3.0
1962	1.753	8.928	28.784	39.465	3.2
1963	1.687	9.000	40.698	51.385	2.9

n.a. not available

(a) Oats used for oatmeal for export and consumption in Australia; excludes oats used for processed stock foods.

(b) Year ended 30th June.

Source: Commonwealth Bureau of Census and Statistics, Primary Industries, Part I - Rural Industries (Canberra), annual bulletins.

Table 4.5.6

UTILIZATION OF MAIZE : AUSTRALIA

Year ended 30th June	Apparent Domestic Utilization[a]				Use in Factories per capita
	In Factories[b]	Seed	Stock Feed	Total	
	thousand bushels				lb
1947	926	70	4,811	5,807	6.7
1948	1,135	60	4,426	5,621	8.4
1949	931	60	4,070	5,061	6.7
1950	1,015	53	3,727	4,795	7.3
1951	986	55	2,499	3,540	6.7
1952	699	57	3,074	3,830	4.5
1953	665	58	3,462	4,185	4.5
1954	735	54	3,786	4,575	4.5
1955	1,109	52	3,457	4,618	6.7
1956	1,009	55	3,506	4,570	6.2
1957	983	57	4,422	5,462	5.6
1958	663	57	4,871	5,591	3.9
1959	852	54	5,796	6,702	4.8
1960	849	55	5,799	6,703	4.7
1961	807	63	5,372	6,242	4.3
1962	1,321	62	5,922	7,305	7.0
1963	1,374	60	5,629	7,063	7.1

(a) Includes small quantities of imports up to 1952-53.

(b) Maize used for distilling and human food for export and consumption in Australia.

Source: Commonwealth Bureau of Census and Statistics, Primary Production, Part I Rural Industries, (Canberra), annual bulletins.

Table 4.5.7

AVAILABILITY OF RICE FOR CONSUMPTION : AUSTRALIA

Year	Area	Production (paddy)	Seed Retained For Next Year (a)	Available for Sale (b)		Export Milled Equivalent	Available for domestic consumption and stock changes (b)	
				Paddy	Milled equivalent		Total (milled)	lb/head
	acres	'000 tons						lb
1952-53	34,490	74.3	2.6	71.7	51.3			
1953-54	38,860	76.3	2.6	73.7	52.7	35.4	15.9	4.0
1954-55	38,690	95.3	2.8	92.5	66.1	30.1	22.6	5.6
1955-56	41,180	88.6	3.4	85.2	60.9	42.0	24.1	5.8
1956-57	50,480	79.9	3.1	76.8	54.9	28.3	32.6	7.7
1957-58	46,770	106.1	3.2	102.9	73.6	30.9	24.0	5.5
1958-59	47,050	124.1	3.3	120.8	86.4	43.3	30.3	6.8
1959-60	48,950	126.2	3.1	123.1	88.0	64.6	21.8	4.8
1960-61	46,120	112.5	3.4	109.1	78.0	59.3	29.2	6.3
1961-62	50,190	132.1	3.7	128.4	91.8	50.0	28.9	6.1
1962-63	54,930	133.7	4.0	129.7	92.7	55.9	36.8	7.6
1963-64	59,400	139.8	4.2	135.6	97.0	54.1	39.6	8.0
1964-65	63,000	152.8				63.5	34.8	6.9

(a) Seed requirement at 150 lbs per acre.

(b) Figures refer to year following year of production; availability for domestic consumption includes imports in 1960-61 and after. Quantity of imports were less than 100 tons prior to 1960-61.

Sources: For acreage and production: as for Table 6.7.6;
For export: Commonwealth Bureau of Census and Statistics, Canberra, Oversea Trade Bulletin;
For population (mean, financial year): Yearbook of the Commonwealth of Australia.

annually, of which 3.7 lb per head is consumed as milled rice, and the rest as processed food (breakfast cereals etc.). Total domestic consumption calculated on this basis would leave considerable quantities unaccounted for, or would indicate unduly large annual additions to stocks. It appeared to us preferable to estimate domestic consumption on the basis of net domestic availability, calculated from recorded production, estimates of seed retained for next year's plantings, and recorded exports. These estimates are given in Table 4.5.7. and indicate a higher level of per capita consumption than that estimated by the Commonwealth Statistician.[29] Average per capita availability for the 10 years ending 1964-65 is 6.55 lb per head (with annual fluctuations resulting in a standard deviation of 1.0 lb). No information is available concerning stock changes, but it is reasonable to assume that at least part of the annual fluctuations in availability is due to these.

The absence of any significant trend in domestic availability is noteworthy. The fluctuations over the period included in the table do not seem to bear any relation to the generally rising level of personal disposable income. There is no evidence of any pronounced relationship between price and consumption—but this is partly because of the very small price changes that have occurred in recent years (in the 7 years ending June 1961, average retail prices, weighted for the 6 capital cities in Australia, has only shown a variation from 9.87 to 9.99¢ per lb). The comparatively minor importance of rice in the Australian diet, and the relative lack of substitution between rice and other foods probably explain the absence of price and income responses.

29. However our estimates ignore various losses and wastage in milling and other operations, and to that extent overestimate actual per capita consumption. Nevertheless, as future requirements will have to include these, the figures presented in the table would form a satisfactory basis for projections.

The estimate of availability of rice, as given in Table 4.5.7, includes imports in 1960-61 and subsequent years. Small quantities of rice have been imported into Australia in most years, but it is only since 1960-61 that imports have become appreciable. Quantities are recorded only since 1961-62, and show an increase from 925 tons in that year to 1,333 tons in 1964-65. Imports are still relatively small, and have contributed only about 4 percent to total milled rice available for domestic consumption and stock changes in 1964-65.

Until recently, there has been little scope for the development of consumer preference for particular varieties, as domestic supply consisted almost entirely of the short-grain Caloro variety. The recent increase in imports, consisting entirely of long-grain rice (mainly from the U.S.A., with smaller quantities from Thailand and the Philippines) suggests a growing preference in favour of these types. This preference for long- and medium-grain varieties has long been established in most Asian countries, and is manifest in the U.S.A., where sales figures indicate that these varieties contribute more than 90 percent to domestic consumption. Recent efforts of the New South Wales Rice Marketing Board to encourage the production of long- and medium-grain varieties in Australia are discussed in Chapter VI.

(d) Grains for Stock Feed

Data relating to the domestic use of grains for stock feed are not very reliable. In his published figures on the annual disposal of wheat, oats, barley and maize, the Commonwealth Statistician treats the use for stock feed as a balancing item. The apparent use of grains for this purpose therefore contains all the errors made in the other estimates. In the case of grain sorghum we were not able to locate any official estimates of the quantities of grain used domestically for stock feed.

The quantities of barley, oats, and maize and wheat estimated to have been used for stock feed are given in Tables 4.5.3, 4.5.5, 4.5.6, and 4.5.8. Some of the grain used for stock feed is retained by farmers on the farms on which it is produced and substantial quantities are also sold from one farm to another, yet another part is distributed through grain merchants. Other grain is processed into manufactured stock feeds. The manufactured stock feed industry has grown rapidly in recent years; the quantities of the various grains used to produce manufactured stock feed and the growth in the output of cereal-based pellets is shown in Table 4.5.9. The growth in this industry reflects the movement towards the greater use of scientifically determined feed rations in the egg and broiler industries and for dairy cattle. The quantities of the various grains used in the stock feed industry and the total quantities of each grain recorded as being used for stock feed, suggests that the proportion used in the manufactured stock feed industry is still only about 20 percent for wheat, oats, maize and barley.

No information is available about the quantities of grain fed to different types of stock. An attempt was made to obtain such estimates by means of a regression analysis. Feed grains were aggregated on the basis of the energy values of the different grains. This was then regressed on the total number of sheep, dairy cattle, the production of pigmeat, eggs, and broilers and on a drought index. Whilst yielding an R^2 of 0.76, the regression coefficients were not significantly different from zero.[30]

Our estimates suggest that the total quantity of grains for domestic stock feeding have grown by about 40 percent—from providing an average of $2\frac{1}{2} \times 10^{12}$ calories annually in the early fifties (1950-51 to 1954-55) to an average of $3\frac{1}{2} \times 10^{12}$ calories in the early sixties (1960-61 to 1962-63). Superimposed on this trend there are considerable annual fluctuations. The major factors which are believed to affect the quantity of feed grains consumed are:

(a) seasonal conditions: in particular major droughts in sheep districts and less pronounced movements in dairying districts—especially those supplying liquid milk;
(b) the recent increase in the size of the broiler industry;
(c) the movement of pig production from dairying areas to cereal districts;
(d) the gains in feed conversion ratios in both the egg and broiler industries;
(e) economic factors—the ratio of feed prices to the prices obtained for the final product.

According to the relative prices ruling, the different grains are to a considerable extent substituted for each other. There is evidence that wheat now comprises a considerably smaller proportion of the total feed grain supply than in earlier years, largely as a result of changes in the pricing policy for stock feed wheat. Thus around 1950 wheat comprised about 60 percent of the total grain used for stock feed, compared with about 30 percent between 1960-61 and 1962-63. (However, in years of heavy demand for feed because of drought, the proportion of wheat used is likely to rise, since it is often the only type of grain available in the quantities demanded).[31]

30. The one exception to this was for broilers, where production figures were largely based on guesswork. In addition, the rapidly increasing output of broilers in recent years coincided with a movement of pig production from dairying areas to cereal districts; this likely accounts for part of the significant coefficient attributed to broiler production.

31. Three studies by G. N. Steele of the Bureau of Agricultural Economics should be mentioned for further reference. These are: "Grain Sorghum in Australia"; "The Manufactured Stock Feed Industry" published in The Coarse Grain Situation, Nos. 5 and 6 (December 1959 and November 1960), respectively; and "A Review of the Australian Maize Industry", Quarterly Review of Agricultural Economics, Vol. 15, No. 1 (January 1962), pp. 23-30.

Table 4.5.8

DISPOSAL WHEAT : AUSTRALIA
1947-1965

Year[a]	(1) Flour, Breakfast Foods and other uses	(2) Seed	(3) Retained on Farms	(4) Sales for Stock feed	(3)+(4) as percentage of total
	million bushels				percent
1947	37.7	13.8	4.7	22.2	34.3
1948	37.8	12.5	3.9	20.7	32.8
1949	38.7	12.2	4.2	22.6	34.5
1950	38.5	11.6	4.7	23.5	36.0
1951	41.9	10.5	4.2	27.4	37.6
1952	41.6	10.3	3.4	23.9	34.5
1953	41.3	10.8	4.6	18.4	30.6
1954	36.0	10.9	3.9	17.6	31.4
1955	40.0	10.1	5.8	16.5	30.8
1956	41.5	7.9	6.7	15.3	30.8
1957	43.1	9.1	5.3	19.6	32.3
1958	41.1	11.1	6.1	15.0	28.8
1959	42.1	12.0	3.7	11.6	22.0
1960	43.2	12.6	6.6	14.7	27.6
1961	43.1	13.8	8.4	13.2	27.5
1962	42.3	15.4	7.4	10.0	23.2
1963	42.1	15.4	5.8	9.1	20.6
1964	43.0[b]	16.3	3.8	12.0[b]	
1965	43.0[b]	23.7		12.0[b]	

(a) Years ended 30 November.

(b) Preliminary.

Sources: Bureau of Agricultural Economics, The Wheat Situation (Canberra) No. 15, September 1959, p. 33; No. 22, December 1963, p. 38.
Commonwealth Bureau of Census and Statistics, The Wheat Industry, (Canberra) Bulletin 106, p. 10.

Table 4.5.9

GRAIN USED IN FACTORIES OF THE ANIMAL- AND BIRD-FOOD INDUSTRY AND OUTPUT OF MAJOR PRODUCTS : AUSTRALIA

Year Ended 30th June	Wheat	Barley	Maize	Oats	Sorghum	Output of Cereal-based Feed: Poultry Pellets	Output of Cereal-based Feed: Other
	million bushels					'000 tons (2000 lb)	
1953	2.0	0.0	0.1	0.7	0.3	n.a.	n.a.
1954	2.7	0.3	0.2	2.1	0.9	102.9	316.2
1955	2.6	0.4	0.2	1.9	1.0	113.6	302.8
1956	4.2	0.6	0.2	2.0	1.1	157.5	265.2
1957	5.0	1.0	0.3	2.8	1.2	206.8	315.3
1958	5.2	2.1	0.3	2.0	1.4	235.6	346.1
1959	3.3	1.8	0.6	2.7	1.8	228.4	272.4
1960	3.3	1.8	0.9	3.0	2.3	277.8	322.0
1961	4.7	2.4	1.0	4.3	1.4	308.5	379.5
1962	4.0	2.1	0.9	5.5	2.0	330.7	359.3

n.a. not available.

Source - Commonwealth Bureau of Census and Statistics, Production Bulletin, Secondary Industries, Part II—Materials Used and Articles Produced in Factories (published annually, Canberra).

6. THE DEMAND FOR FRUIT

(a) Canned Fruit

Table 4.6.1 contains annual consumption and retail price statistics for canned fruit. In 1963-64 per capita consumption was more than twice as high as at the end of World War II. But this increase has not been spread evenly over the post-war period; instead it has been particularly marked since 1959. This increase might be attributed in large part to the reduction in the real prices of canned fruits and the establishment of the Australian Canned Fruit Sales Promotion Committee in 1959.

Since 1958-59 average retail prices of canned fruits have been falling. Our price index is based on the prices of peaches and pears in the capital cities. The combined price (the weighted average price of a 29 oz can) reached a peak in 1957-58 and has fallen steadily in almost every subsequent year. When considered in relation to the rises in the price of food in general, the decline in the prices of canned fruits is even more marked.

The Australian Canned Fruit Sales Promotion Committee was created by Commonwealth Statute at the request of growers and given the task of stimulating consumer demand for canned fruit by promotion and advertising. For this purpose the Committee obtains funds from an excise levy on canned fruit sales.

With the increases which have occurred in recent years, Australian consumption of canned fruit is now similar to that of the U.K. and only slightly below the consumption levels of the U.S. However international comparisons of the consumption of canned fruit alone are of limited value because of the variety of forms in which fruit products reach the consumer. In addition to fresh fruit, fruit juice and frozen fruit are now important outlets. In Australia no separate statistics are available for the consumption of frozen fruit and juice, but we can compare the consumption of all fruit with the consumption levels elsewhere. In Australia in 1960-61, per capita consumption was 173 lb; in the U.S. in 1960, it was 201 lb. U.S. consumption of citrus fruit is 2 1/2 times the Australian level; for other fruit, including dried fruit, Australian consumption exceeds that of the U.S.

Regression equations were fitted to the data from 1946-47 to 1963-64.

The promotion activities of the Sales Promotion Committee were allowed for by including the actual annual expenditure of advertising as a variable. For the year before the formation of the Committee, the variable was given a value 1 and in the later years, actual expenditure in thousands of pounds. Any possibility of allowing for the lagged effect of advertising expenditure on consumption has been thwarted by the small number of years for which the Committee has been operating.

When a linear equation was fitted to the data the promotion expenditure was significant as an explanatory variable. The coefficient of 0.082 suggests that annual per capita consumption would be raised by 0.082 lbs, if annual expenditure on promotion was raised by £1,000. This result is matched approximately by the rise in per capita consumption from 15.3 lb to 20.5 lb between 1959-60 and 1963-64.

The logarithmic equation does not present promotion expenditure as a significant variable and the proportionate expansion of consumption associated with a 1 percent increase in promotion expenditure is very small. In fact the only significant explanatory variable in this equation is log C (total consumption expenditure) with a coefficient of 1.94, suggesting that an increase in per capita total consumption of 1 percent is associated with a rise in consumption of canned fruit of almost 2 percent. On the

Table 4.6.1

CONSUMPTION AND PRICES OF CANNED FRUIT AND DRIED FRUIT AUSTRALIA 1946-47 TO 1963-64

	Canned Fruit		Dried Fruit		
	Consumption per capita per annum	Index of Real Prices (1952-53 = 100)	Consumption per capita per annum	Index of Real Prices (1952-53 = 100)	3 year moving average consumption of vine fruits
	lb		lb		lb
1946-47	8.4	97.23	8.0	103.22	
1947-48	11.0	102.46	8.4	107.93	
1948-49	13.3	96.69	10.2	98.34	
1949-50	12.2	93.48	8.4	98.70	
1950-51	12.1	89.93	9.5	107.89	
1951-52	15.9	88.48	8.3	102.00	6.0
1952-53	11.5	100.00	7.1	100.00	5.2
1953-54	12.2	94.70	7.3	97.25	5.3
1954-55	13.9	95.97	7.9	93.55	4.8
1955-56	13.8	92.73	5.4	87.83	4.4
1956-57	13.4	96.25	5.3	86.94	4.2
1957-58	14.6	109.54	7.0	95.88	4.1
1958-59	13.0	99.86	5.7	95.10	4.5
1959-60	15.3	87.51	6.7	95.26	4.3
1960-61	17.8	78.24	6.4	91.17	4.7
1961-62	16.4	79.55	6.2	(a)	4.9
1962-63	20.4	76.52	7.4		4.3
1963-64	20.5	69.19	5.1		

(a) Retail price data not available after June 1961.

Sources: Comonwealth Bureau of Census and Statistics, Report on Food Production and the Apparent Consumption of Foodstuffs and Nutrients in Australia, No. 19, 1963-64 (Canberra) and earlier issues. Commonwealth Bureau of Census and Statistics, Labour Report (Canberra, published annually).

other hand the linear equation shows an income elasticity of 1.3 when 1963-64 values are used, and this seems a more reasonable result.

The following equations record the results obtained:

$$(4.6.1)\quad Q_{cf} = 9.114 - \underset{(0.0593)}{0.0049}\, P_{cf} + \underset{(0.0385)}{0.0822}\, S + \underset{(0.0178)}{0.0678}\, C \quad (R^2 = 0.868)$$

$$(4.6.2)\quad \log Q_{cf} = -3.620 - \underset{(0.469)}{0.0781} \log P_{cf} + \underset{(0.0345)}{0.0336} \log S + \underset{(0.480)}{1.938} \log C \quad (R^2 = 0.820)$$

where Q_{cf} is per capita consumption of canned fruit, in pounds,
C real personal consumption expenditure, in £ per capita,
P_{cf} retail price of canned fruit (1952-53 = 100).
S annual expenditure on promotion, in £'000.

(b) Dried Fruit

Vine fruits (sultanas, raisins, and currants) comprise 70 to 80 percent of consumption, the balance being made up of tree fruits (apricots, prunes, and imported dates). The published figures of Australian consumption are not very precise. The Commonwealth Statistician does not quote any statistics measuring annual changes in stocks of dried fruits. Any data collected are apparently unreliable and apparent Australian consumption is calculated as annual production less exports.[32] The apparent consumption of sultanas shows very wide fluctuations. These seem likely to reflect movements in annual production rather than changes in domestic consumption.

When we look at a 3-year moving average of per capita consumption of dried vine fruits, it seems that from 1950-51 there was a gradual decline in consumption until around 1957-58. Since then there has been a slight increase in consumption. However the provisional statistics for 1963-64 record a very sharp drop in consumption. As usual the main contribution to the change has been a fall in the consumption of sultanas. The 1963-64 figure published for per capita consumption is only 46 percent of the 1962-63 figure.

The published figures on the consumption of dried tree fruits show fluctuations from year to year, but movement seems to be around an average consumption of about 2.0 lb per capita per year, with little evidence of any trend. There is some suggestion of a decline in consumption in the mid-fifties and a rise in more recent years, but again, no figures are available regarding changes in stocks. Table 4.6.1 presents the data relating to the consumption of dried fruit.

It would appear that the Australian levels of consumption are similar to those in the U.K. where annual per capita consumption of dried fruits is 6-7 lb; on the other hand in the U.S., it is 3.0-3.5 lb; and in Canada, between 5 and 6 lb.

A large proportion of vine fruit consumption occurs as an ingredient in bread, cake, and other baked goods. Hence the consumption of fruit depends to some extent on the consumption of these other foods. In the equations we have fitted to the data, the consumption of flour is taken as the variable registering this effect on the demand for fruit.[33] The three explanatory variables used all show a significant effect on the consumption of dried fruit. However the price variable has a coefficient of the wrong sign. The logarithmic equation yields an income-elasticity of 1.6 and the semi-

32. In some early post-war years the Statistician made a deduction from production to allow for other uses of the fruit, such as wine-making, but this has not been done in recent years.

33. The Commonwealth Statistician ceased the collection of data on the retail price of dried fruits in June 1961. Hence the estimation is limited to 15 observations and the calculation of income-elasticity in the semi-logarithmic equation is based on 1960-61 values.

logarithmic equation, an elasticity of 2.3 (at 1960-61 values).

$$(4.6.3)\quad \log Q_{df} = -12.695 + \underset{(0.603)}{1.749} \log P_{df} + \underset{(0.786)}{1.565} \log C + \underset{(0.959)}{2.696} \log Q_f \qquad (R^2 = 0.777)$$

$$(4.6.4)\quad Q_{df} = -234.653 + \underset{(10.165)}{26.448} \log P_{df} + \underset{(13.259)}{29.023} \log C + \underset{(16.176)}{51.100} \log Q_f \qquad (R^2 = 0.777)$$

Q_{df} is per capita consumption of dried fruit in pounds;
P_{df} real retail price of dried fruit (1952-53 = 100);
Q_f per capita consumption of flour, in pounds;
C real personal consumption expenditure, in £ per capita.

In an attempt to overcome the difficulties associated with the erratic movements in the annual consumption of sultanas, consumption of dried fruits over a 2-year period was taken as the dependent variable and appropriate explanatory variables used in regression equations. The following results were obtained:

$$(4.6.5)\quad \log Q_{df} = -9.0912 + \underset{(0.816)}{0.717} \log P_{df} + \underset{(0.668)}{0.881} \log C + \underset{(0.876)}{2.443} \log Q_f \qquad (R^2 = 0.877)$$

$$(4.6.6)\quad Q_{df} = -352.348 + \underset{(29.596)}{23.192} \log P_{df} + \underset{(24.228)}{33.451} \log C + \underset{(31.757)}{87.283} \log Q_f \qquad (R^2 = 0.866)$$

One feature of these results is that the significance of the price variable is reduced Although the coefficient still has a positive sign, it is no longer significantly different from zero. The importance of the quantity of flour consumed is not reduced and the two equations produce income-elasticities of 0.9 and 1.3 (at 1960-61 values) respectively.

7. THE DEMAND FOR EGGS

In estimating the consumption of eggs in Australia, the Commonwealth Statistician draws on data supplied by the Egg Boards of the various States, but has to supplement this information with data obtained from other sources. In addition to eggs produced under the control of the Egg Boards (given the classification of "controlled eggs" in the official statistics), a large part of annual production comprises "backyard or uncontrolled eggs". For the post-war period the Statistician estimated that between 49 percent and 56 percent of the domestic market was supplied by uncontrolled producers. Some of these eggs are produced by small backyard flocks; others are produced by poultry farmers wishing to avoid the payment of marketing levies imposed by the Boards.[34]

Since World War II Australian per capita consumption of eggs has been lower than before the war. For the pre-war period and for the early post-war years to 1948-49, average annual consumption has been estimated at more than 20 dozen eggs per capita. However consumption fell as low as 17 dozen per capita in the mid-fifties and the earlier levels have never been recovered.

The Statistician emphasizes that methods available for estimating uncontrolled egg production are not very reliable, and in particular, that there are no adequate methods for the independent estimation of any trends in uncontrolled production. Hence the estimate of the consumption of these eggs is also very tentative.

In spite of these weaknesses in the data, we attempted to estimate a relationship between per capita consumption of eggs and several variables thought to be useful in explaining variations in egg consumption.

34. For further discussion of this matter, see Chapter VI, Section 6(a).

A simple model of the egg market was formulated. It consists of two behavioural equations and two identities. Of the first two equations, one attempts to explain per capita consumption of eggs, while the other explains the production of uncontrolled and backyard yards. Consumption of eggs is considered to depend on total consumption expenditure and on the current retail price of eggs. The production of uncontrolled eggs is assumed to be a function of the price of eggs, lagged by 6 months, and of the ratio of the levy imposed on controlled egg producers to the average gross return to growers.

In its linear form this model appears as follows:

$$(4.7.1)\quad \begin{aligned} Q_E &= x_1 + \beta_{11}C + \beta_{12}P_e & (1)\\ Q_{bep} &= x_2 + \beta_{21}L + \beta_{22}P_{e-\frac{1}{2}} & (2)\\ Q_E &= Q_{ces} + Q_{bes} & (3)\\ Q_{bep} &= Q_{bes} & (4) \end{aligned}$$

where Q_E is annual per capita consumption of eggs;
- Q_{bep} annual per capita production of uncontrolled and backyard eggs;
- Q_{bes} annual per capita consumption of uncontrolled and backyard eggs;
- Q_{ces} annual per capita consumption of controlled eggs;
- C total consumption expenditure per capita;
- P_e index of real retail price of eggs;
- $P_{e-\frac{1}{2}}$ index of real retail price of eggs, lagged by six months;
- L the difference between gross and net return received by growers, expressed as a ratio of gross return.

Equations (3) and (4) are considered as identities. Of these (3) is a true identity; (4) based on the assumption that all backyard and uncontrolled eggs produced are sold on the domestic market.

When this linear model was fitted to the data the following results were obtained.[35]

$$(4.7.2)\quad \begin{aligned} Q_E &= 13.791 + \underset{(0.0055)}{0.106\, C} - \underset{(0.0147)}{0.0024\, P_e} \qquad (R^2 = 0.500)\\ Q_{bep} &= 6.540 - \underset{(0.0282)}{0.0029\, L} + \underset{(0.01995)}{0.0266\, P_{e-\frac{1}{2}}} \qquad (R^2 = 0.370) \end{aligned}$$

The expenditure elasticity of demand in equation (1) is 0.23 when 1963-64 values of the variables are used. Expressing the variables in logarithmic form, the same degree of fit is obtaining and the expenditure elasticity of demand is 0.2.

The predicted levels of total per capita egg consumption and per capita consumption of backyard and uncontrolled eggs were compared for the years covered by the data. The balance represents the production of per capita consumption of controlled eggs, and we found a coefficient of determination of 0.59 when we compared the predictions with actual consumption.

The failure of the price variable in equation (1) to add significantly to the explanation of variations in egg consumption is somewhat surprising in view of the policy of the Egg Boards of changing retail prices during the year with a view to disposing of as many eggs as possible on the domestic market. Previous studies attempting to estimate the responsiveness of demand to changes in price have also been restricted by the lack of reliable data. The conclusion of one of these studies was that the

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35. Data on deductions made by Egg Boards from growers gross returns are available only from 1953-54 onward. Hence estimates are based on annual data for 11 years from 1953-54.

Table 4.7.1

CONSUMPTION AND PRICES OF EGGS : AUSTRALIA

	Consumption Per Head Per Annum			Index of Real Price (1952-53 = 100)	Levy Ratio (a)
	Controlled	Uncontrolled and Backyard	Total		
	dozens per annum				
1947-48	10.62	10.27	20.89	103.52	
1948-49	9.79	10.84	20.63	101.33	
1949-50	9.78	9.95	19.73	102.92	
1950-51	9.42	9.66	19.08	101.05	
1951-52	9.27	8.91	18.18	102.46	
1952-53	7.50	9.50	17.00	100.00	
1953-54	7.58	9.37	16.95	109.00	16.14
1954-55	8.15	9.22	17.37	93.58	18.29
1955-56	8.05	9.00	17.05	94.08	16.38
1956-57	8.47	9.09	17.56	89.92	18.80
1957-58	7.92	9.01	16.93	91.87	20.30
1958-59	8.35	8.67	17.02	88.57	17.95
1959-60	9.02	8.68	17.70	90.94	21.03
1960-61	8.76	8.72	17.48	84.86	25.14
1961-62	8.60	8.89	17.49	82.83	27.51
1962-63	8.58	8.86	17.44	83.99	22.83
1963-64	9.04	8.71	17.75	89.57	20.29

(a) The difference between gross return on domestic sales and net return after equalization, expressed as a ratio of gross return. Not available prior to 1953-54.

Sources: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Bulletins Nos. 41-56, 1946-47 to 1961-62 (Canberra); Report on Food Production and the Apparent Consumption of Foodstuffs and Nutrients in Australia, Nos. 18 and 19, 1962-63 and 1963-64 (Canberra); Labour Report (published annually, Canberra).
Australian Egg Board, 17th Annual Report, 1963-64 (Sydney), Appendix B.

price elasticity of commercial (or controlled) eggs in the Australian market is greater than unity. However the conclusion did not extend to total egg consumption.[36]

In 1960 the Victorian Egg Board commissioned Roy Morgan Research Centre Pty. Ltd. (the marketing associate of the Australian Gallup Poll) to conduct a survey into the seasonal fluctuations in household egg consumption and the relation of these to changes in the price of eggs. The general conclusion reached was that consumption fluctuations were small and that changes in price were not clearly effective in accommodating demand to available supply. However the report does not succeed in separating the effects of the various influences on egg consumption.[37]

The conclusion that the demand for eggs is relatively price inelastic is supported by the findings of Stone and Brown, who estimated the elasticity in the United Kingdom at -0.43 and -0.27, respectively.[38]

Other research workers have considered that a rise in the proportion of the farmer's

36. F.D. Gillies, Helene Walker and K.L. Kinsman, "Egg Prices in Australia", Quarterly Review of Agricultural Economics, Vol. XII, No. 1, pp. 32-37.

37. Roy Morgan Research Centre Pty. Ltd., Survey on Eggs in Victoria (Melbourne 1960).

38. R. Stone, et al., Consumers' Expenditure and Behaviour in the United Kingdom 1920-1938 (Cambridge University Press), 1954.
J.A.C. Brown, "Seasonality and Elasticity of the Demand for Food in Great Britain Since Derationing", a paper read to the Agricultural Economics Society of Great Britain); referred to by Gillies, Walker and Kinsman, op. cit.

gross return from the domestic sale of eggs which is retained by the Egg Board (to compensate for the lower return obtained on exported eggs) will encourage growers to operate outside the control of the Board. Hence we would expect the estimate of β_{21} in equation (2) to have a positive sign. Instead, it is negative but not significantly different from zero.[39]

The price variable in equation (2) has a coefficient with the expected sign but again the estimate is not significant. Although the estimates obtained in the model are not too unrealistic, it seems that a satisfactory estimation of a model describing the egg market in Australia must wait for the availability of more reliable statistics.

8. MISCELLANEOUS PRODUCTS

(a) Cotton

Cotton consumption in Australia cannot be assessed with great accuracy because:

(i) the greater part of consumption is in the form of woven cotton piece goods and other cotton textiles, most of which are imported. Estimates of the quantity of cotton consumed in these forms can only be very approximate, owing to the difficulty of converting the various textile items into raw cotton equivalents;

(ii) although consumption statistics on raw cotton (other than imported cotton piece goods and other cotton textiles) are contained in various official publications, no information is available on the annual changes in inventories.

For the above reasons and the lack of published price statistics for cotton manufactures, the available data do not allow us to estimate income and price elasticities of demand for cotton in Australia. Published statistics of personal consumption expenditure on clothing and drapery do not dissect total expenditure according to the various types included in this rather broad commodity group. Similarly, price indices for clothing generally do not provide guidance as to the price movements of cotton manufactures.

Estimates of the availability of the various textile fibres per head of population have been prepared by the Food and Agriculture Organization of the United Nations for many countries. They show that Australian annual per capita cotton consumption has been well above the world average, and comparable with the United Kingdom, Western and Eastern European countries and the U.S.S.R., New Zealand, but below per capita consumption in North America. Apart from a sharp decline in cotton consumption in Australia in 1953 (due to the imposition of import restrictions on textile manufactures) consumption per head has been fairly stable between 1948 and 1963.[40]

The relative importance of cotton and other textile fibres is illustrated in Table 4.8.1, which contains estimates of the availability of the major textile fibres per person in Australia. Cotton still appears to be the most important textile fibre, constituting over 50 percent of total fibre consumption. However, this percentage share has declined considerably in 1962 and 1963—the last two years for which we have data in this form. On the other hand, there has been an almost continuous growth in the use of synthetic fibres since 1955, the rate of growth having been particularly rapid in the last 4 years.

Most cotton is consumed in the form of woven textiles. The Australian textile industry at its present stage of development

39. On the other hand, it may be that Egg Boards become more zealous in the prosecution of offenders during periods of high deductions.

40. Average consumption per head for the years 1948 to 1963, excluding the "abnormal" year 1953, was 12.6 lb, with a Standard Deviation of 1.12 lb.

Table 4.8.1

AVAILABILITY OF APPAREL FIBRES PER HEAD OF POPULATION, AUSTRALIA[(a)]

Year	Wool		Cotton		Rayon		Synthetics		Total	
	Quantity	Percent	Quantity	Percent	Quantity	Percent	Quantity	Percent	Quantity	Percent
	lb	%	lb	%	lb	%	lb	%	lb	%
1938	7.5	34.1	10.8	49.1	3.7	16.8	-	-	22.0	100.0
1948	8.0	32.0	12.5	50.0	4.5	18.0	-	-	25.0	100.0
1949	7.8	30.6	13.2	51.8	4.5	17.6	-	-	25.5	100.0
1950	7.1	32.0	11.5	51.8	3.6	16.2	-	-	22.2	100.0
1951	6.8	26.2	13.9	53.5	5.1	19.6	0.23	0.7	26.0	100.0
1952	4.0	16.9	14.0	59.1	5.4	22.8	0.29	1.2	23.7	100.0
1953	3.0	24.6	6.2	50.8	2.7	22.1	0.27	2.5	12.2	100.0
1954	5.5	22.7	13.6	56.2	4.7	19.4	0.42	1.7	24.2	100.0
1955	5.9	24.1	13.8	56.3	4.1	16.7	0.65	2.9	24.5	100.0
1956	5.3	23.9	12.3	55.4	3.8	17.1	0.78	3.6	22.2	100.0
1957	4.0	20.9	10.5	55.0	3.9	20.4	0.73	3.7	19.1	100.0
1958	4.5	20.4	12.2	55.4	4.2	19.1	1.12	5.1	22.0	100.0
1959	5.7	24.5	12.8	54.9	3.8	16.3	1.03	4.3	23.3	100.0
1960	5.5	22.7	13.7	56.6	3.7	15.3	1.28	5.4	24.2	100.0
1961	5.3	22.6	13.4	56.8	3.3	14.1	1.50	6.5	23.6	100.0
1962	5.3	24.3	11.7	53.7	3.1	14.2	1.70	7.8	21.8	100.0
1963	5.7	24.2	11.9	50.4	3.3	14.0	2.60	11.0	23.6	100.0

(a) The availability for home use, which is divided by the estimated mid-year de facto population of the country is estimated from recorded mill consumption adjusted by the balance of external trade measured in terms of the fibre content of traded manufactured textile goods.

Sources: Commonwealth of Australia, Bureau of Agricultural Economics, Canberra, Statistical Handbook of the Sheep and Wool Industry (3rd edition, 1961); and Supplement to the Statistical Handbook of the Sheep and Wool Industry (1964)
F.A.O., World Apparel Fibre Consumption, 1961-63 (Rome 1965).

supplies about 16 percent of the country's requirements of all woven cotton fabrics. The other major group of textiles where cotton is important is knitted cotton garments (socks and stockings, knitted underwear, and knitted outer garments, such as cardigans, pullovers, etc.). Here the Australian industry supplies almost the entire domestic requirement. The amount of cotton used in the manufacture of rope and cordage (e.g. for vehicle tyres and other industrial purposes) and sewing thread is small.

Considerable quantities of cotton waste are imported annually from India, Pakistan, and Japan (averaging about one-fifth of the total raw cotton imports over the last 5 years). This, together with locally produced cotton waste—including cotton waste arising as a by-product of cotton spinning—is used in bedding, upholstery, and cotton wool.

The Australian spinning industry supplies the greater part of cotton yarns for local knitting and weaving industries and other industrial purposes. Imported cotton yarns constitute only about 10 to 15 percent, by weight, of local requirements, and are usually of the finer counts (principally 1/50s and finer for knitting interlock underwear) not spun in Australia.[41] Increased domestic production has replaced part of the imports of cotton yarns, which have tended to decline since 1960-61.

Of greater immediate relevance to our projections is the pattern of demand for raw cotton excluding the quantity contained in imported cotton piece goods. The market for raw cotton in Australia has been about 110,000 to 120,000 bales annually, equivalent to about 55 to 60 million lb; a requirement that was relatively stable between 1951-52 and 1962-63. A sharp upturn of both imports and domestic production occurred in 1963-64 and 1964-65, resulting in a total availability of about 73 million lb. This sudden increase "appears to have been caused predominantly by an increase, in late 1962, in the tariff protection on finer counts of yarn. It seems likely that the main effect on usage of the tariff has occurred and little or no further increases can be expected in the short run.[42]

The bulk of Australia's raw cotton imports falls within the medium staple, $\frac{15}{16}$" to $1\frac{3}{8}$" group. Minor quantities of short staple ($\frac{3}{4}$" to $\frac{7}{8}$") and extra long staple are imported annually, mainly from India and Pakistan. Total availability of raw cotton from both overseas and domestic sources is given in Table 4.8.2, which also shows the growing proportion of total supply which domestic production represents.

The growth in the availability of man-made fibres in recent years has been mentioned earlier. The increased use of synthetics is not necessarily a measure of this displacement because:

(a) synthetics may find new uses in fields where no textile fibres had been used before;
(b) synthetics compete with other natural fibres as well, notably with wool;
(c) there is competition among the various man-made fibres in many fields, so that newer man-made fibres may replace rayon or acetate rather than a natural fibre (e.g. the displacement of rayon by nylon in vehicle tyre fabrics, in women's stockings, and in men's and boys' socks).
(d) in some fields, cotton is displaced by other materials, e.g., by paper in wrapping materials, napkins, facial tissues, etc.; by plastics in baggings, table cloths, etc.; and by spun metal and glass fibres in hard-wearing, washable products (e.g., vehicle upholstery).

41. Recently there has been an expansion into the production of fine-count yarns (1/50s) for underwear knitting.

42. W.J. Kerridge, "Cotton: The Effect of Current Trends on Production Prices", Quarterly Review of Agricultural Economics, Vol. 19, No. 2 (April 1966).

Table 4.8.2

RAW COTTON SUPPLIES, AUSTRALIA

Year	Imports of Raw Cotton Excluding Cotton Linters and Waste	Imports of Cotton Linters and Waste	Total Imports of Raw Cotton	Domestic Production of Raw Cotton (a)	Total Supply of Raw Cotton including Linters and Waste	Domestic Production of Raw Cotton as Percent of Total Supply
	mil. lb.					%
Average of 3 years 1936-37 to 1938-39	9.9	n.a.	n.a.	5.2	n.a.	n.a.
1948-49	37.2			0.7		
1949-50	28.4	10.1	38.5	0.3	38.8	0.8
1950-51	45.2	11.4	56.6	0.4	57.0	0.7
1951-52	43.3	11.6	54.9	0.5	55.4	0.9
1952-53	24.8	4.8	29.6	0.8	30.4	2.6
1953-54	44.3	12.6	56.8	1.9	58.7	3.2
1954-55	43.3	15.0	58.2	1.3	59.5	2.2
1955-56	37.6	12.0	49.6	2.0	51.6	3.9
1956-57	47.8	12.5	60.3	1.4	61.7	2.3
1957-58	42.6	13.2	55.8	1.3	57.1	2.3
1958-59	44.0	12.0	56.0	1.5	57.5	2.6
1959-60	41.5	14.4	55.9	3.5	59.4	5.9
1960-61	41.8	11.7	53.5	5.8	59.3	9.8
1961-62	37.7	12.7	50.4	3.9	54.3	7.2
1962-63	42.5	13.8	56.4	4.9	61.3	8.9
1963-64	56.7	12.5	69.2	4.0	73.2	5.4
1964-65	55.5	12.2	67.7	6.1	73.8	8.3

(a) No statistics available as to the quantity of raw cotton suitable for spinning and weaving, and quantity of cotton linters and cotton waste.

Sources: Commonwealth Bureau of Census and Statistics, Canberra, Australia Yearbook of the Commonwealth of Australia (published annually); Manufacturing Industries, No. 10—Cotton Mills (published annually); Overseas Trade (published annually); Recent years from Kerridge, op. cit., Table 5.

No numerical estimate can be made of the displacement of cotton by man-made fibres, but it will probably become more marked in future years.

(b) Tobacco

Details of total and per person consumption of manufactured tobacco products in Australia in 1938-39 and annually from 1950-51 to 1963-64, are given in Table 4.8.3. Total quantities were calculated from recorded domestic production to which recorded net imports were added. Annual stock changes—for which no statistics are available—were disregarded.[43] Total annual consumption of manufactured tobacco products—both imported and domestic— increased steadily from 42.6 million lb in 1950-51 to 58.3 million lb in 1963-64. This increase represents an annual average compound rate of 2.8 percent over the 14 years. During the same period, population in the potential consuming age group, 15 years and above,[44] increased by an average annual compound rate of 1.9 percent. Thus, about 70 percent of the increase in total consumption was accounted for by population increase, and the rest has been due to the increase in consumption per person.

After considerable fluctuation in the 5 years to 1954-55, annual per person consumption of total manufactured tobacco products has shown a steady and continuous rise from 7.1 lb in 1955-56 to a peak of 8.2 lb in 1960-61. Since 1960-61 there has been a slight downward trend in per person consumption (1963-64:7.5 lb). The consumption of cut tobacco, which shared the market in equal proportion with cigarettes in 1950-51, has declined since 1954-55. Annual per capita consumption of cut tobacco fell from 3.6 lb in that year to 1.4 lb in 1963-64. On the other hand, annual consumption of cigarettes increased from 3.5 lb in 1950-51 to 6.1 lb in 1960-61. Since then there has been little change.

To what extent the increase in cigarette smoking and decline in the consumption of cut tobacco has been due to new smokers preferring cigarettes rather than cut tobacco, or former consumers of cut tobacco changing to cigarettes, is not known. No results of cross-sectional survey data are available in Australia giving the pattern of tobacco consumption for various segments of the population (i.e., age, occupation, income, urban/rural, male/female, etc.). New smokers are often believed to be largely in the age group 15-24 years, and the importance of the proportion of this age group to total population is sometimes emphasised when assessing the trend in cigarette smoking.[45] The proportion of this group to the total 15 years and above population declined moderately in the early 1950's, but has been increasing steadily since 1953-54, (from 18.4 percent in that year to about 22.2 percent in 1963-64). While the upswing in individual consumption of cigarettes between 1958-59 and 1960-61 has coincided with a high proportion of the 15-24 years age group, this relationship was not evident prior to 1954-55, when an increase in cigarette consumption was associated with a declining proportion of people in that age group, nor after 1960-61 when per capita consumption remained static despite an increase in the proportion of the 15-24 age group. The relationship between per capita consumption of cigarettes and the proportion

43. An alternative method of calculation would be to sum the quantity on which excise duty was paid and the quantity of imports cleared for home consumption. This method would still not account for stock changes at wholesale and retail level, though it might be preferable in allowing for stock changes in bonded stores.

44. In the rest of this discussion all per capita consumption will apply to persons of the age of 15 years and above.

45. N.D. Honan and W.J. Byrne, "The Growing Australian Market for Tobacco Products", Quarterly Review of Agricultural Economics, Vol. 15, No. 1 (Canberra, January 1962).

Table 4.8.3

ANNUAL TOTAL AND PER CAPITA CONSUMPTION OF MANUFACTURED TOBACCO : AUSTRALIA

Year ending 30th June	Consumption of Cut Tobacco		Consumption of Cigarettes, Cigars and Snuff (a)		Total Consumption of Manufactured Tobacco Products	
	Total	Per head	Total	Per Head	Total	Per Head
	'000 lb	lb	'000 lb	lb	'000 lb	lb
1938-39	15,349	2.9	7.078	1.4	22,427	4.3
1950-51	21,125	3.5	21,426	3.5	42,551	7.0
1951-52	21,753	3.5	24,024	3.9	45,777	7.4
1952-53	22,132	3.5	18,470	2.9	40,602	6.4
1953-54	23,290	3.6	24,645	3.9	47,935	7.5
1954-55	21,409	3.3	25,786	4.0	47,195	7.3
1955-56	18,751	2.8	27,984	4.2	46,735	7.1
1956-57	18,820	2.8	30,912	4.6	49,732	7.4
1957-58	18,221	2.7	32,951	4.8	51,171	7.5
1958-59	16,983	2.4	35,630	5.1	52,612	7.5
1959-60	15,470	2.2	40,461	5.7	55,931	7.9
1960-61	15,458	2.1	43,974	6.1	59,432	8.2
1961-62	13,334	1.8	43,779	5.9	57,113	7.7
1962-63	12,399	1.6	46,450	6.1	58,849	7.7
1963-64	10,875	1.4	47,384	6.1	58,260	7.5
1964-65	9,941	1.3(b)	50,662	6.4(b)	60,603	7.7

(a) Consumption of cigars and snuff contributes less than 1 percent of the total.

(b) Estimated.

Sources: Commonwealth Bureau of Census and Statistics, Manufacturing Industries, No. 26—Tobacco, Cigars and Cigarettes, (annual, Canberra); Secondary Industries, Part II—Manufacturing Industries, (annual); Oversea Trade (annual); Imports Cleared for Home Consumption (annual).

of population in the 15-24 age group has been tested, and found to be significant.[46]

Other factors which might be associated with changes in demand for manufactured tobacco products are price and personal disposable income. Studies in the United States of America indicated that price has little effect on cigarette consumption,[46a] and the available evidence for Australia and the United States also suggests a very low income elasticity of demand.[47] Tobacco occupies a special place in consumers' demand since it is not substitutable by other commodities. However there is scope for substituting cheaper brands for more expensive ones without significantly changing the total quantity consumed. A great variety of tobacco products is available in Australia at a very wide range of prices, and the rate of appearance of new brands on the market is high. On 1st November 1964, some 25 different types and units of sale of imported cigarettes, over 40 types and brands of Australian-made cigarettes, more than 150 brands and packages of cigars, and nearly 120 kinds of cut tobacco could be bought by consumers.

46. The equation expressing this relationship (for 1950-51 to 1962-63) was:

$$Y = -8.6051 + \underset{(0.1378)}{0.6771}\,X \;;\; R^2 = 0.67 ,$$

where Y = annual per capita consumption of cigarettes, and
X = population in the 15-24 years age group as per-cent of total population, 15 years of age and above.

As serial correlation was indicated by the Durbin-Watson test, the relationship was re-calculated in the first-difference form, using the coefficient of serial correlation = 0.6498. The equation thus obtained was

$$Y = -1.6218 + \underset{(0.1832)}{0.4890}\,X \;;\; R^2 = 0.39 .$$

46a. N.D. Honan and W.J. Byrne, op. cit.

47. For Australia, see Table 4.1.4 above; for the U.S.: S.M. Sackrin, "Income Elasticity of Demand for Cigarettes: A Cross-Sectional Analysis", Agricultural Economics Research (U.S.D.A., January 1957).

There are no statistics of the relative price movements of the various brands and types of tobacco products. The only data available are in an index of the combined retail prices for cigarettes and tobacco applying to a constant quality.[48] This index was used to estimate the relationship between price and the consumption of total manufactured tobacco products. None of the regression equations obtained have yielded useful results. The number of observations included in the analysis has been very small (11 years, 1950-51 to 1960-61) the limit being set by the price series available. Annual per capita consumption of total manufactured tobacco products generally increased during the period, though the annual changes were relatively small. Changes in the consumption of cigarettes and of cut tobacco separately were more pronounced, but since no separate price series was available for these commodities, there was no possibility of estimating the relationship between consumption and price for these groups separately.

The regression equation obtained suggested an income elasticity of demand of 0.4. However, due to the high standard error of the coefficient (0.33) and low value of R^2 (0.12) no reliance can be placed on this estimate. It could reasonably be assumed that changes in personal disposable income may be responsible, at least partly, for the shift in preference from cut tobacco to cigarettes, the latter being a more convenient, though more expensive, product. Equation (4.8.1), based on data for 1950-51 to 1963-64 gives a relatively good statistical fit, but the resulting income elasticity of 6.1 (at 1963-64 values) is obviously unrealistically high and results from the association of other factors with the secular growth in real consumption expenditure.

48. N.D. Honan and W.J. Byrne, op. cit.

(4.8.1) $T = -89.824 + 37.218 \log C,$
(4.247)
$R^2 = 0.865$

where T = annual per capita consumption of cigarettes (lbs),
C = annual per capita consumption expenditure (in £)

Factors that would not be accounted for by a time series analysis, but probably important in changing the pattern of consumption, are the increasing social acceptance of smoking by women and young persons, the appearance of new brands, and the level of advertising expenditure. The publicity given to the likely connection between cigarette smoking and lung cancer as reported by the United Kingdom Royal College of Physicians in March 1962, and by the United States Surgeon-General in January 1964 is probably responsible for the downward trend in total tobacco consumption in recent years. It may be reasonably expected that the rate of cigarette smoking will be further affected by these apprehensions concerning lung cancer, and the stepping up of campaigns to discourage young persons from commencing to smoke. As present evidence suggests no relation between cigar or pipe smoking and lung cancer, some increase in the consumption of these tobacco products may be anticipated.

Compared with domestic demand in Australia, export demand for unmanufactured tobacco leaf and manufactured tobacco products is negligible. The quantity of exports of manufactured tobacco and cigarettes, while small in comparison to domestic supply, has been increasing rapidly in recent years. Almost all exports are Australian-made, and the chief destination is Papua and New Guinea, and to a lesser extent the Pacific Islands.

(c) Tallow

According to its end-uses, tallow is divided into edible and inedible tallow. Edible tallow is used predominantly by the margarine and shortening industries. Tallow is often used in the manufacture of table margarine and it is a major ingredient of Australian cooking margarine, where State legislation prescribes the minimum quantities of tallow which must be used. The other major use of edible tallow is in the form of dripping.

It is difficult to reconcile the available statistics about domestic use of tallow. The quantity of edible tallow used in factories over a number of years falls about 20 percent short of reported production minus exports. This could be the result of the use of tallow in establishments which do not need to file factory returns. On the other hand the total usage of inedible tallow in factories is about 30 percent above production of inedible tallow minus exports (for the 10 years ended 1963-64). This could be because a large quantity of tallow is made by small butchers who do not report their production. Finally it is possible that tallow which is reported as "edible" when produced, is used for other purposes (especially for the manufacture of high-quality toilet soaps) and hence appears as "inedible" in the factory utilisation statistics. The last explanation would account for most of the discrepancy, but this does not necessarily prove that it is the only correct one.[49]

The main outlet for inedible tallow is in the production of soap and washing powders. The principal fats and oils used in the manufacture of soap are tallow and coconut oil. The latter is used mainly in the production of fine quality toilet soaps, as a certain minimum percentage of lauric acid is needed to give quick lathering properties. In Australia, tallow is the principal fat used, coconut oil contributing less than 10 percent of fats used in soap manufacture. Table 4.8.4 contains details of inedible tallow used in

49. The relevant statistics are given in Appendix Table A.4.8.1.

Table 4.8.4

FACTORY UTILISATION OF TALLOW AND PRODUCTION OF SOAP AND DETERGENTS : AUSTRALIA
('000 tons)

Year	Inedible Tallow Used For:		Total Inedible Tallow Used in Factories (a)	Production of Soaps and Detergents: (b)							
				Soaps:-					Detergents:-		
	Soap and Candles	Chemicals, Drugs, and Medicine		Personal Toilet	House-hold	Industrial (c)	Extracts and Powders (d)	Toilet Soaps, Soap Powders, and Soap Extracts	Soap-Based	Non-soap Based	Total Detergents
1954-55	57.6	2.1	59.7	17.1	37.4	8.7	50.4	113.6	8.6	n.a.	n.a.
1955-56	58.1	2.4	60.5	16.4	37.2	9.9	45.6	109.1	9.7	n.a.	n.a.
1956-57	57.6	2.7	60.4	16.1	35.8	9.7	43.4	105.0	14.1	19.1	33.2
1957-58	61.0	2.8	64.0	18.6	38.5	8.5	44.5	110.1	21.2	27.5	48.7
1958-59	58.1	2.6	60.8	19.9	34.8	7.8	40.0	102.5	27.3	34.2	61.5
1959-60	51.6	4.3	63.9	18.8	36.4	7.7	41.4	104.3	33.6	40.8	74.4
1960-61	48.9	3.1	59.8	20.2	35.6	6.3	34.3	96.4	40.2	47.9	88.1
1961-62	43.6	3.5	53.9	20.0	34.2	4.6	32.7	91.5	45.9	52.2	98.1
1962-63	42.8	4.7	55.0	21.0	35.0	4.5	31.9	92.4	50.5	57.7	108.2
1963-64	41.9	5.5	54.6	21.4	35.4	3.9	31.0	91.7	56.2	67.4	123.6

n. a.—not available.

(a) The total exceeds the sum of the previous two columns in some years; the difference is due to tallow being used in factories other than soap and chemicals (e. g. stock feed) .

(b) The recorded production in factories is incomplete, as production in establishments which do not come within the definition of a factory is excluded.

(c) Includes soft and liquid soap, not separately described.

(d) Household and industrial.

Sources: Commonwealth Bureau of Census and Statistics, Canberra, Year Book of the Commonwealth of Australia; Secondary Industries Bulletin; Principal Factory Products, Australia; Manufacturing Industries, No. 3-Chemicals, Drugs and Medicines, No. 6—Soap and Candles.

factories, and the quantity of soaps and detergents manufactured in Australia between 1954-55 and 1963-64.

Almost all soap and soap preparations produced in Australia is for domestic consumption. Net exports accounted for 5.8 percent of total production in 1963-64. As net exports have been insignificant when compared to production in the 10 years ending 1963-64, production statistics also indicate the level of domestic consumption.

Total soap production, including soap extracts and powders, declined from 104,000 tons in 1959-60 to 92,000 in 1963-64. On a per capita basis, the decline has been almost continuous since 1954-55, from about 28 lb in that year to 18 lb in 1963-64. While production of toilet soap has increased approximately in proportion to the growth of population (consumption per head remaining almost static at 4.3 lb), total production of household soap remained unchanged at about 36,000 tons annually over the last 10 years, with a consequent decline in consumption from 9 lb to 7 lb. However, the greatest decline occurred in the production of industrial soap preparations (8,700 tons to 3,900 tons) and in soap extracts and powders (54,000 tons to 31,000 tons).

In contrast the manufacture of liquid detergents has increased considerably—from 33,200 tons in 1956-57 to 123,600 tons in 1963-64. Liquid detergents are used mainly for hard-surface cleaning (dish washing, car washing, etc.) where lathering properties are a disadvantage. The trend of demand from solid soaps to liquid detergents is world-wide, and started earlier in some overseas countries.

Production of non-soap based ("synthetic") detergents has grown at approximately the same rate as that of soap-based detergents, and for the 8 years for which statistics are available (1956-57 to 1963-64), non-soap based liquid detergents constituted an average of 55 percent of total liquid detergents produced. In 1963-64, non-soap based detergents represented 31.4 percent of total soap and detergents produced. This was considerably lower than the corresponding figure in the U.S.A., where synthetic detergent production outpaced that of soap as early as 1953, and in 1962 accounted for about 75 percent of total soap and detergent sales (corresponding figures in other countries in 1961 were: Federal Republic of Germany, 70 percent; France, 57 percent; U.K., 44 percent; Japan, 34 percent).[50] However, as the components of non-soap based detergents are only slowly broken down by bacterial action, increased use of these detergents may lead to water pollution. Concern over this led to research in the U.S.A. and Europe into the production of tallow-based detergents, which are more readily bio-degradable.

As shown in Table 4.8.4, the quantity of inedible tallow used in the chemical, drug, and medicine industry is comparatively small, although it has been on the increase in the last 5 years. These industries use mainly fatty acids and glycerine, all of which can be obtained from tallow. However, they can also be obtained from other oils and fats (e.g. marine oils). Fatty acids and glycerine are normally obtained also as by-products of soap manufacture. In the U.S.A. and other countries, some fatty acids are obtained as by-products of the paper and petro-chemical industries. In Australia no fatty acid is derived from these sources. Similarly, no synthetic glycerine is produced in Australia.

Stearine, which can be obtained from tallow as well as from other fats, is used in the manufacture of candles. While there are no statistics of the quantities of tallow involved, it is believed that this outlet is relatively unimportant. Production of

50. F.A.O., Rome, Synthetics and their Effects on Agricultural Trade (Commodity Bulletin Series No. 38), 1964.

Table 4.8.5

NUMBER SLAUGHTERED, HIDES AND SKINS USED IN TANNERIES AND EXPORTED, FOR CATTLE, CALVES AND SHEEP AND LAMBS, AUSTRALIA, 1946-47 TO 1964-65

Year	Number Slaughtered			Hides and Skins Used in Tanneries			Hides and Skins Exported		
	Cattle (a)	Calves	Sheep and Lambs	Cattle Hides	Calf Skins	Sheep and Lambskins (b)	Cattle Hides	Calf Skins (c)	Sheep and Lambskins (d)
	(Thousands)							('000 lb)	(Thousands)
1946-47	2205	959	17861	2591	1439	5463	116	-	20727
1947-48	2395	983	16643	2561	1283	4673	102	-	12140
1948-49	2415	1079	18336	2493	1306	4085	270	-	12059
1949-50	2528	1080	20313	2594	1351	4307	259	-	18360
1950-51	2647	1088	15696	2539	1243	4090	210	-	13201
1951-52	2512	1174	15967	2615	1380	3469	178	-	10693
1952-53	2832	1134	21751	2767	1370	3431	226	267	18923
1953-54	3014	1402	20992	2835	1629	3466	348	133	16130
1954-55	3154	1330	22234	2800	1448	3495	617	99	16988
1955-56	3184	1427	20760	2595	1131	3466	1417	450	16661
1956-57	3393	1559	20247	2556	1097	2952	773	804	15594
1957-58	3566	1773	24709	2672	1187	2652	802	4036	20255
1958-59	4191	1681	27552	2519	675	2592	1335	8053	20269
1959-60	3435	1527	33173	2452	693	2652	860	5084	25708
1960-61	2891	1387	32604	2248	754	2448	670	3647	26895
1961-62	3591	1524	33290	2254	723	2712	1139	4095	26271
1962-63	4265	1666	33813	2370	852	2328	1483	5162	26905
1963-64	4648	1790	33502	2491	657	2592	1482	6827	27912
1964-65	4910	1906	33600	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

(a) Includes yearlings; (b) includes pelts; (c) prior to 1952-53, exports of calf skins were recorded by number; (d) does not include skins exported as pieces; (e) Preliminary estimates.

Sources: Commonwealth Bureau of Census and Statistics, Primary Industries Bulletin, Part I—Rural Industries, Canberra, 1962-63; Statistical Bulletin-The Meat Industry, (Canberra), various issues; Manufacturing Industries—No. 13, Tanneries, (Canberra), 1946-47 to 1963-64; Oversea Trade, (Canberra), 1946-47 to 1963-64.

candles has declined in recent years, from 850 tons in 1951-52 to 460 tons in 1962-63.

The inclusion of tallow in the preparation of stock feed—mainly poultry feed— as a high-energy source, provides a comparatively recent outlet. Similarly, a new use for tallow is in pasture sprays to prevent bloat in livestock. No information is available of the quantities of tallow used for these purposes.

(d) Hides and Skins

Australian consumption of locally produced hides and skins, as indicated by their use in tanneries, declined considerably from 1953-54 to 1960-61. Since that year however, their usage increased again slightly (Table 4.8.5). There is no evidence of relationship between the quantity of hides and skins used in Australia and total slaughterings, because overseas markets are easily found for those hides and skins not consumed locally. A quantity of leather goods (principally shoes) and processed leather is exported, but the bulk of the tannery output (about 80 percent) is consumed domestically.

Many factors contributed to the decline in the domestic consumption of hides and skins. Since the war, rubber and a number of synthetic materials have been increasingly used as substitutes for leather in many products—particularly shoes, belting, and upholstery. The use of substitute materials has been encouraged by the high cost of tanning in Australia and the poor quality of many of the hides and skins available for tanning. In addition there has been a considerable rise in the quantity of leather goods being imported into Australia.

CHAPTER V

THE PROJECTION OF AUSTRALIAN CONSUMPTION

1. INTRODUCTION

This chapter contains projections of the likely future levels of Australian consumption for the products and groups of products discussed in Chapter IV. The projections were based on the preceding discussions and analyses of factors affecting past consumption trends.

For most products it was assumed that retail prices (in real terms) will remain constant. In the case of many products—liquid milk, butter, cheese, flour, eggs, and dried fruit—retail prices are largely determined by administrative decisions of governments and marketing authorities. Even where some information is available of the response of consumption to changes in retail prices, it is difficult to justify the use of a different assumption in these situations.[51] In isolated cases where we had strong reasons to expect changes in relative prices—e, g., for broilers—some arbitrary allowance was made to allow for price changes.

The major products where the assumption of unchanged relative prices seems particularly unrealistic are beef, mutton, and lamb. Here our projections should be regarded as first approximations. If the projections of overseas demand in Chapter VIII call for it, we intend to revise the carcass meat consumption projections on the basis of the expected future movements in the retail prices for these meats.

For many products, projections of per capita consumption had to be based on judgements—in turn based on discussions with various industry organisations, processors, and others with detailed technical knowledge of the different markets. In some cases overseas comparisons seemed the most useful benchmark. Where income (or consumption expenditure) elasticities were used, the assumed "low" and "high" projections of per capita G. N. P. and per capita personal consumption expenditure from Chapter III were used. For convenience these are reproduced in Table 5.1.1.

To convert per capita projection into (conditional) forecasts for total Australian consumption, the "low" and "high" population projections of Chapter III were used, (Table 5.1.1). To arrive at "low" and "high" total consumption projections, the "low" per capita projection was multiplied by the "low" population projection and vice versa.[52] Under the terms of our contract we have undertaken to specify a "most likely" projection whenever low and high projections are given. Our "most likely" projections are given by taking the arithmetic mean of the "low" and "high" projections for each year.

51. However if the study of overseas trends in supply and demand in Chapter VIII reveals situations where it appears fairly likely that export prices will change significantly, some revisions of these projections may be made.

52. By implication, this procedure differs from that adopted in the text of Chapter III, but it seemed wisest to allow for the greater range of possible outcomes obtained by coupling "low" and "high" income and population growth assumptions.

Table 5.1.1

PROJECTIONS OF AUSTRALIAN POPULATION, PER CAPITA G.N.P. AND CONSUMPTION EXPENDITURE

Projections of:	Unit	1960	1965		1970		1975		1980	
			Low	High	Low	High	Low	High	Low	High
Population	000's	10,278	11,215	11,537	12,263	12,915	13,459	14,454	14,790	16,136
G.N.P. per capita	$A* at constant 1959-60 prices	1,333	1,486	1,515	1,653	1,727	1,833	1,970	2,029	2,252
Personal Consumption Expenditure**	"	855	933	946	1,015	1,049	1,100	1,164	1,192	1,294

* 1 Australian dollar equals 1.12 U.S. dollars.

** per capita.

Source: Tables 3.1.1 and 3.2.1.

2. PROJECTIONS OF EXPENDITURE FOR BROAD COMMODITY GROUPS

In Chapter IV, Section 1, the retail demand for food, clothing, and eight other broad commodity groups was analysed. On the basis of the average coefficients associated with movements in incomes and time (i.e., the b_i and c_i coefficients in Table 4.1.4), both total and per capita consumption projections have been made,[53] based on the maintenance of constant 1959-60 prices.

Table 5.2.1 gives the per capita consumption projections for the different commodity groups—based on our assumed "low" and "high" growth rates in per capita personal consumption expenditure. In constant prices, total personal expenditure per head is expected to rise by 39 to 51 percent during 1960-80. Broad commodity groups where expenditure is likely to rise slower than the average are: fares (where the expenditure is expected to decline by 15 to 17 percent over this period), food (where an increase of 12 1/2 to 20 percent is projected), tobacco and drink (15 to 18 percent), clothing (15 to 34 percent). All other types of expenditure are expected to rise more rapidly than total personal consumption expenditure. The greatest percentage increase over the period is expected for motoring (110 to 139 percent), followed by household durables (63 to 83 percent), gas and electricity (63 to 79 percent) and housing (69 to 81 percent).

Table 5.2.2 gives similar projections for total Australian consumption expenditure. Comparisons can be made between our "1965" projections and the actual 1964-65 consumption expenditure for some of these commodity classifications.[54] All comparisons are in terms of 1959-60 prices. Because there have been some changes in relative prices, it would be unrealistic to expect too close a correspondence. The comparisons of the "most likely" projections (the average of "high" and "low" in Table 5.2.2) and the actual figures are given below.

3. DAIRY PRODUCTS

Liquid Milk: The annual per capita consumption of liquid milk[55] in Australia varied only between 286 and 295 lb (or 33.3 to 34.4 gals) since 1950. The level of consumption has shown some response to changes in real price and real income, but generally the price and income elasticities of demand have been negligible. On the evidence available, changes in future levels of consumption are expected to remain fairly small.

The introduction and more widespread use of ultra-heat treated (UHT) milk and cream[56] may be responsible for an increased consumption of liquid milk in remote pastoral and mining regions of Australia. Depending on the present frequency and cost of milk distribution in these areas, the use of UHT milk will probably replace some pasteurised milk as well as condensed and powdered full cream products. It seems that this would lead to some increase in total whole milk consumption. However, the proportion of the population that may

53. Due to pressure of time, it was not possible to use the standard deviations of the coefficients for the projections which would have given us wider and more realistic "confidence limits". This would have been essential if the projection of retail demand and expenditure by broad commodity groups had been a more central part of our enquiries.

54. Commonwealth Bureau of Census and Statistics, Australian National Accounts, National Income and Expenditure, 1948-49 to 1964-65 (Canberra, February 1966), Table 56, p. 55.

55. Including the whole milk equivalent of ice cream consumption. Of the figure given for liquid milk consumption, approximately 10 percent is used in ice cream manufacture.

56. Milk treated by ultra-high temperatures to induce complete sterilisation can stay fresh at room temperatures for longer than 3 months and yet still retains practically all the original flavour of pasteurised milk. The milk is marketed in cans or other containers that guarantee lasting sterility.

Table 5.2.1

PROJECTIONS OF PER CAPITA RETAIL EXPENDITURE
(By Commodity Groups; in constant 1959-60 Australian dollars)*

Commodity Group	Base Period[a]	1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
Food	205.8	214.0	215.8	220.4	225.1	227.1	235.9	234.7	248.9
Clothing	97.7	100.7	102.9	104.3	110.2	108.4	119.3	113.6	131.2
Housing	78.9	88.2	89.3	101.1	104.0	114.2	119.6	127.9	43.7
Gas and Electricity	23.5	29.0	29.1	33.5	33.8	38.1	38.7	42.7	43.7
Household Durables	72.5	79.1	80.9	89.8	94.4	100.8	109.3	112.6	126.4
Other	68.0	71.6	71.9	80.5	83.7	89.7	95.5	99.4	108.7
Fares	30.4	29.1	29.1	27.8	27.9	26.5	26.8	25.2	25.7
Tobacco and Drink	88.0	91.9	92.2	95.2	96.1	98.5	100.2	102.1	104.8
Services	111.6	134.4	136.0	147.6	151.7	161.1	168.9	175.5	187.9
Motoring	73.0	94.8	97.5	115.1	122.3	136.0	149.5	158.3	180.0
Total	849.4	932.6	944.7	1,015.2	1,049.2	1,100.4	1,163.8	1,192.0	1,294.0

(a) Base Period is average of the 4 years 1958-59 to 1961-62.

* 1 Australian dollar = 1.12 U.S. dollars.

Source of data: For base period—Table 5.2.2, base period expenditure divided by population estimate for 30.6.1960.
For method of estimation see text.

Table 5.2.2

PROJECTIONS OF NATIONAL RETAIL EXPENDITURE BY COMMODITY GROUPS
(All Figures in $A million at Constant 1959-60 Prices)*

Commodity Group	Base Period[a]	1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
Food	2,121	2,400	2,490	2,702	2,907	3,056	3,409	3,471	4,016
Clothing	1,007	1,129	1,187	1,279	1,423	1,459	1,725	1,681	2,117
Housing	813	989	1,030	1,240	1,538	1,729	1,892	1,892	2,204
Gas and Electricity	242	325	336	411	437	512	560	632	706
Household Durables	747	887	933	1,101	1,219	1,356	1,580	1,666	2,040
Other	701	804	829	988	1,080	1,207	1,380	1,469	1,755
Fares	314	326	336	340	361	356	387	373	415
Drink and Tobacco	907	1,030	1,064	1,167	1,241	1,326	1,449	1,510	1,691
Services	1,150	1,507	1,568	1,810	1,960	2,169	1,441	2,595	3,032
Motoring	752	1,063	1,125	1,412	1,580	1,831	2,161	2,341	2,905
Total	8,754	10,459	10,898	12,450	13,551	14,810	16,821	17,630	20,880

(a) Base period is the average of the 4 years 1958-59 to 1961-62.

* 1 Australian dollar = 1.12 U.S. dollars.

Source of data: For base period—Commonwealth Bureau of Census and Statistics, Australian National Accounts, National Income and Expenditure, 1948-49 to 1964-65 (Canberra, February 1966) Tables 49 and 56.
For methods of estimation see text.

Commodity Group	"Most Likely" Constant Price Projection for 1965	Actual 1964-65 (in 1959-60 A$)	Actual as Percentage of Projections
Food	2,445	2,442	98.9
Clothing	1,158 1/2	1,194	103.1
Housing	1,009 1/2	959	95.0
Household Durables	910	934	102.6
Tobacco and Drink	1,047	1,043	99.5
Total Consumption Expenditure	10,684	10,571	98.9

be significantly affected by the advent of UHT milk is not likely to be high for at least 10 or 15 years, and therefore the immediate net effect is likely to be small.[57] If the distribution of UHT milk becomes established in urban areas (as seems possible in the long run), it could depress consumption due to less wastage. But the major contribution by UHT to the Australian dairy industry will probably come through the creation of new export markets.

Since the income elasticity of demand for liquid milk in fully developed countries is considered to be close to zero, it is interesting to note the decline in consumption that has occurred in such countries as the United States, Sweden, and Switzerland, and to speculate on the likelihood of a similar fall occurring in Australia. Some of the decline can be associated with a rise in real price, but the remainder appears to be due to a shift in demand caused mainly by a change of consumer preference. This has been particularly true in the United States where not only are consumers showing an increasing preference for non-fat milks, but total consumption of milk products has fallen. No such trend has been evident in Australia. In making our projections it has been assumed that any downward shift in demand that may occur will be offset by an increase in consumption resulting from the greater availability of milk and cream to a wider range of consumers.

Another factor which may influence milk consumption is the crude birth rate. The lower consumption levels of 1962-63 and 1963-64 may be partly attributed to the markedly lower birth rate in those years (Table 4.3.1). The decline in birth rate continued into 1965-66 and although some increase is likely in the future, we have implicitly assumed a constant birth rate at the relatively low level of 21 births per 1,000 population.

The "best" estimates of the income elasticity of demand for liquid milk indicate a value of about 0.05 to 0.075. To allow for some of the uncertainties outlined above, per capita consumption of liquid milk has been projected from a base of 290 lb per head[58] with an assumed "low" income elasticity of zero, and a "high" elasticity of 0.15. Hence, the projected "low" for liquid milk consumption is a constant value of 290 lb until 1980. The "high" estimates are 300.3 lb per head in 1970, 304.9 lb in 1975 and 309.6 lb in 1980.

From the "low" and "high" estimates for per capita consumption and population, the

57. The marketing of UHT cream may influence cream consumption by the urban as well as rural population, but its contribution to total liquid sales will be minor. Other factors contributing to a rising consumption of cream are improved distribution, promotion and rising real incomes. Present per capita consumption of cream in Australia is officially estimated at 2.0 pints (≡1.5 gals. of milk).

58. This is the approximate 1963-64 consumption figure when crude births were just above 21 per 1,000.

projected total consumption of liquid milk in 1970 is 345.27 to 376.65 million gals, the "most likely" consumption figure being about 360 million gallons. Corresponding figures for 1975 are 378.93 to 427.85 (400) million gals, and for 1980, 416.67 to 485.02 (450) million gals.

Butter: In Chapter IV.3, the identification of factors influencing the consumption of butter proved more successful than assigning quantitative estimates to their relative importance. The continuous decline in consumption could be explained by either a strong negative consumption expenditure elasticity or by a simple trend variable. The two factors are not independent. Total fat consumption may be declining with higher real incomes, smaller proportions in manual occupations and lower bread consumption. On the other hand these alone cannot account for the highly negative income elasticity of -1.4. The connection between saturated fats and heart disease and the competition from margarine are factors which must have contributed significantly to the decline in consumption. Nor do international comparisons provide us with any clear cut conclusions about likely future trends in Australian butter consumption. Butter consumption in the United States appears to be declining further from its already low level, but in Canada, Sweden, New Zealand, and many European countries, the post-war decline in butter consumption has halted. In these countries consumption has remained nearly constant or risen slightly in the most recent years.

Although consumption in Australia continued to decline through 1964-65, the evidence since 1961-62 indicates that the rate of decline is now less than previously. This slower rate of decline may foreshadow the trend for the future. The factor in Australia most likely to alter this tendency is the possibility of a relaxation, in part or whole, of margarine quotas at present enforced by all State Governments. Although it is contended by many dairy industry representatives that present margarine production is sufficient to meet local demand, without quota restrictions margarine producers would have an incentive to increase their sales—either by intensifying promotion, by lowering prices, or by quality improvements, etc. Margarine could then be expected to replace butter further—both as a spread as well as in baking. It is impossible to predict future Government legislation on margarine and therefore two sets of projections for butter consumption have been made: the first assumes the status quo on margarine quotas; the second assumes their complete relaxation.

Although initially intending to use equation 4.3.4 for projections, we finally decided against the use of any mechanical extrapolation. On the basis of the most recent levelling out of the decline in butter consumption, and on the basis of international comparisons we have made some arbitrary judgements about likely future trends. In 1970, butter consumption may be between 20 and 22 lb per head; in 1975 between 18.5 and 20.5 lb and between 18 and 20 lb in 1980. Applying accepted low and high population projections, total butter consumption in the respective periods may fall in the following ranges: 1970, 245.26 to 284.13 million lb; 1975, 248.98 to 296.30 million lb; 1980, 266.38 to 322.72 million lb.

In assuming a full relaxation of present production quotas for margarine, an extreme assumption is being adopted which is unlikely to occur. In most countries, but particularly those whose dairy industries are of economic and political significance, margarine production is restricted by some form of government control.[59] This suggests that some form of control will remain in force in Australia. However, there remains

59. Licensing requirements, quality regulations and control of colouring and other added ingredients. (See: Food and Agriculture Organization of the United Nations, Means of Adjustment of Dairy Supply and Demand (Commodity Bulletin Series, Rome 1963), Table 14, p. 52.

Table 5.3.1

PROJECTED PER CAPITA AND TOTAL BUTTER CONSUMPTION, AUSTRALIA, 1965, 1970, 1975 AND 1980

Year	Projected Consumption					
	Low Estimates				High Estimates	
	No Margarine Quotas		Present Margarine Quotas Retained		Per Capita	Total
	Per Capita	Total	Per Capita	Total		
	lb	'000 tons	lb	'000 tons	lb	'000 tons
1965	22.8	115.73	22.8	115.73	22.8	115.73
1970	19.0	104.02	20.0	109.49	22.0	126.84
1975	15.5	93.13	18.5	111.15	20.5	132.14
1980	12.0	79.28	18.0	118.92	20.0	144.07

ample room for permitting a greatly increased production of margarine and a consequently stronger competitive position with respect to butter. It is only necessary to select another "low" estimate for butter to allow for the removal of restrictions. Once again the values have been selected arbitrarily; this time by linearly extending the decline in butter consumption between 1959-60 and 1964-65. This extrapolation is accepted as the new "low" and the estimates of per capita and total butter consumption are summarised in Table 5.3.1.

Cheese: Compared to other developed countries, Australia's per capita cheese consumption is still very low, despite the distinct upward trend of recent years. A number of factors suggest that cheese consumption will continue to increase for some years. Firstly, the most significant increases have occurred in the consumption of non-cheddar varieties. The percentage of these cheeses consumed is still only small (19 percent in 1964-65) and they are still a relatively new commodity to many Australian homes. Increased promotion, improvement of cheese quality, and wider diversification of cheese varieties should substantially raise the level of demand. Secondly, migrants of European origin generally consume considerably more cheese than indigenous Australians and their increasing proportion of the population should give a further lift to cheese consumption. Thirdly, the demand for cheese does have a positive income elasticity and therefore consumption should rise with increasing real income. It is expected that, with increased promotion, cheese may replace some meats (irrespective of price cross-elasticities) and cheese consumption with wines should also grow in popularity. On balance we would expect cheese to occupy a more prominent position in total food consumption.

The separate effects of these factors were distinguished from the influence of real incomes as such in our demand equations. A large part of their effect is represented by the income elasticity of 0.75 derived in equation 4.3.5. The real prices of cheese and competing products was assumed constant[60] and future consumption

60. The real price of cheese in Australia has been remarkably constant for many years. One uncertainty surrounding future trends is the possible introduction of protection to the home industry by placing a tariff on imported non-cheddar cheeses.

was estimated from changes in real income (consumer expenditure) with an income elasticity of 0.75 (±0.2). Projections were made from a base period consumption of 7.2 lb per head in 1965 instead of 6.3 lb in the base period 1958-59 to 1961-62. During this period the conditions influencing cheese consumption changed considerably. The higher level of meat prices, the greatly increased availability of non-cheddar cheeses (imported and home produced), a greater range of cheese varieties, and improved cheese quality are among the factors that were responsible for the sharp lift in cheese consumption since 1960. It is expected that their influence will remain important in determining future consumption and therefore use of 1965 as the base year seems preferable. The "low" and "high" estimates of future per capita and total cheese consumption are contained in Table 5.3.2.

Based on the consumption trends apparent from 1960 to 1965, the proportion of non-cheddar cheeses consumed should rise from 19 percent in 1965, to about 25 percent in 1970 and 35 percent by 1980. In the same period, per capita consumption of cheddar cheese should only rise by a small amount, or remain approximately at its present level.

Other Milk Products: Per capita consumption of whole milk products (in terms of milk solids content) is not expected to change significantly in the next 15 years. There should be a continued increase in the per capita consumption of unsweetened and evaporated milk and a smaller rise in the consumption of infants' and invalids' milk products. An unknown factor is the timing, extent, and likely effect of the introduction of UHT milk. If its use becomes general the demand for sweetened condensed milk and powdered full cream milk, in particular, could decline considerably. The consumption of these products will probably remain steady for a number of years, but some decline is expected before 1980.

Table 5.3.3 gives the projections of per capita consumption of whole milk products. These have been made individually on a purely subjective basis, after discussion with dairy technologists and other persons with knowledge of the industry. (Figures for the individual products are given in Table A5.3.1). When summed in terms of milk solids content, the low and high estimates approximate the projections of total whole milk products obtained from a 1965 base using respectively constant per capita consumption and an income elasticity of 1.0. In terms of gallons of whole milk, the quantity of milk used in the production of these products should lie between 56.82 and 68.80 million gals. in 1970, 61.52 and 81.73 million gals. in 1975 and 65.22 and 94.65 million gals. in 1980.[61]

Considerable increases are expected in the future consumption of skim milk products. There should be a continuing wider use of skim milk powder in the preparation of infant cereals and in its demand from diet-conscious adults. A considerable increase is also expected in the use of skim milk powder for stock feeds. Cottage cheese is prepared from skim milk powder and it is anticipated that consumption of this product will rise from the present negligible amount of 0.1 lb per head to at least 2.0 lb in 1980. Small increases are also expected in the consumption of condensed skim milk. Using the same estimating procedure as for whole milk products, the total per capita consumption of skim milk products (in terms of milk solids content) is estimated to rise from a 1965 value of about 6.3 lb to between 12.3 and 17.5 lb in 1980 (Table 5.3.3).[62] To realise the "most likely" estimate of demand, will require an

61. Estimated by converting to whole milk on the basis of 1 lb milk solids = 0.78 gals. of whole milk, and using low and high population estimates.

62. The small quantity of casein consumed domestically is excluded from these estimates.

Table 5.3.2

PROJECTED PER CAPITA AND TOTAL CHEESE CONSUMPTION, AUSTRALIA, 1970, 1975 AND 1980

Year	Projected Consumption			
	Low Estimate		High Estimate	
	Per Capita	Total	Per Capita	Total
	lb	mil. lb	lb	mil. lb
1965	7.20	80.749	7.20	83.064
1970	7.50	91.973	7.95	102.676
1975	7.82	105.247	8.77	126.757
1980	8.14	120.462	9.68	156.196

increase in availability of skim milk by about 220 percent in 15 years. It is this factor of supply that appears most likely to limit consumption below the "high" estimates made.

Hence, in terms of milk solids content, per capita consumption of total milk products (excluding casein) is estimated to increase from a base period average of 9.6 lb and a 1965 figure of about 12.2 lb to between 17.9 and 25.0 lb in 1980. In terms of total domestic consumption, our projection for 1980 would then be between 266 and 404 million lb. Casein consumption in Australia is not likely to rise a great deal in this period, although some uncertainty exists as to the likely trend in the use of casein (and other milk proteins) as a food protein. Ultimately this use for casein could replace some of the demand for other milk products.

Consumption of All (Whole Milk) Domestic Dairy Products : Table 5.3.4 brings together projections of total domestic milk consumption in the form of liquid milk, butter, cheese, ice cream, cream, and whole milk condensery products. This table differs from earlier ones in this section in three respects: (i) projections of butter, cheese, etc., are in terms of whole milk equivalents; (ii) estimates of cheese consumption exclude Australian consumption of imported cheeses and (iii) it includes an allowance for liquid milk consumed as cream, while the estimates earlier in this section excluded cream.

In 1960-65, total dairy consumption increased by about 65 million gallons. If present margarine quotas remain, the "most likely" increase in 1965-70 is expected to be similar — about 60 million gallons. However given the possibility of some relaxation of margarine quotas, it is difficult to specify a "most likely" level of consumption unless some other specific assumption is made about margarine quotas.

4. MEAT

During the projection period, and particularly during the next 5 years, domestic consumption of carcass meats is likely to be affected by the expected rise in poultry meat consumption, including a fall in the relative price of poultry, increased promotion of poultry and the influence of rising real incomes. No estimates of the elasticity of demand for poultry in Australia are available, but it is likely to be fairly high. Similarly the extent of cross elasticities between poultry and other meats are not known; it is probably higher for pork than for other carcass meats. Promotion may have a considerable influence on consumer

Table 5.3.3

PROJECTED CONSUMPTION OF WHOLE MILK AND SKIM MILK PRODUCTS, AUSTRALIA, 1965, 1970, 1975 AND 1980

Domestic Consumption	Unit	Base (a)	1965 (a)	1970		1975		1980	
				Low	High	Low	High	Low	High
Whole milk products:									
Per capita as milk solids	lb/head	5.65	5.94	5.94	6.83	5.86	7.25	5.65	7.52
Total as whole milk(b)	million gals.	45.30	52.71	56.82	68.80	61.52	81.73	65.18	94.65
Skim milk products (c):									
Per capita as milk solids	lb/head	3.93	6.30	8.33	11.34	10.40	14.50	12.30	17.51
Total as milk solids	million gals.	41.01	71.67	102.52	146.46	139.97	209.57	181.91	282.54
Total milk products (c):									
Per capita as milk solids	lb/head	9.64	12.24	14.07	18.17	16.26	21.75	17.95	25.03
Total as milk solids	million gals.	99.08	139.24	172.54	234.67	218.84	314.36	265.48	403.88

(a) Base period is average of years 1958-59 to 1961-62. Source Table 4.3.3.

(b) Assumes 1 lb milk solids content is equivalent to 0.78 gallons of whole milk.

(c) Excludes casein.

Table 5.3.4

PROJECTED TOTAL CONSUMPTION OF LIQUID MILK, BUTTER, CHEESE AND CONDENSERY PRODUCTS (IN TERMS OF WHOLE MILK), AUSTRALIA: 1965, 1970, 1975 AND 1980[a]

Period	Liquid Milk		Butter			Cheese(b)		Condensery Products		Total(c)		
	Low	High	Low(d)	Low(e)	High	Low	High	Low	High	Low(d)	Low(e)	High
	million gallons of whole milk											
Base Period (f)	292.4		541.7			58.4		45.3		958.9		
1965(g)	341.0		540.1			72.4		52.7		1025.4		
1970	345.3	376.6	485.4	510.9	591.9	78.8	90.9	56.8	68.8	986.3	1011.8	1153.2
1975	378.9	427.9	434.6	518.7	617.3	90.1	112.3	61.5	81.7	985.1	1069.2	1239.2
1980	416.7	485.0	369.7	554.6	672.3	103.1	139.3	65.2	94.6	974.7	1159.6	1415.2

(a) Assumes 1 ton butter ≡ 4,666.6 gals. of whole milk and 1 ton cheese ≡ 2,180.3 gals. of whole milk.

(b) Estimates for cheese consumption exclude the domestic consumption of imported cheese—12 percent for "low" estimates and 9 percent for "high" estimates. The percentages for the base period and 1965 were 4.7 and 9.1 respectively.

(c) Totals for base period and 1965 include estimates of liquid milk consumed as cream. For 1970, 1975 and 1980, "low" estimates are raised by 20.0 million gals. and "high" estimates by 25.0 million gals. to account for future cream consumption.

(d) Predicted "low" when margarine quotas are not applied.

(e) Predicted "low" when existing margarine quotas are retained.

(f) Calculated from the average per capita consumption 1958-59 to 1961-62, and a 1960 population of 10.278 million.

(g) Assumes a mean 1965 population of 11.376 million.

Sources: Tables 5.3.1, 5.3.2 and 5.3.3.

preferences, but the extent of future shifts in demand is not known. The income elasticity of demand for poultry appears to be fairly high, but again no estimates are available for Australia.

Current per capita consumption figures for poultry (mainly broilers) are fairly crude, but they provide the only starting point for an estimation of future consumption trends. In 1964-65 consumption of broilers was estimated at 9.0-9.3 lb per head, while consumption of total poultry meat was estimated to be 12.0-12.4 lb. Assuming a continuation in the relative decline of poultry prices and successful promotion of poultry, total consumption of poultry is estimated to reach 16.0 to 20.0 lb per person by 1970. These judgements are based partly on international comparisons and partly on discussions with industry organisations. After 1970, the rate of increase in consumption is expected to decline, due to smaller changes in relative prices and possibly lower price and income elasticities. By 1975 we estimate consumption to be between 18.0 and 24.0 lb and in 1980 between 20.0 and 28.0 lb per head.

For purposes of estimating future carcass meat consumption, it was decided to use as a projection base the arithmetic average of consumption per head in the normal 1960 base period (i.e. the average of the 4 years 1958-59 to 1961-62) and the 1964-65 figures, since meat prices are expected to recede somewhat from the very high levels reached in 1964-65 and 1965-66. (However we do expect meat prices to remain fairly high under the influence of strong overseas demand). In other words, we assumed that—given the constant prices on which we are basing our projections — 1965 consumption would have been equal to the average consumption between our 1960 base period and 1964-65.

In choosing high and low income elasticities for our projections of carcass meat consumption, the assumption was made that the average income elasticity obtained in the single equation estimates provided a suitable bench mark for our "high" projection, while the "low" projection used the average income elasticity minus one standard error. The reason for departing from the standard procedure of regarding the average value of the income elasticity as the "most likely" level, was that we expect the rapid rise in poultry consumption to exercise some depressive effect on carcass meat consumption.

For the various carcass meats the following income elasticities were assumed: beef and veal—"low" 0.0, "high" 0.5 (cf. equation 4.4.1); lamb — "low" 0.5, "high" 0.8 (cf. equation 4.4.2). For mutton the income elasticity obtained in the corresponding equation (namely minus 1.7, equation 4.4.3) was regarded as being unrealistically low. As an arbitrary alternative, we decided to use the income elasticity from equation 4.4.5—i.e. a "low" of minus 0.9 and a "high" of minus 0.6. For pork, equation 4.4.4 appeared to provide an implausibly high income elasticity; instead we chose to adopt the income elasticities provided by equations 4.4.6— a "low" of 0.9 and a "high" of 1.4.

For offal, canned meat, bacon, and ham it was again necessary to make arbitrary assumptions about future levels of consumption per head, based largely on extrapolations of past trends. Table 5.4.1 gives the projections of per capita consumption of the various meats for the period with which we are concerned. Table 5.4.2 provides total Australian consumption projections, using the high and low population projections specified in Chapter III.

Table 5.4.1

PROJECTED PER CAPITA CONSUMPTION OF MEATS, AUSTRALIA 1965, 1970, 1975, AND 1980

Type of Meat Consumed	Base (a)	Projection Base (b)	1965 (a)	1970 Low	1970 High	1975 Low	1975 High	1980 Low	1980 High
	lb/head carcass equivalent weight								
Beef and Veal	98.7	99.0	98.8	99.0	104.0	99.0	109.4	99.0	115.0
Lamb	38.0	39.0	39.4	40.6	42.3	42.2	45.9	43.9	49.8
Mutton	59.4	53.0	47.2	48.3	50.5	44.0	48.2	40.1	46.0
Pork	11.5	12.0	12.5	12.8	13.9	13.6	16.0	14.5	18.5
Total Carcass Meat	207.6	203.0	197.9	200.7	210.7	198.8	219.5	197.5	229.3
Poultry (c)	8.0	10.0	12.2	16.0	20.0	18.0	24.0	20.0	28.0
Offal	11.6	12.0	12.4	12.0	14.0	13.0	15.0	14.0	16.0
Carcass Meat (d)	5.9	6.0	5.7	5.6	6.3	5.6	6.7	5.6	7.0
Bacon and Ham (d)	9.8	10.0	10.3	9.8	10.5	9.8	10.9	9.8	11.2
Total Non-Carcass Meat	35.3	38.0	40.6	43.4	50.8	46.4	56.6	49.4	62.2
TOTAL ALL MEATS	242.9	241.0	238.5	244.1	261.5	245.2	276.1	246.9	291.5

(a) Base period is average for years 1958-59 to 1961-62. Figures for 1965 include unofficial estimates for canned meat and bacon and ham. Source of data: Bureau of Agricultural Economics, The Beef Situation No. 10 (Canberra, November 1965), Table VII.

(b) Projections for 1970, 1975 and 1980 are based on the mean of the consumption figures for the base period and 1965 (taken to the nearest whole number). Income elasticities apply from 1965.

(c) Poultry consumption for the base period and 1965 are "best" estimates.

(d) Figures for canned meat and for bacon and ham have been expressed in carcass equivalent weight on the assumption that 1 lb of canned meat or cured carcass weight is ≡ to 1.4 lb carcass equivalent weight.

Table 5.4.2

PROJECTED TOTAL CONSUMPTION OF MEATS, AUSTRALIA, 1965, 1970, 1975 AND 1980

Type of Meat Consumed	Base (a)	1965 (b)	1970		1975		1980	
			Low	High	Low	High	Low	High
	'000 tons (long) carcass equivalent weight							
Beef and Veal	450.5	501.7	542.0	599.6	594.8	705.9	654.0	828.4
Lamb	174.8	200.1	222.3	243.9	253.6	296.2	290.0	358.7
Mutton	272.2	239.7	264.4	291.2	264.4	311.0	264.9	331.4
Pork	52.9	63.5	70.1	80.1	81.7	103.2	95.8	133.3
Total Carcass Meat	950.4	1,005.0	1,098.7	1,214.8	1,194.4	1,416.3	1,304.8	1,651.7
Poultry (c)	37.0	61.9	87.6	115.3	108.2	154.9	132.1	201.7
Offal	52.6	63.0	65.7	80.7	78.1	96.8	92.5	115.3
Canned Meat (d)	27.0	28.9	30.7	36.3	33.7	43.2	37.0	50.4
Bacon and Ham (d)	45.1	52.3	53.7	60.5	58.9	70.3	64.7	80.7
Total Non-Carcass Meat	161.7	206.1	237.6	292.9	278.8	365.2	326.4	448.1
TOTAL ALL MEATS	1,112.1	1,211.1	1,336.3	1,507.7	1,473.2	1,781.5	1,631.1	2,099.8

(a) Base period is average of years 1958-62. Source of data: Commonwealth Bureau of Census and Statistics, Primary Industries Bulletin, Part I - Rural Industries (Canberra), 1958-59 to 1961-62.

(b) Estimated from per capita figures Table 5.4.1 and an assumed population of 11.376 million.

(c) Poultry consumption for the base period and 1965 are "best" estimates.

(d) Figures for canned meat and for bacon and ham have been expressed in carcass equivalent weight on the assumption that 1 lb of canned meat or cured carcass weight is ≡ to 1.4 lb carcass equivalent weight.

5. GRAINS

(a) For Human Consumption

Wheat Products: Equation 4.5.4 (Table 4.5.2) was used for the projection of Australian consumption of wheat products. This equation "explained" a high proportion of the variation of per capita wheat consumption in the post-war period ($R^2 = 0.951$) and we used the associated income elasticity of 0.112 and the negative trend coefficient of 0.006 to project future per capita consumption of wheat products. These income and trend coefficients were applied to the average per capita consumption of the base period (i.e. 1958-59 to 1961-62). To obtain "high" and "low" projections, the following coefficients were used:

"High"—Income coefficient: 0.26; trend coefficient: -0.005, plus the assumed "high" growth rate for total consumption expenditure.

"Low"—Zero income coefficient; trend coefficient: -0.007, plus the assumed "low" total consumption expenditure growth rate.

To obtain an upper limit for total human consumption of wheat products high per capita estimates were multiplied by the high population projections and conversely for the lower total consumption projection (Table 5.5.1).

Barley[63] Because the data in Table 4.5.4 show little evidence of a trend in unit beer consumption since 1954-55, we used a constant consumption of 65.0 gallons per consumption unit for our "most likely" projections. This was the average consumption during the 10 years ended June 30th 1964. It is higher than consumption in our normal base period (1958-59 to 1961-62 average equals 63.9 gallons), but was preferred—partly because consumption has risen again since then and partly because we had no reason to expect any permanent decline in average beer consumption. For our low and high projections we have used 63.0 and 67.0 gallons per consumption unit respectively—i.e. broadly the limits within which consumption has fluctuated in the last 10 years. Over the post-war period an average of 27.8 million gallons of beer was produced from one million bushels of barley.[64] This relationship was used to convert the beer consumption projections into estimates of likely barley use (Table 5.5.1). They were made on the basis of the projected number of consumption units, based on the age distribution of our population projections for the different years.

Oats. "Most likely" projections are based on a constant per capita level of consumption of 0.165 bushels per head. This is the average per capita use since 1957-58.[65] We used 0.14 and 0.19 as our low and high projections. Total projected consumption is reported in Table 5.5.1.

Maize. Human consumption of maize is relatively small. Table 4.5.6 shows that there was considerable variation in the annual domestic use of maize for human consumption, with no evidence of a clear trend. Consumption was relatively high in the early post-war years (until 1950-51), followed by 3 years of low consumption and more recently there has been considerable variation in estimated annual consumption. For our "most likely projection" we have taken the average for the 17 years given in the table (5.8 lb per head per annum), with a "high" projection of 7.1 lb—i.e. the highest level reached since 1949-50. For our "low" projection we have therefore used a figure of

63. The direct human consumption of pearl barley is less than 1 percent of total barley consumption in the form of beer. It has been ignored here and is implicitly included in the estimate for barley used in the manufacture of beer.

64. This relationship was obtained by averaging the ratio of barley used to beer produced over the post-war period.

65. This average is derived from dividing total "apparent domestic utilisation" in factories (Table 4.5.5) by the mean population. Hence it makes allowances for losses in processing. A small proportion of oatmeal (5-10%) which is exported is included in these figures. Hence the projections include the implicit assumption that such exports will continue.

Table 5.5.1

PROJECTED CONSUMPTION OF GRAIN PRODUCTS FOR HUMAN CONSUMPTION

Product		Unit	Base (a) Period	1965		1970		1975		1980	
				Low	High	Low	High	Low	High	Low	High
Wheat*	per capita	lb	249.2	229.9	241.8	212.1	235.2	195.7	229.4	180.6	224.4
	Total	million bushels	42.7	43.0	46.5	43.4	50.6	43.9	55.3	44.6	60.4
Barley**	"	"	8.33	9.01	9.82	9.86	11.0	10.7	12.2	11.6	13.5
Oats †	"	"	1.71	1.57	2.19	1.72	2.45	1.88	2.75	2.07	3.07
Maize ††	"	"	0.957	0.901	1.46	0.985	1.64	1.08	1.83	1.19	2.05
Rice ‡	"	"	27.8	38.9		30.4	43.5	33.4	48.7	36.7	54.4

(a) Base period is average of years 1958-59 to 1961-62.

* Projections based on equation 4.5.4. (Table 4.5.2).

** Projections based on constant beer consumption of 63 (low) and 67 (high) gallons per consumption unit.

† Projections based on constant per capita consumption of 0.14 bushels for "low" and 0.19 bushels for "high" projections.

†† Projections based on constant per capita consumption of 4.5 lbs and 7.1 lbs respectively.

‡ Projections based on constant per capita consumption of 5.55 lbs and 7.55 lbs respectively.

Source: for base year data: Commonwealth Bureau of Census and Statistics, Rural Industries (Canberra) 1962-63.

4.5 lb (although in 2 of the 17 years, apparent consumption has fallen below this level). The total projections are again given in Table 5.5.1.

Rice. Experience suggests that domestic consumption of rice (including stock changes) increased roughly in proportion to population growth, and per person consumption has shown no demonstrable relationship to retail price or to personal disposable income.

Factors which may influence future per capita consumption are firstly promotion and secondly the growing preference for long-grain rice. The New South Wales Rice Marketing Board recently conducted some vigorous promotional activity to increase domestic consumption of rice by various means (T.V. advertising, introduction of an annual "Rice Week" in Sydney, the distribution of recipes, etc.). The Board claimed that, as a result of the increase in publicity, per capita consumption of rice increased to 5.11 lbs compared to the prewar level of 3.5 lbs.[66] However, because Australian per capita consumption of rice is already high by Western standards, it is not anticipated that promotion will be able to lead to any further substantial increase in rice consumption per head.[67] With strong competition from other vigorously promoted foodstuffs, promotional efforts will likely be needed to keep consumption of rice at the present level. New forms, including those which provide some added convenience ("minute rice") may increase demand somewhat.

Another factor which may increase rice consumption is the growing preference for long-grain rice. At the present, no really suitable variety of long-grain rice exists in Australia which gives yields comparable to those obtained with the short-grain variety Caloro. The Rice Marketing Board pays a premium for long-grain rice, and consumers appear to be willing to pay a higher retail price for these varieties (17 cents as against 12 cents retail in February 1966). It seems likely that expansion in consumption of long-grain rice will be largely at the expense of short-grain rice.

In view of the above, future domestic demand in Australia is projected on the basis of constant per capita consumption. The average consumption of 6.55 lb per head, and a standard deviation of 1.0 lb, for the 10 years ending 1964-65, give us a "high" and a "low" projection of 7.55 lb and 5.55 lb per head (Table 5.5.1). The quantities calculated on this basis include average stock changes and various losses and wastage in milling and other operations.

(b) For Stock Feed

The attempts, in Chapter IV, to estimate the relationship between grain used for stock feed and the number of pigs, poultry, sheep, and dairy cattle on farms were unsuccessful. We obtained estimates from Department of Agriculture officers (mainly in Victoria, but also in other States), of the quantities of grain fed to poultry, pigs, and dairy cattle. We estimated the total quantities of grains fed to stock.[68] The difference between the estimated consumption of grains by poultry, pigs, and dairy cattle and the total quantities fed to stock were assumed to be fed to sheep, though a small proportion would be fed to vealers, beef cattle, and horses. To project the quantity of grain used for stock feed, each stock classification was considered separately except for the joint projection of sheep, non-dairy cattle, and horses.

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66. Mr. C.E. Dalton, Manager, Rice Marketing Board, in the Australian Financial Review (16 December 1964)

67. Recorded average consumption in the United States of America, for the 10 years ending 1963 has been 5.4 lb per head, and is currently about 5.7 lb, in spite of very strong promotional activities.

68. Tables 4.5.3; 4.5.6 and 4.5.8 give the figures for barley, oats, maize and wheat respectively. Estimates were also made for grain sorghum consumption.

Total (i.e., controlled and uncontrolled) egg production in Australia in 1964 - 65 was estimated at 240 million dozen. Feed consumption per dozen eggs produced was estimated at $6\frac{1}{2}$ to $8\frac{1}{2}$ lb, of which approximately 50 percent is in the form of grain.[69] This includes the estimated grain content of prepared pellets and that fed loosely as forage grain (but, to avoid double counting, it excludes grain by-products — bran and pollard, etc.). Wheat is believed to comprise 50 to 65 percent of the grain consumed, while barley and oats account for most of the remainder.[70] The calorie value of all grain used by laying hens was estimated at 0.75 to 0.86 million million calories (i.e. 10^{12} calories),[71] on the basis of an intake of 7.0 to 9.0 million bushels of wheat and lesser amounts of oats, barley, maize, and sorghum. While little change is expected in the grain content of layers' rations, lower feed/egg ratios are projected because of the expected increase in the proportion of eggs produced by large-scale enterprises.

Broiler production in 1964 - 65 was estimated at 41 to 44 million. Of the estimated 10 lb of feed consumed per bird, about $6\frac{1}{2}$ are grain — including about 2 - $2\frac{1}{2}$ lb of wheat, maize, or sorghum, 2 - $2\frac{1}{2}$ lb of barley, and $1\frac{1}{2}$ - 2 lb of oats. Total grain consumption by broilers in 1964 - 65 can therefore be estimated at 0.23 to 0.25 million million calories. Allowing an extra 5 to 8 percent for other poultry meats (ducks, turkeys and geese), grain consumption by the whole poultry industry is estimated at 0.24 to 0.27 million million calories. In projecting future grain consumption by the poultry meat industry a slight improvement in conversion ratios (10 percent by 1980) has been assumed, whilst total poultry production (and consumption) projections given in Tables 7.6.2 and 5.4.2 have been used to arrive at projections of feed grain use by the poultry meat industry.

Pigmeat production in 1964 - 65 was about 122,000 tons. It is believed that each lb of pigmeat produced requires an average intake of 2.3 to 2.7 lb of grain, including 1.0 to 1.6 lb of wheat, maize or sorghum, 0.9 to 1.2 lb of barley and 0.1 to 0.3 lb of oats. This suggests a total grain intake equivalent to 0.55 to 0.63 x 10^{12} calories. Estimates of future grain consumption by pigs have been based on the pigmeat production projections of Table 7.4.2; a gradual reduction in the feed/pigmeat ratio (of 10 percent by 1980) and a gradual increase in the proportion of grain in the total feed intake by pigs (from an estimated 40 percent in 1964 - 65 to 55 percent in 1980).[72]

Supplementary feeding of grain to dairy cattle is not a general practice; it is significant mainly in areas supplying the liquid milk market. On the basis of the accepted feeding rates in these areas of about 1 lb of grain to every $\frac{1}{2}$ gallon of milk produced, we have estimated normal grain consumption of dairy cattle in 1964 - 65 at 0.51 to 0.56 x 10^{12} calories — including 10 to 12 million bushels of oats; 2.3 to 3.0 million bushels of barley and 1.8 to 2.5 million bushels of sorghum, maize and wheat.[73]

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69. This figure includes an estimated $1\frac{1}{2}$ lbs of feed consumed in rearing birds to the laying stage. Efficient commercial producers would have a lower feed/egg ratio, but allowance is made for the higher ratios prevailing among backyard and part-time producers.

70. In New South Wales and Queensland maize and sorghum are often used as high protein substitutes for wheat.

71. The calorific value of the different grains was estimated by using the following conversion factors: wheat - 0.0570 million calories per bushel; oats -0.0304; barley 0.0400; maize 0.0641; grain sorghum -0.0648.

71. However skim milk (both in liquid and in powdered form) will probably still constitute a significant portion of the national pig ration.

72. These estimates assume "normal" seasonal conditions. In 1964-65 some of the residual grain consumption allocated to "other" should have been included under dairy cattle, because of abnormally dry conditions in some dairying areas of New South Wales and Queensland.

Table 5.5.2

PROJECTED CONSUMPTION OF GRAIN AS STOCK FEED, AUSTRALIA, 1965, 1970, 1975 AND 1980

Type of Stock	Base Period	1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
	million million calories								
Broilers and Other Poultry Meat Products	0.12	0.24	0.27	0.34	0.47	0.41	0.62	0.48	0.78
Laying Hens	0.73	0.75	0.85	0.80	1.00	0.87	1.14	0.95	1.27
Pigs	0.52	0.55	0.63	0.64	0.84	0.77	1.10	0.94	1.43
Dairy Cattle	0.49	0.51	0.56	0.51	0.60	0.51	0.64	0.51	0.68
Sheep, Beef Cattle, Vealers, Horses, etc.	1.27	2.20	2.38	1.45	1.68	1.60	1.83	1.70	2.00
TOTAL	3.13	4.25	4.70	3.74	4.59	4.16	5.33	4.58	6.16

Source of data — largely private estimates — see text.

Table 5.5.3

CURRENT ESTIMATES AND PROJECTIONS OF FEED GRAIN CONSUMPTION BY VARIOUS STOCK CATEGORIES

		Broiler and Other Poultry Meats		Layers		Pigs		Dairy		Sheep, Beef etc.		TOTAL	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
		million bushels[a]											
Wheat[b]	1965	0.7	1.1	7.0	9.0	2.6	3.6	0.3	0.5	19.5	23.1	30.1	37.3
	1970	1.0	1.9	7.4	10.4	3.0	4.8	0.3	0.5	5.3	9.0	17.0	26.6
	1975	1.2	2.5	8.1	11.9	3.6	6.3	0.3	0.6	5.9	9.8	19.1	31.1
	1980	1.4	3.2	8.8	13.2	4.4	8.1	0.3	0.6	6.2	10.6	21.1	35.7
Oats	1965	1.6	2.1	3.0	4.0	1.0	1.7	10.0	12.0	22.4	24.2	38.0	44.0
	1970	2.2	3.7	3.2	4.6	1.2	2.3	10.0	12.9	23.8	27.0	40.4	50.5
	1975	2.7	4.8	3.4	5.3	1.4	2.9	10.0	13.7	26.2	29.5	43.7	56.2
	1980	3.2	6.1	3.7	5.9	1.7	3.8	10.0	14.4	27.8	31.9	46.4	62.1
Barley[c]	1965	1.6	2.2	2.5	3.3	5.0	6.0	2.3	3.0	3.6	4.5	15.0	19.0
	1970	2.2	3.8	2.7	3.8	5.8	8.0	2.3	3.2	3.2	4.5	16.2	23.3
	1975	2.7	5.0	2.9	4.4	7.0	10.4	2.3	3.4	3.5	4.9	18.4	28.1
	1980	3.2	6.4	3.2	4.9	8.5	13.6	2.3	3.6	3.7	5.3	20.9	33.8
Maize	1965	0.5	0.6	0.8	1.1	1.0	1.4	0.5	0.7	1.6	2.0	4.4	5.8
	1970	0.7	1.0	0.9	1.3	1.2	1.9	0.5	0.7	1.7	2.2	5.0	7.1
	1975	0.9	1.4	0.9	1.5	1.4	2.4	0.5	0.8	1.9	2.4	5.4	8.5
	1980	1.0	1.7	1.0	1.6	1.7	3.2	0.5	0.8	2.0	2.6	6.2	9.9
Sorghum	1965	0.4	0.5	0.8	1.0	0.9	1.3	1.0	1.3	1.0	1.3	4.1	5.4
	1970	0.6	0.9	0.9	1.2	1.1	1.7	1.0	1.4	1.1	1.4	4.7	6.6
	1975	0.7	1.2	0.9	1.3	1.3	2.2	1.0	1.5	1.2	1.6	5.1	7.8
	1980	0.8	1.5	1.0	1.5	1.5	2.9	1.0	1.6	1.3	1.7	5.6	9.2

(a) Apparent discrepancies in projected values are due to rounding errors.

(b) Wheat has been projected from an assumed "normal" 1965 base of "low" = 5.0 and "high" = 8.0.

(c) Barley has been projected from assumed 1965 values of 3.0 and 4.0.

Source of data - For 1965 total feed consumption - Commonwealth Bureau of Census and Statistics, private information.
For individual stock categories - private estimates (see text).

This estimate assumes that roughly 20 percent of dairy cattle are fed at the accepted feeding rate. No increase is expected in the proportion of dairy cattle fed supplementary grain rations, or in the quantity of grain in the rations. In fact, with further increases in the proportion of dairy cattle on improved pastures and on irrigated pastures, some decline in both the proportion of cattle fed and the amount fed per animal could occur. For our "low" projections of grain consumption by dairy cattle we have therefore held the estimate constant at the 1964—65 "low" estimate; whilst for the "high" projection we have allowed for an expansion in grain consumption at the same rate as the increase in total milk production.

The total quantity of grain available as stock feed in 1964—65 is estimated between 4.25 to 4.7 x 10^{12} calories, suggesting that between 2.2 and 2.38 x 10^{12} calories were fed to sheep, beef cattle, and horses. This would comprise about $19\frac{1}{2}$ to 23 million bushels of wheat, $22\frac{1}{2}$ to $24\frac{1}{4}$ million bushels of oats; 6.2 to 7.8 million bushels of other grains. These figures are considerably higher than in earlier years — mainly because of drought feeding of sheep and beef cattle.[74] In non-drought years wheat consumption is estimated at around 5 to 8 million bushels. In our projections no allowance was made for droughts of the 1964—66 magnitude. Projections to 1980 were made on the basis of a small (10— 15%) increase in per capita consumption of grain by sheep as a result of the expected expansion of supplementary feeding of sheep (or more intensive feeding by farmers at present practising supplementary feeding). They have also been based on the expected rise in sheep numbers given in later chapters.

74. Some of this residual feed grain would have been fed to dairy cattle—see footnote 73.

Table 5.5.2 gives the projections of feed grains in terms of calories; Table 5.5.3 gives the projections in terms of the different types of grain. In allocating calorie requirements to individual grains, we have assumed that the proportion of the grains consumed by the various classes of stock will remain constant. This is a very artificial assumption, since there is evidence of considerable substitution of one grain for another — on the basis of changes in relative prices.[75] However, in the absence of more adequate data on consumption, it is difficult to find reasonable alternative assumptions.

6. FRUIT

(a) Canned Fruit

Probably as a result of declining real prices and the introduction of intensive promotion efforts, the Australian per capita consumption of canned fruits rose rapidly from 1958—59 to 1962—63. Since Chapter IV on canned fruits was prepared, the Commonwealth Statistician revised his preliminary 1963—64 estimates downwards from 20.5 to 18.6 lb. It appears that "consumption" was particularly large in 1962—63, partly as a result of the build-up of stocks by some retailers in anticipation of an increase in excise duty on canned fruits. The present consumption figure is not known accurately, but is probably between 18 and 20 lb per head. Peaches, pears, and apricots would comprise 11—12 lb of this total, pineapple and tropical fruit salad $5 - 5\frac{1}{2}$ lb, whilst the remaining $2 - 2\frac{1}{2}$ lb consist of canned apples, berries, and other fruits.

The income elasticities derived in Chapter IV, section 6 (equations 4.6.1 and 4.6.2) project consumption to levels well above those at present experienced overseas.

75. cf. Chapter IV, Grains for Stock Feed.

Table 5.6.1

PROJECTED PER CAPITA AND TOTAL CONSUMPTION OF CANNED FRUITS
AUSTRALIA, 1965, 1970, 1975 AND 1980

Projected Consumption	Base Period (a)	1965 Low (b)	1965 High	1970 Low	1970 High	1975 Low	1975 High	1980 Low	1980 High
PER CAPITA CONSUMPTION: All Canned Fruit	15.6	18.0	20.0	20.0	22.0	20.0	24.0	20.0	25.0
	thousand standard cases (c)								
TOTAL CONSUMPTION:									
Apricots	370	530	580	640	725	700	890	770	1030
Peaches	1050	1430	1550	1710	1935	1880	2370	2065	2750
Pears	556	500	650	600	810	660	995	725	1160
Mixed Fruits	140	300	350	360	440	395	535	435	620
Pineapple	520	900	950	1080	1190	1185	1455	1300	1690
Tropical Fruit Salad	408	370	400	445	500	485	610	535	710
Other (d)	510	510	560	615	700	675	855	740	1000
ALL FRUIT	3560	4540	5040	5450	6300	5980	7710	6570	8960

(a) Base period is average for years 1958-59 to 1961-62. Values given are estimates obtained by combining the information of both sources.

(b) Estimates for 1965 are largely based on the Canned Fruits Board Report for 1965.

(c) Conversion from the weight measure has been made on the assumption 1 standard case = 45 lb of canned fruit.

(d) Includes canned apples, berries, cherries, passion fruit, etc.

Sources: For Base Period and 1965 Estimates: Commonwealth Bureau of Census and Statistics, Statistical Bulletin, Report on Food Production and the Apparent Consumption of Foodstuffs and Nutrients in Australia, No. 16, 1960 — 61, and No. 17, 1961 — 62 (Canberra). Australian Canned Fruits Board, Annual Report and Accounts 1965 (Canberra, May 1966).

Table 5.6.2

PROJECTED PER CAPITA AND TOTAL CONSUMPTION OF DRIED FRUITS, AUSTRALIA, 1965, 1970, 1975 and 1980

	Base Period[a]	1965 (b)		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
	lb. per head								
PER CAPITA CONSUMPTION:									
Dried Vine Fruit	4.4	4.5	4.6	4.0	4.7	3.7	4.9	3.3	5.2
Dried Tree Fruit	1.8	1.9	2.0	2.0	2.2	2.0	2.3	2.0	2.4
Total Dried Fruit	6.2	6.4	6.6	6.0	6.9	5.7	7.2	5.3	7.6
	thousand tons								
TOTAL CONSUMPTION:									
Sultanas	11.6	14.2	14.5	14.6	18.0	15.8	22.0	16.7	26.6
Raisins	4.5	4.4	4.6	4.2	4.7	4.0	5.0	3.8	5.5
Currants	4.1	4.2	4.3	4.0	4.5	3.9	4.9	3.7	5.3
Total vine fruit	20.2	22.8	23.4	22.8	27.2	23.7	31.9	24.2	37.4
Apricots	0.9	1.0	1.1	1.2	1.3	1.3	1.6	1.4	1.8
Prunes	2.8	3.2	3.3	3.6	4.2	3.9	4.9	4.3	5.7
Other tree fruits[c]	4.8	5.4	5.7	6.1	7.2	6.8	8.3	7.5	9.8
Total tree fruit	8.5	9.6	10.1	10.9	12.7	12.0	14.8	13.2	17.3
TOTAL DRIED FRUIT	28.7	32.4	33.5	33.7	39.9	35.7	46.7	37.4	54.7

(a) Base period is average for the years 1958-59 to 1961-62. The figures have been largely derived from: Commonwealth Bureau of Census and Statistics, op. cit. Per capita consumption figures were obtained by totalling the quantity available for consumption in Australia during the entire period and dividing by the mean population. This explains the slight discrepancy with the base period average obtained from Table 4.6.1.

(b) Estimated from: Australian Dried Fruits Control Board, Forty-first Annual Report (Canberra, August 1965).

(c) Includes apples, peaches, pears, figs and nectarines.

Consumption trends in North America and the United Kingdom suggest that the rate of increase in per capita consumption of canned fruit was relatively slow after consumption reaches a level of about 20 lb per head. Since we expect Australian developments to be somewhat similar to those which occurred in overseas countries, the projections based on our estimated income elasticities appeared unreasonably high. Our per capita consumption projections are given in Table 5.6.1; they were derived from an arbitrary subjective assessment of expected trends. We expect canned fruit consumption to show a slow, long-term increase — subject to year-to-year fluctuations resulting from erratic movements in yields per acre. We expect these to affect mainly the frequency of retail "specials" and promotion expenditure. Our "most likely" estimate gives a rise in consumption of all canned fruits from approximately 19 lb in 1965 to 21 lb in 1970 and $22\frac{1}{2}$ lb in 1980. Consumption was divided into the various types of canned fruit used, on the assumption that the "most likely" proportion represented by each fruit would remain at the levels estimated for 1965. However separate percentages were used for the "low" and "high" projections.

(b) Dried Fruit

Vine fruit projections have been made on the basis of equation 4.6.5 which gave an average income (total consumption expenditure) elasticity of 0.88 and an elasticity of 2.44 with respect to changes in per capita flour consumption. Since per capita flour consumption is expected to fall, the quantity of dried vine fruit used with bread, cake, and other baked goods is also expected to decline. In the "high" projections this is more than counterbalanced by the increase in per capita vine fruit consumption resulting from the increase in total consumption expenditure. However in the "low" projection, a decline in consumption is obtained. Our mid-point, "most likely" per capita consumption projection gives a slight ($3\frac{1}{2}$%) decline between our base period and 1980. Since Australian dried vine fruit consumption is one of the highest in the world, this seems reasonably realistic.

In 1965 sultanas represented over 60 percent of the dried vine fruits consumed; raisins and currants supplied the remainder. In distributing projected consumption among the different vine fruits, we assumed that sultanas will increase to about 70 percent of the total by 1980 (Table 5.6.2). This is based on discussions with distributors of dried fruits and our extrapolation of past trends.

Tree fruit consumption in 1965 was estimated at 1.9—2.0 lb per head, compared to 1.8 lb during the base period. Our projections in Table 5.6.2 provide for further small increases in consumption. The "low" projections are based on a constant per capita figure of 2 lb, whilst the "high" projection increases to 2.4 lb by 1980. These projections are based largely on extrapolation of trends during the last few years.

Separate estimates are given for apricots and prunes; the proportions consumed during the base period are assumed to provide a reasonable guide for future changes. The projections are again given in Table 5.6.2. The "other" category which is not projected separately includes apples, peaches, pears, figs, and nectarines.

7. EGGS

The fitted regression equations (chapter IV) give an expenditure elasticity of demand for eggs of 0.2. This result is obtained with both linear and logarithmic equations. The extent to which variation in egg consumption is explained by total consumption expenditure and egg prices is relatively low, the R^2 value being 0.50. However the estimates of the FAO[76] also yield an income elasticity of 0.2 for Australia.

Table 4.3.6 suggests that we can divide the post-war years into three periods — (1) 1947—48 to 1951—52 — years of declining per capita consumption; (2) 1952—53 to 1958—59 — years of relatively low per capita consumption, the recorded variation being between 16.93 and 17.56 dozen per year; (3) the years since 1959—60 — years in which some small increase in per capita consumption was noticeable but there was no real evidence of an upward trend. One probable reason for this slightly higher level of consumption is the promotion effort made by Egg Boards throughout Australia.[77]

For the purpose of projections we assumed as a low projection, that per capita consumption remains constant at the average level of 1958—59 to 1963—64 — 17.5 dozen eggs per annum (Table 5.7.1). Thus we assumed that promotion activities will be continued at least to the extent of maintaining present consumption levels. As a high projection we assumed that the estimated income elasticity of demand (0.2) is effective.

8. MISCELLANEOUS PRODUCTS

(a) Cotton

In Chapter IV the difficulties encountered in estimating total cotton consumption in Australia was enumerated. Briefly, they arose partly from the fact that a large proportion of cotton piece goods and other cotton manufactures was imported, and it was difficult to estimate their new cotton content, and partly from the lack of statistics as to the annual inventory changes.

In addition the lack of appropriate price series for the various products containing cotton, make it impossible to calculate price and income elasticities for cotton. For the purpose of our projections, only raw cotton supplies, excluding those in the form of imported cotton piece goods, will be considered.[78]

Between 1950—51 and 1962—63, total consumption of raw cotton from both domestic sources and imports varied between 55 and 60 million lb, and has been relatively stable at this level. On a per capita basis, availability ranged between 5.2 and 7.0 lb. In 1963—64 and 1964—65, total supply increased sharply to 73 and 74 million lb respectively, as a result of higher tariff protection for finer counts of yarns and increased imports of raw cotton, raising per person availability to about 7 lb.

Our "high" projection will be based on the assumption that the Australian cotton weaving industry receives some further protection — resulting in a rise in per capita consumption of raw cotton by the Australian industry of 5 percent every 5 years. As pointed out below (footnote 78) there is still very substantial scope for further expansion of the

76. F.A.O., Agricultural Commodities Projections for 1970 (E/CN 13/48 CCP 62/5 Rome) Table M4, p. A-14.

77. E.L. Banks and R.G. Mauldon, "Effects of Pricing Decisions of a Statutory Marketing Board; A Case Study", The Australian Journal of Agricultural Economics, Vol. 10, No. 1, June 1966. The authors obtain an income elasticity of demand for eggs in Western Australia of 1.42 but regard this as an over-estimate. They consider that it includes some of the effect of the promotion of eggs.

78. The local cotton weaving industry currently produces a small proportion of total domestic requirements. It is not equipped at present to manufacture fine, light-weight cotton fabrics, suitable for the production of fine shirtings and dresses. Although this situation could be changed with further tariff protection, we have assumed that no additional protection will be granted in the foreseeable future to the local weaving industry. Apart from the fact that such protection would considerably increase the price of cotton manufactures to Australian consumers, it would be likely to result in strong protests from present suppliers of imported woven cotton piece goods—notably Japan, which is Australia's fastest-growing export market.

Table 5.7.1

PROJECTED PER CAPITA AND TOTAL EGG CONSUMPTION
AUSTRALIA, 1965, 1970, 1975 AND 1980

Year	Projected Consumption			
	Low Estimate		High Estimate	
	Per Capita (dozens)	Total (million doz)	Per Capita (dozens)	Total (million doz)
Base Period[a]	17.4	179.88	17.4	179.88
1965	17.5	196.26	17.9	206.51
1970	17.5	214.60	18.2	235.06
1975	17.5	235.53	18.6	268.84
1980	17.5	258.82	19.0	306.58

(a) Base period is average for 1958-59 to 1961-62.

Source: for base period consumption — Table 4.7.1.

local industry. In view of recent increases in the quantity of cotton produced in Australia, it seems plausible to assume there will be pressure for further protection.

Our "low" projection incorporates some assumptions concerning the possible displacement of cotton by synthetic fibres (and assumes — by implication — that the local cotton weaving industry is not granted any additional protection). There has been a spectacular growth in the use of man-made fibres in Australia in recent years. Despite this, the total demand for cotton has not declined, though we cannot guess at the growth of consumption that would have occurred in the absence of competition from man-made fibres. The extent of the displacement of cotton by synthetic fibres will depend partly on fashion, partly on relative price and partly on the availability of synthetic fibres. In Australia, Fibremakers Ltd. (ICIANZ) have increased their capacity in the last 7 years from 5 million lb of synthetic yarn a year to 30 million lb. Allied Chemicals (Australia) Pty, Ltd. has an extension to its nylon plant under construction in Sydney, which will increase its capacity from 3.5 million lb a year to 6.5 million.

Nylon is still dear in Australia, both in relation to competing materials and to the price in Europe, where substantial reductions in price have been announced recently. Price cuts in Australia would give great impetus to consumption. Outlets where sales are expected to accelerate are in upholstery fabrics, carpets, vehicle tyres, and cigarette filters.

Although we can only guess at the extent of future displacement of cotton by synthetics in the next 15 years, at least one organization concerned with the changes in fibre usage in Australia estimates a likely displacement of cotton amounting to about 40 percent in the next 15 years.[79] Assuming that this displacement will be continuous, we have formulated an alternative "low" projection of domestic demand for cotton, based on this assumption (Table 5.8.1). The quantities of raw cotton have been converted to those of seed cotton at an extraction rate of 37 percent.

79. Cotton and Man-Made Fibres Federation, Australia (private communication).

Table 5. 8. 1

AUSTRALIAN DEMAND PROJECTIONS FOR RAW COTTON (INCLUDING WASTE AND LINTERS) AND SEED COTTON

Product	Base Period[a]	1965	1970		1975		1980	
			Low	High	Low	High	Low	High
	(million lb)							
Raw Cotton	57.6	73.8	75.7	91.5	70.1	105.2	63.1	120.6
Seed Cotton	155.5	199.5	204.5	246.9	189.3	283.9	170.4	325.7

(a) Base period is the average for 1958-59 to 1961-62.

Source (for base period and 1965): Table 4.8.2

(b) Tobacco

The analysis of past trends has not yielded any reliable estimates of the effect of price on consumption. A great variety of manufactured tobacco products, with a wide range of prices is available to Australian consumers, and should relative prices change, demand may shift from a more to a less expensive product without significant change in the total quantity consumed. What little evidence is available from the analysis of consumption expenditures suggests that consumption is not very responsive to price changes, since the price elasticity of demand for expenditure on the tobacco and drink category as a whole at -0.11 was the second lowest of the 10 commodity groups.[80]

Historically the most important factor influencing per capita consumption of all tobacco products have probably been the proportion of persons in the 15—24 age group, rising real incomes, the level of tobacco advertising, and the publicity given in Australia to the connection between lung cancer and cigarette smoking since 1961—62. Future tobacco consumption is also likely to be affected by these factors and, in addition, by possible future statutory regulations concerning cigarette advertising and the intensification of educational efforts designed to discourage young persons from commencing to smoke. The effects of these factors are impossible to estimate in quantitative terms. On balance, it seems most reasonable to project likely future demand on the basis of trends in consumption of cut tobacco and cigarettes. in recent years. Two limiting assumptions will be made. (1) A "low" assumption to the effect that the per person consumption of cut tobacco, cigarettes, cigars, and snuff will remain near the average level of the last 4 years to 1963—64 — 7.8 lb per head per annum. (The actual average was 7.78 lb).

(2) In some overseas countries, tobacco consumption resumed its upward trend 2 to 3 years after a temporary interruption resulting from the realisation of a likely link between lung cancer and cigarette smoking. Our second ("high") assumption will then be that cigarette consumption per head will rise at an annual rate of 0.2 lb for the period 1965 to 1980. This is slightly below the average annual increase in cigarette smoking between 1950—51 and 1962—63

80. cf. Table 4.1.4 above.

which was 0.25 lb per head.[81] One reason for using a slightly lower rate than has existed in the past is that the increase over this period was accompanied by a sharp reduction in the consumption of cut tobacco; factory-made cigarettes partly substituted for cut tobacco used for "roll-your-own" cigarettes. Since the consumption of cut tobacco has now reached a very low level, there would seem to be little scope for any further substitution. Given an annual rate of increase of cigarette consumption of about 0.2 lb per head, consumption of cigarettes (including cigars) would be about 7 lb in 1970, 8 lb in 1975, and 9 lb in 1980. At this last figure it would still be below recent levels of consumption in the United States (which was estimated at about 10 lb per head in 1963). Consumption of cut tobacco is also expected to increase slightly from the present low level of 1.4 lb to about 1.8 lb in 1970, and 1.8 lb per head in 1975 and 1980, mainly as a result of an expected increase in the popularity of pipe smoking.

In addition to the requirements for domestic consumption, quantities required for export have to be added. Domestic availability, and details of imports and exports of unmanufactured tobacco leaf and manufactured tobacco products are shown in Table A5.8.1 for 1950—51 to 1964—65. Table 5.8.2 sets out the estimated and projected domestic and export requirements for cut tobacco and cigarettes for the base year, and for 1965, 1970, 1975, and 1980. The Table also includes estimates of the population in the potential consuming age group.

Both unmanufactured tobacco leaf and manufactured tobacco products are exported from Australia, although the quantities are relatively small. Export of unmanufactured tobacco from Australia amounted to considerably less than 1 percent of total domestic supply (including imports). The chief destination in recent years has been Fiji and other Commonwealth countries (Hong Kong in 1963—64). No significant change is anticipated, and it is unlikely that new export markets taking up significant quantities of unmanufactured tobacco leaf will be found in the foreseeable future. In terms of absolute quantity, exports increased from 87,600 lb in 1960—61 to 555,000 lb in 1964—65. In percentage terms, however, the quantity in 1964—65 constituted only 0.7 percent of total domestic supply. It is projected that a steady increase in the quantity exported will take place, to the extent of about 1 percent of total domestic supply, including imports.

The quantity of manufactured cut tobacco exported was comparatively small, at 300,000 to 400,000 lb annually in the last 15 years. Papua and New Guinea were by far the most important export market, followed by Pacific Islands, mainly Fiji. Except for very small quantities of re-exports, most of the exported cut tobacco is manufactured in Australia. As total domestic availability of manufactured tobacco has been declining (owing to a shift in preference to cigarettes) the more-or-less constant quantity of exports has represented a growing percentage, as high as 4.7 percent of total domestic supply in 1963—64. It is expected that the quantity of manufactured tobacco required for export will rise only slightly as the growth of incomes in the territories constituting the chief market will probably increase the demand for cigarettes rather than for cut tobacco.

Exports of cigarettes — almost entirely Australian-made — increased in recent years, mostly to Papua and New Guinea. In 1963—64 the quantity exported reached 591,000 lbs, rising from 152,300 lbs in 1959—60. The quantity exported in 1963—64 constituted

81. The equation expressing this trend is

$$Y = -9.9253 + 0.2560\,X; \quad R^2 = 0.90,$$

where Y = annual per caput consumption of cigarettes (lbs).
X = year ending 30th June, starting with 1951.

Table 5.8.2

POPULATION (15 YEARS OF AGE AND ABOVE) AND REQUIREMENTS FOR MANUFACTURED TOBACCO PRODUCTS: AUSTRALIA, 1965, 1970, 1975, AND 1980[(a)]

Period	Population 15 Years and Above[(b)]		Requirements of:—								Total	
			Cut Tobacco				Cigarettes					
			High		Low		High		Low			
	High	Low	Per Head	Total	Per Head	Total	Per Head	Total	Per Head	Total	High	Low
	'000	'000	lb.	'000 lb.	lb.	'000 lb.	lb.	'000 lb.	lb.	'000 lb.	'000 lb.	'000 lb.
Average 3 years 1959—1961	7,187	7,187	2.1	15,738	2.1	15,738	5.7	41,180	5.7	41,180	56,918	56,918
1965 (Estimated)	8,004.4	7,918.1	1.4	11,000	1.3	10,000	6.1	48,000	5.9	47,000	58,000	57,000
1970	9,057.6	8,663.6	1.6	16,304	1.7	14,728	7.0	63,403	6.1	52,848	79,708	67,576
1975	10,069.3	9,445.0	1.8	18,125	1.7	16,057	8.0	80,554	6.1	57,615	98,679	73,672
1980	11,130.3	10,221.3	1.8	20,035	1.7	17,376	9.0	100,173	6.1	62,350	120,208	79,726

(a) Domestic and export requirements. Actual, estimated and projected quantities of exports of cut tobacco and cigarettes are:

Period	Cut Tobacco ('000 lbs)	Cigarettes "High" ('000 lbs)	Cigarettes "Low" ('000 lbs)
Average 3 years, 1959-61	427	220	220
1965 (estimated)	300	591	591
1970	400	612	525
1975	450	763	572
1980	500	934	622

(b) Figures derived from Appendix Table A3.1.2.

Table 5.8.3

ESTIMATED AND PROJECTED REQUIREMENTS OF STEMMED AND UNSTEMMED TOBACCO LEAF FOR DOMESTIC CONSUMPTION AND EXPORT: AUSTRALIA [a] '000 lbs

Period	High		Low	
	Stemmed	Unstemmed	Stemmed	Unstemmed
Average 1959—61	51,192	54,460	51,192	54,460
1965 (Estimated)	52,980	56,362	52,066	55,390
1970	70,504	75,002	60,992	64,883
1975	89,335	95,035	66,494	70,736
1980	108,998	115,952	71,958	76,549

(a) Export of unmanufactured, unstemmed tobacco leaf, and its stemmed equivalent, is included. The actual, estimated and projected quantities of export of unmanufactured, unstemmed tobacco leaf, are:

	('000 lbs)
Average 3 years 1959-61	91
1965 (estimated)	555
1970	731
1975	910
1980	1,100

about 1.2 percent of total domestic supply. For want of any better estimate, it is assumed that export demand will represent a constant 1 percent of total domestic availability for our projection period.

On the basis of present conversion ratios,[82] the quantities of stemmed and unstemmed tobacco leaf required to satisfy domestic requirements and the rather small export demand for unmanufactured tobacco and manufactured tobacco products are set out in Table 5.8.3. It is emphasised again, that these estimates cannot claim to be more than broad approximations, in view of the manifold influences that may affect demand for tobacco products, and which defy attempts at quantitative analysis.

82. On average, 100 lbs of unstemmed tobacco leaf produce 94 lbs of stemmed tobacco leaf. Conversion ratios for stemmed tobacco into manufactured tobacco products have been calculated from statistics contained in Commonwealth Bureau of Census and Statistics, Manufacturing Industries, No. 26—Tobacco, Cigars and Cigarettes (Canberra). Production of 100 lbs of cigarettes requires approximately 92 lbs, and 100 lbs of cut tobacco 84 lbs of stemmed tobacco leaf.

(c) Tallow

As pointed out in Chapter IV Australian statistics on the domestic consumption of edible and inedible tallow are difficult to interpret; this may be due to under-reporting of production from small butchers, lack of coverage of tallow-using establishments in the official definition of "factory" or the shifting of some tallow which is produced as "edible" into the "inedible" category when factory utilization statistics are compiled. Under these circumstances projections become very difficult indeed.

Table 5.8.4

PROJECTIONS OF TALLOW DISAPPEARANCE
(i.e. Production minus Exports)

Period	Inedible	Edible
	(in thousand tons)	
Base Period	50.1	50.8
1965	50 — 70	60 — 80
1970	40 — 80	66 — 101
1975	40 — 80	72 — 126
1980	40 — 80	79 — 147

(a) Base period is the average of the 4 years 1958-59 to 1961-62.

Source: of Base period data — Appendix Table A4.8.1

In the case of inedible tallow consumption, factory utilization statistics suggest a slight downward trend in consumption between the late fifties and the early sixties. On the other hand production minus export figures show an irregular upward movement, though — probably as a result of changes in inventories — year-to-year fluctuations in the second series are much more pronounced.

Our projections of inedible tallow consumption in Table 5.8.4 reflect the lack of reliable data for past changes in consumption. Because our main interest is in export projections and because we will intend to use published production statistics for our production projections, it seemed more appropriate to use statistics of production minus exports as a measure of consumption instead of the factory utilization statistics. On this basis average annual domestic disappearance in the base period is estimated at 50,000 tons; judging by the statistics available for 1963 — 64 and discussions with users of inedible tallow, some slight increase in domestic disappearance of tallow in 1965 seems likely. However, users of inedible tallow expressed the general opinion that little further increase in tallow consumption appeared likely. As a result we have put arbitrary lower and upper limits of 40,000 and 80,000 tons on the Australian disappearance of tallow for 1970, 1975 and 1980.

Most edible tallow is used for the manufacture of margarine and shortening. Future levels of consumption will depend in large part on government legislation. A liberalising of table margarine quotas — or their complete removal — is likely to lead to a substantial increase in the long-run consumption of table margarine (though some part of this could be at the expense of "other" i.e., cooking and industrial margarine); in addition current State legislation sets minimum percentages of tallow which must be used in the manufacture of various types of cooking and industrial margarine. It is difficult to foresee what changes will take place in these legislative provisions. For our "low" projection we assumed that edible tallow consumption will rise at the same rate as our "low" population growth assumptions — that per capita consumption will remain constant. For our "high" projection we allowed for an expansion in table margarine consumption of 15 lb per head by 1980 and assumed that one-third of the ingredients used will be tallow. This is the approximate percentage of tallow used in

Table 5.8.5

PROJECTED USE OF HIDES AND SKINS BY TANNERIES
AUSTRALIA, 1965, 1970, 1975 AND 1980

Period	Cattle Hides		Calf Skins		Sheep and Lamb Skins	
	Low	High	Low	High	Low	High
	thousands					
Base Period[a]	2,368		711		2,601	
1965	2,500		750		2,600	
1970	2,500	2,700	750	850	2,600	2,800
1975	2,500	2,900	750	950	2,600	3,000
1980	2,500	3,100	750	1,050	2,600	3,200

(a) Base period is average for period 1958-59 to 1961-62.

Source of data: Table 4.8.5.

table margarine manufacture by one of the largest manufacturers at present. Our projections are again given in Table 5.8.4.

(d) Hides and Skins

There appears little likelihood of any substantial increase in the use of hides and skins by Australian tanneries. The high cost of tanning is expected to remain a significant problem in finding sufficient outlets for the leather produced. The substitution of other materials for leather has become less marked, particularly in the case of the upper leather of shoes. However, the replacement of sole leather by synthetic materials appears permanent and continuing replacement of leather in industrial uses seems likely. External trade is expected to continue to have an important influence on the level of Australian usage of hides and skins. On the one hand, export prices set a lower limit on the prices Australian tanneries must pay; on the other, they are confronted with rising imports of finished leather goods.[83]

Domestic consumption of cattle hides and calf skins was relatively low during the base period (1958—59 to 1961—62) because of the very high prices prevailing. 1965 consumption was estimated after discussions with trade sources. The estimate for the consumption of sheep and lamb skins in 1965 is equal to the average for the base period. The "low" estimates for cattle hides, calf skins and sheep and lamb skins, assume no change from the 1965 estimated consumption. The "high" estimates are based on a rise every 5 years of 200,000 cattle hides, 100,000 calf skins and 200,000 sheep and lamb skins (Table 5.8.5).

These projections were based largely on discussions with industry representatives.

83. Imports of hides and skins have been very low in recent years and they are expected to remain negligible in the future.

CHAPTER VI

MAJOR TRENDS IN AUSTRALIAN AGRICULTURE IN THE POST-WAR PERIOD — THE ANALYSIS OF SUPPLY

BACKGROUND

The depression which preceded World War II had a serious long-term effect on Australian agricultural development. Not only did total farm output stagnate during the thirties, but the low levels of income which farmers experienced and their inability to maintain adequate investment in structures and other improvements during most years in the pre-war decade, proved a severe handicap when prices improved and widespread shortages appeared.

During the war the two major products of pre-war agriculture were on the "low priority" list of the Allied Nations' needs in the Pacific area. "Throughout the war in the case of wool, and until 1945 in the case of wheat, the demand for these products was, for a variety of reasons, far below production."[84] Large stocks of wool accumulated in specially erected stores. There was a huge and expanding surplus of wheat until late in the war.

In later war years production of priority crops such as potatoes and other vegetables, flax, and rice were expanded greatly but the output of wheat, wool, milk, beef, mutton and lamb declined. During this time and during the early post-war years Australian farmers suffered from far more serious shortages than did farmers in other allied countries which were not occupied by the enemy. Fertilisers, machinery, fencing materials, fuel, and, in fact, everything a farmer needed in his production programme were in extremely short supply. To add to Australian farmers' troubles came the disastrous drought of 1944—46. This reduced sheep numbers by about 30 million or about 25 percent. Thus in 1944—45 total farm production was 12 percent below the pre-war level. By 1946 the agricultural 'plant' had run down after 15 years failure to pump in the necessary capital and this needed to be remedied before a major expansion in Australian farm production was possible.

At the time, Governments (and also many leaders of Farmers' Organisations) were still influenced by the spectre of the thirties, fearing that — after a brief boom — the marketing difficulties and the unprofitable surpluses of the depression would return. As a result, a series of stabilization plans, especially for the wheat and dairy industries, were put into operation. These were designed to syphon off that proportion of receipts from exports which was regarded as "excess" and temporary. Actual returns to wheat growers in 1946—52 were, on the average, less than 80 percent of the returns which would have been realised if all the

84. J.G. Crawford et al. and A. A. Ross, Wartime Agriculture in Australia and New Zealand 1939-50 (Stanford University Press, 1954), p. 170.

wheat had been exported. Similar "negative" protection (sales to local consumers at lower prices than could have been obtained abroad plus — in some cases — the payments of part of the export proceeds into stabilisation funds) was important in the case of sugar (1947—48 to 1951—52), barley (1947—48 to 1952—53) and to a much lesser extent for rice (1946—47 to 1952—53), and eggs (1948—49 and 1949—50).[85] For most of these products in succeeding years the two price systems operating have raised the prices received by farmers above the levels which would have prevailed in the absence of such schemes. In the case of wheat the level of protection has been modest (reaching its highest level of 8.5 percent in 1962—63); for barley, linseed, and rice, levels of protection have also been comparatively moderate (the highest rate reached being 17 percent for rice in 1962—63).[86] On the other hand, producers of butter, eggs, tobacco and cotton have been heavily protected in the last 10 years (with levels of protection rarely falling below 20 percent and normally being considerably higher). The case of sugar is somewhat special, the level of protection having varied widely. Thus in 1960—61 it reached its highest point since the war, 44 percent, but in some other years since 1952—53 it was below 10 percent; and in 1963—64 Australian sugar producers subsidised the local consumer by supplying sugar at a price well below export parity.

The pattern of farm price determination which emerged after the war is still to a large extent the current pattern. There is in Australia no general system of price supports for agriculture such as exists in the United Kingdom and other developed economies. Methods of price support have been arranged separately for each commcdity (or occasionally for groups of commodities such as butter and cheese and the various types of dried vine fruits). For a number of important products including wool, beef, mutton and lamb, and apples and pears, there have been no price support measures.[87]

For a number of export products including sugar, eggs, barley, rice and dried fruits two price schemes operate.[88] Under such schemes the returns from the local market and the returns received from the usually lower-priced export markets were pooled and growers received a price for their total output equal to the average price realised from sales at home and abroad. Another variant of such two price schemes exists in the wheat and dairying (butter and cheese) industries and, since 1964, in the dried vine fruit industries. Two price schemes operate, but a stabilisation fund is accumulated (usually up to some fixed monetary limit) during years of what are expected to be above average export prices. As a collary of this, the government usually guarantees either some absolute rate of return (in the case of dried vine fruits) or the return on a fixed amount of sales for export. On balance, these schemes tended to raise

85. Detailed calculations of the levels of protection for various products during the post-war period are given in S.F. Harris, "Some Measures of Levels of Protection in Australia's Rural Industries" (Paper presented to the Annual Conference of the Australian Agricultural Economics Society, 1964).

86. In the case of commodities exported the term "level of protection" is used to denote the difference between growers' actual returns and sales valued at export parity—expressed as a percentage of such sales. In the case of commodities imported it is the difference between growers' actual average returns per unit and the f.o.b. price of imports, expressed as a percentage of the import price. Harris discusses a number of other alternative measures of protection.

87. This statement is subject to some qualifications. Thus in the case of beef, there has been a limited amount of government support of the market by means of bounty payments under the 15-year United Kingdom meat agreement, especially between 1953 and 1958. However, the sums involved in these bounty payments were comparatively small.

88. In addition, under the Canned Fruits Excise Act 1963 the Australian Canned Fruits Board has levied a duty equivalent to 2s per dozen No. $2\frac{1}{2}$ size cans on local sales. This levy has been used for overseas publicity and promotion.

the prices received by producers in recent years rather than merely "stabilising" them.[89]

Of the products which concern us here, special mention should be made of cotton and tobacco. In both cases production is less than local consumption — at least up to now — and heavy protection is given to producers. In the case of cotton it is given by means of a bounty and in the case of tobacco, by offering manufacturers a concessional rate of duty on imported tobacco, provided they use a certain annually specified percentage of locally produced tobacco.[90]

1. POST-WAR TRENDS IN AGGREGATE FARM OUTPUT

After the 1944—46 drought Australian agricultural output seemed at first to increase rapidly. By 1947—48, due in part to a large wheat crop, the index of Australian farm output exceeded the pre-war level by 9 percent. However, in the next 4 years progress was disappointing, with the index remaining fairly stable between 109 and 115 points (1936—37 to 1938—39 = 100). In 1951—52, mainly because of poor seasonal conditions, the index dropped to 103.[91]

As over 80 percent of Australia's export earnings came from rural products, this low level of output had its effect on the volume of exports. Coupled with a drop in wool prices from the record 1950—51 levels and an abnormally large volume of imports, it produced a serious balance of payments crisis in 1952. This drew attention rather dramatically to the economy's dependence on a substantial growth of exports. As well as short-term measures, mainly designed to curtail imports, the Federal government adopted a long-term policy designed to encourage a more vigorous growth of farm production. To this end it extended tax concessions originally introduced in 1947. These concessions were designed to stimulate development expenditure on farms by allowing accelerated depreciation rates to be applied to such expenditure for tax purposes. Some determined efforts were also made to secure a high priority for agriculture in obtaining those materials still in short supply; for instance a large part of the dollar loans subsequently arranged from the International Bank for Reconstruction and Development were used to procure agricultural machinery. At a later stage again the Government raised the home consumption price of wheat above the official "cost of production". In addition the Federal Government laid down a series of production aims calling for an increase of 24 percent in total farm production over the pre-war level to be achieved by 1957 — 58.

Soon after the introduction of these measures the index of farm output did indeed turn upwards; between 1952—53 and 1954—55 it was between 21 and 22 percent above the pre-war level. In succeeding years it increased even further, but in 1957—58 (largely because of bad seasonal conditions) it did actually stand at 124.

In succeeding years total farm output has been expanding steadily, subject to some seasonal fluctuations. Thus during the 10 years ended 1963 — 64 the index of farm output grew at an average compound rate of $3\frac{1}{2}$ percent per annum, historically a very rapid rate of growth. There is no evidence

89. This is not to deny that the existence—in some industries but not in others—of the two price mechanism and of stabilisation schemes may have led to uneconomic movement of resources between unprotected and 'stabilised' products (e. g. wool and wheat). Consequently net receipts have, to some extent, been lowered.

90. A more detailed discussion of the price policies operating will be given, where necessary, where the projections for individual products are discussed.

91. "Poor seasonal conditions" refers to a comparison of one crop year (or livestock year) with earlier or later years, not to changes within a 12-month period. This is a common Australian usage of the term "season".

Table 6.1.1

INDEXES OF QUANTUM OF AUSTRALIAN FARM PRODUCTION

Financial Year	U.S. Department of Agriculture Index 1957—59 = 100	Statistician's Index 1936—37 to 1938—39 = 100	"Seasonally Adjusted" Index (a)
1945—46		92	98
1946—47		91	101
1947—48		109	105
1948—49		109	109
1949—50		115	109
1950—51		109	110
1951—52		103	110
1952—53		121	113
1953—54		122	120
1954—55	88	123	119
1955—56	95	131	123
1956—57	94	131	129
1957—58	88	124	141
1958—59	108	149	140
1959—60	104	144	147
1960—61	108	152	145
1961—62	111	155	155
1962—63(b)	119	166	164
1963—64(b)	125	173	163
1964—65(c)	129	179	167
2965—66(c)	120	151	n.a.

(a) The method of seasonal adjustment is outlined in the text.

(b) Subject to revision.

(c) Estimated by the Bureau of Agricultural Economics.

n.a. not applicable.

Sources: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries (Bulletins Nos. 40—56, issues for 1945—46 through 1961—62, Canberra).
Bureau of Agricultural Economics, Trends in Australian Rural Production and Exports, No. 35, September 1965 (Canberra), Table I.
U.S. Department of Agriculture, Foreign Regional Analysis Division, Economic Research Service, Indices of Agricultural Production of East Asia, South Asia and Oceania, December 1965, Table 38.

so far of any slowing down of the rate of expansion of output; if anything the rate of growth has tended to rise in the last 4 to 5 years. Fluctuations which result from seasonal variations make it difficult to form any definite judgement.

To ascertain whether this stepping up in the rate of growth over the last 4 to 5 years foreshadows a high long-term rate of growth of Australian farm output in the future, an attempt — admittedly crude — was made to adjust the output index for changing seasonal conditions. The basic method used was to assume that any deviation of 'yield' from the 'norm' is due to the influence of varying seasonal conditions. This will not be strictly true, but a greater part of the year to year variation in 'yields' is caused by direct (e.g., rainfall, temperature) and indirect (e.g., disease, predators) weather effects. The basic method used was to derive regressions for yield of various products on time and to treat deviations from the regression line as being 'caused' by weather effects. The products for which this procedure was used were: wheat, coarse grains, wool, and milk. For the grains the yield indicator was bushels per acre whilst for the other two products it was fleece weight and milk yield per animal. In addition, percentage deviations of annual sheep and cattle losses from the median percentage losses were also estimated and ascribed to weather conditions. The assumption was then made that such deviation in sheep and cattle losses would have affected sheep and cattle slaughterings in the current year. The two sets of index numbers — actual and 'seasonally adjusted' farm output are given in Table 6.1.1.[92] An examination of the two sets of figures shows (1) an elimination of the sudden dips in actual output in 1951—52 and 1957—58, (2) a slower rate of growth of 'seasonally adjusted' farm output in the last 2 to 3 years than in the Statistician's (non-adjusted) index of output. Thus over the 5-year period 1959—60 to 1964—65 the Statistician's index shows a rise of 24 percent (equivalent to an annual average growth rate of 4.4 percent) compared to a rise of 14 percent in the seasonally adjusted index (equivalent to an annual average growth rate of 2.7 percent). Average annual growth rates for both adjusted and unadjusted farm output between all post-war years are given in Table A6.1.1.

An examination of the movements in the seasonally adjusted index suggests that the apparent rise in the rate of growth of farm output in the 5 years to 1965 has been largely the result of more favourable seasonal conditions than can be expected to prevail normally.

2. FACTORS RESPONSIBLE FOR CHANGES IN AGGREGATE OUTPUT IN THE POST-WAR PERIOD

The post-war expansion of farm output has been achieved without any major changes in either the land base, the number of farms or the total farm labour force. Due to changes in data collection methods, no long-term series on either the total land area in rural holdings, the number of farms or the total farm labour force is available. There has probably been an increase of 10 percent (or 90 million acres) in the total area in rural holdings in the post-war period. The large amount of land clearing which is known to have taken place is probably of more significance; unfortunately figures on the area cleared are available only for Western Australia. The number of farms has also risen slightly (Table A6.2.1).

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92. Table 6.1.1 also gives an index of Australian net agricultural products as prepared by the U.S. Department of Agriculture. This index was included because it uses a more recent base period for weighting individual products and is therefore preferable. No direct comparison between the Commonwealth Statistician's index and the one prepared by the U.S.D.A is possible since the latter uses calendar years whilst the former measures production in financial years (i.e. ending on June 30th).

The total farm labour force has probably declined by 5 to 10 percent, most of this decline having taken place since 1954. Information on the Australian farm labour force is available from two sources — the annual Agricultural and Pastoral returns (abbreviated to A and P returns below) which are filled in by each landholder and the periodic Census or quasi-Census (1939, 1943, and 1945) collections. Referring specifically to the A and P returns, the Commonwealth Statistician has drawn attention to the difficulty encountered in obtaining data on persons working on holdings on a comparable basis from year to year. The problems associated with obtaining these data on a comparable basis were accentuated in 1959 by changes in the collection of A and P returns and, as a result there were breaks in the continuity of the series.[93] The Census information is probably more reliable, though it has the disadvantage of being available only for certain individual years (or more precisely for certain definite days within these years). According to this source the total farm labour force declined from 522,000 persons in 1939 to 422,000 in 1943; by June 1945 some servicemen had been released to go back to the land and the total number working on farms had increased by 35,000. The return of servicemen between 1945 and 1947 was accompanied by an almost equal decline in female workers; total number rose by only 3,000 to 460,000. The next Census in 1954 showed a static male labour force of 436,000, but female farmers and farm workers increased by 7,700. During the succeeding 7 years there appears to have been a 10 percent decline in the male farm work force, while female numbers again increased by 7,000, giving a total farm labour force of 435,000 in 1961. More detailed information for selected years is given in Table 6.2.1.

A comparison between movements in the agricultural labour force as shown in the annual collection of the agricultural and pastoral statistics and as given in the two most recent Censuses — 1954 and 1961 — shows some discrepancies. According to the 1954 Census there were 435,900 male rural workers in June 1954; this compares with an estimate of 444,300 permanent and temporary male rural workers according to the annual A and P returns. This discrepancy is plausible in view of the relatively small amount of casual rural employment during the winter months. However, according to the annual A and P collections, the number of rural workers rose to 447,200 by 1958 (no later figures have been published); whilst according to the Census, the male rural labour force declined to 396,500 by 1961. It seems unlikely that the decline in the rural labour force between 1954 and 1961 took place entirely after 1958, as the A and P statistics suggest.

The expansion in farm output in the post-war years has been made possible by (i) a high rate of fixed capital formation in the last 10 to 12 years; (ii) the use of increased quantities of non-farm inputs such as fertiliser and other chemicals, fuel, fencing materials, etc. and (iii) technical advances by agricultural scientists and others. It is very difficult to measure the relative contribution of each of these factors; at first we will confine our attention to a description of the data available and the changes which have occurred.

Data on the volume of capital used by Australian farmers is not easily obtained. Estimates are available on the expenditure on fixed equipment. These are given in Table 6.2.2 and show a marked rise in money expenditure on farm machinery, equipment and buildings between 1947—48 and 1951—52; a pause for the 4 succeeding year with renewed growth in money expenditures in later years. In real terms expenditure on fixed equipment has also risen

93. Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries (Bulletin No. 54, 1959-60, Canberra), p. ix.

Table 6.2.1

THE FARM WORK FORCE IN SELECTED YEARS
(Thousands)

Year	Census or Quasi-Census			Agricultural and Pastoral Statistics								
				Male			Female			All Persons		
	Male	Female	Total	Permanent	Temporary	Total	Permanent	Temporary	Total	Permanent	Temporary	Total
1933	528.2	19.6	547.8	386.0	n.a.	n.a.	38.0	n.a.	n.a.	424.0	n.a.	n.a.
1939	502.0	20.0	522.0	391.9	n.a.	n.a.	32.1	n.a.	n.a.	424.0	n.a.	n.a.
1943	382.0	39.7	421.7	315.2	45.3	360.5	68.0	10.0	78.0	383.2	55.3	438.5
1945	416.3	39.8	456.1	339.4	63.9	403.3	59.0	8.0	67.0	398.4	71.9	470.3
1947	435.2	24.3	459.5	357.3	n.a.	n.a.	48.8	n.a.	n.a.	406.1	n.a.	n.a.
1954	435.9	32.0	467.9	357.6	86.7	444.3	49.8	8.4	58.2	407.4	95.1	502.5
1958	-	-	-	354.1	93.1	447.2	39.8	13.0	52.8	393.9	106.1	500.0
1961	396.5	38.9	435.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Sources: Commonwealth Bureau of Census and Statistics, Census of the Commonwealth of Australia, issues for the Censuses of 1933, 1947, 1954 and 1961 (Canberra).
C.B.C.S., Labour Report, No.33, 1944; and No.48, 1960 (Canberra).
C.B.C.S., Production Bulletin, Primary Industries, No.54, 1959—60 (Canberra).

Table 6.2.2

EXPENDITURE ON EQUIPMENT BY PRIMARY INDUSTRIES
AUSTRALIA: 1947—48 to 1962—63
(A $ Million)*

Financial Year	In Current Prices	In 1953—54 Prices**
1947—48	76	143
1948—49	126	217
1949—50	182	284
1950—51	255	336
1951—52	301	331
1952—53	257	260
1953—54	299	299
1954—55	304	298
1955—56	303	286
1956—57	317	291
1957—58	322	273
1958—59	316	253
1959—60	338	264
1960—61	358	273
1961—62	331	243
1962—63	374	275

* In 1966, Australia changed from the Australian pound to a dollar currency system. £A1=$A2= $.U.S. 2.24. The original data was in pound values.

** Current values deflated by the B.A.E. Index of Machinery and Plant Prices.

Sources: Commonwealth Bureau of Census and Statistics, Australian National Accounts — National Income and Expenditure, 1948—49 to 1964—65 (Canberra), Table 72, p. 67. Figure for 1947—48 from K.O. Campbell, "Current Agricultural Development and the Utilization of Resources", Economic Record, Vo.32, No.62 (May 1956), Table 3, pp.119—134.

substantially. To provide some indication of the change in the volume of expenditure — as opposed to its money value — the money expenditure has been deflated by the B.A.E. Index of Farm Machinery prices.[94] In real terms it would appear that expenditure on fixed equipment did not regain the record levels of 1950—52 in succeeding years but fluctuated between 75 and 85 percent of this total, and showed some evidence of a downward trend until 1961—62. However, it is known that investment in farm machinery rose markedly during the 2 succeeding years, especially in 1963—64; but comparable figures for total expenditure on fixed equipment are not yet available for these years.

A comparison of the gross expenditure on fixed assets with various measures of farm income or spending power shows that increases in farmers' receipts tend to be reflected in gross expenditure on fixed assets in the same year and the following year. The following equation, fitted by least squares, shows the relationship.

$$(6.2.1)\quad GEA_t = -3.071 + \underset{(0.057)}{0.104}\, GSP_t + \underset{(0.044)}{0.200}\, GSP_{t-1} \quad (R^2 = 0.686)$$

where GEA_t = gross expenditure on fixed assets (in year t)

GSP_t = gross spending power of farmers (in year t). Gross spending power equals farmers' income plus depreciation minus estimated farmers' income tax payments.

GSP_{t-1} = gross spending power of farmers (in year t-1).

The period of the regression was 1949—50 to 1961—62. Equation (6.2.1) gave a high level of autocorrelation in the residuals, the first serial correlation coefficient being 0.576 and the Durbin-Watson statistic 0.8119. Another feature of the regression — not revealed in the equation — is that the negative residuals were bunched in the first 4 years of the period, when supply limitations and shortages were of considerable importance. The regression was therefore re-run for the period 1954—55 to 1962—63.[95] This gave the following results:

$$(6.2.2)\quad GEA_t = 180.3 + \underset{(0.027)}{0.069}\, GSP_t + \underset{(0.030)}{0.074}\, GSP_{t-1} \quad (R^2 = 0.664)$$

where the variables have the same meaning as above.[96]

The second equation indicates a substantially lower level of expenditure on fixed assets as a result of variations in gross spending power.

However in some respects these data do not reflect the full extent of investment on farms; it is very difficult to measure statistically the value of investment undertaken by a farmer when he uses his own or hired labour to build a shed, erect a fence, or sow some improved pasture. Such forms of capital formation are difficult to catch in their entirety in any statistical estimate. It seems likely that the available expenditure estimates understate the value of expenditure on improvements, where the use of farm labour is likely to be important. The most thorough attempt to estimate changes in the volume of farm capital in Australia — as opposed to expenditure on fixed assets — was made by Gutman; but Gutman's work only covers 1921 to 1947.[97] In addition

94. Purchases of farm machinery, trucks, etc. would be the largest group included; perhaps accounting for 65-75 percent of the total expenditure on fixed assets estimated by the Statistician.

95. 1962-63 data had become available in the meantime.

96. The Durbin-Watson statistic of (6. 2. 2) being 2. 121.

97. G.O. Gutman, "Investment and Production in Australian Agriculture", Review of Marketing and Agricultural Economics, Vol. 23, No. 4 (December 1955), pp. 237-310.

Gutman's method for estimating the capital invested in improvements cannot be applied during later years because of the difficulty of allowing for the rapid price changes taking place during the post-war decade. Saxon has made the most comprehensive recent estimates of the volume of capital used on Australian farms.[98] He provides separate estimates for capital in the form of land, livestock, plant and land improvements. Saxon stresses the difficulty of securing reliable estimates and suggests that his figures "could be up to 20 percent in error, but it is difficult to find a basis for better estimates".[99] Saxon's estimates suggest that there was a steady growth in the volume of farm capital used in the post-war period, with particularly rapid growth in the volume of farm machinery.

A series for purchases of current inputs in current prices is available from the annual farm income estimates of the Bureau of Census and Statistics and a recent paper by two officers of the Bureau, F. Juhasz and B. Hillsdon, gives inputs in terms of constant prices (Table A6.2.2 and A6.2.3).[100] Four categories of inputs are distinguished in the tables: marketing inputs, seed and fodder, hired labour used and "other inputs" (which includes over one-third of the total in the most recent years). In constant 1953—54 producer prices, hired labour inputs remained remarkably stable (fluctuating between £103 and £111 million between 1948—49 and 1960—61). Marketing inputs almost doubled over this period (1948—49 — £76 million, 1960—61— £140 million, in constant prices), the major increases taking place during the periods 1948—49 to 1950—51 and 1957—58 to 1960—61. Seed, fodder, and "other inputs" increased by about 40 percent in constant prices over this period (1948—49 to 1960—61), with fairly regular annual increases in the case of "other inputs" and minor fluctuations resulting from drought and changes in crop acreages in the case of seed and fodder inputs.

Further information is available about the purchases of farm requisites from different manufacturing industries. As shown in Table 6.2.3, the sales by Australian manufacturing industries to rural industries rose steadily over the period 1948—49 to 1960—61. In constant 1953—54 prices they registered a 60 percent increase over this period, compared with a rise of slightly less than 40 percent for the total "other costs" category discussed above. In real terms sales of chemicals to the farm sector grew particularly fast — increasing by 100 percent. Sales of superphosphate — the major fertiliser — doubled over the period, but there was an equally marked growth in inputs of other agricultural chemicals — insecticides, drenches, fertiliser mixtures.

The picture which these statistical series present is one of a technically dynamic agriculture which is steadily using more capital, particularly in the form of farm machinery and equipment and an increasing volume of non-farm produced inputs such as fuel, fertiliser, and other agricultural chemicals. In part this trend can be explained in economic terms as the gradual substitution of capital for labour in response to the relative rise in the price of labour. Thus over the last 17 years the price of labour has risen by 34 percent relative to the prices paid for inputs of equipment and supplies. As a result it paid farmers to substitute fixed capital and current inputs both for hired labour and for the labour supplied by the farm family. In addition,

98. E. A. Saxon, "Changes in Volume and Composition of Farm Capital", Quarterly Review of Agricultural Economics, Vol. 15, No. 4 (October 1962) pp. 179-187. These estimates were brought up to date in a paper submitted to the Committee of Economic Enquiry entitled "Rural Productivity".

99. Ibid., p. 19.

100. F. Juhasz and B. Hillsdon, "Farm Income Estimates in Relation to Economic Changes" (Paper presented to Section G, Australian and New Zealand Association for the Advancement of Science, 37th Congress, 1964).

Table 6.2.3

SALES OF MANUFACTURING INDUSTRIES TO RURAL INDUSTRIES, AUSTRALIA: 1948 - 49 to 1960 - 61
(£Million)*

Financial Year	In Current Purchaser Prices					In Constant 1953 - 54 Purchaser Prices				
	Metal	Chemi-cal (a)	Oil	Other (b)	Total	Metal	Chemi-cal (a)	Oil	Other (b)	Total
1948 - 49	18.6	16.4	23.8	10.8	69.6	31.8	37.4	29.9	22.1	121.2
1949 - 50	19.8	19.1	25.8	10.7	75.4	31.4	40.0	30.6	19.4	121.4
1950 - 51	23.0	24.9	28.7	12.9	89.5	30.5	42.8	32.0	21.0	126.3
1951 - 52	28.0	34.4	31.6	20.9	114.9	30.8	44.6	32.1	22.4	129.9
1952 - 53	32.9	45.1	38.1	25.9	142.0	33.3	46.2	38.9	26.7	145.1
1953 - 54	34.8	50.6	38.9	29.3	153.6	34.8	50.6	38.9	29.3	153.6
1954 - 55	36.0	51.7	39.5	29.6	156.8	35.3	54.8	41.0	28.7	159.8
1955 - 56	38.9	53.5	40.0	29.7	162.1	36.7	57.4	39.2	29.5	162.8
1956 - 57	41.3	56.3	42.9	35.5	176.0	37.6	57.6	38.3	34.3	167.8
1957 - 58	40.3	61.6	42.5	36.5	180.9	35.0	60.3	38.2	32.7	166.2
1958 - 59	43.3	70.4	43.2	31.4	188.3	36.7	68.7	39.7	29.8	174.9
1959 - 60	45.5	69.8	44.8	35.2	195.3	37.7	71.7	41.1	34.4	184.9
1960 - 61	48.3	70.8	46.7	40.0	205.8	39.2	74.0	43.0	37.8	194.0

* In 1966, Australia changed from the Australian pound to a dollar currency system. £A1 = $A2 = $U.S. 2.24.
(a) Includes rubber.
(b) Food and textiles.

Source: F. Juhasz and B. Hillsdon, "Farm Income Estimates in Relation to Economic Changes" (Paper presented to Section G, Australian and New Zealand Association for the Advancement of Science, 37th Congress, 1964).

advances in technology probably contributed to the gradual substitution of off-farm inputs for farm produced inputs.

Superimposed on this broad trend towards a more capital-intensive agriculture, the volume of purchases of both fixed equipment and current inputs such as fertilisers fluctuated with the changing economic position of Australian farmers. The periodic declines in farm incomes as a result of adverse seasonal conditions or price declines (1951—52 and 1957—58) led to the postponement of development plans, reductions in purchases of fixed equipment and slowing the expansion of fertiliser use. Conversely, the buoyant economic position in which most farmers found themselves in 1962—63 and 1963—64 led to increasing purchases of most farm requisites.

An Econometric Investigation into Factors Affecting Aggregate Farm Output

An attempt was made to estimate the relative contribution made to changes in output by changes in the quantity of labour, capital, and current inputs. Although we experienced no difficulty in obtaining very high correlation coefficients in various regression analyses, our attempt to isolate the relative contributions made by different factors in the expansion of farm output was not successful.

Originally we attempted to estimate an aggregate production function for Australian agriculture; we assumed that the volume of Australian farm production depended on the quantities of various inputs such as fixed capital, labour and current inputs. Adjustments were made to the Statistician's All Farm Production Quantity Index to allow for (a) changes in livestock numbers, on the assumption that the total productive effort of the farm sector is not affected by market decisions as to whether output is sold to consumers or used to increase the farm sector's capital stock (in the form of breeding herds); and (b) by estimating the quantitative effect of seasonal variations on Australian agricultural production. (An outline of the methods used was given earlier).

The three basic groups of inputs used originally were (a) labour, (b) various types of fixed capital, and (c) current inputs. For the current input series we used Juhasz and Hillsdon's estimates of the volume of "other inputs" in constant 1953—54 producer prices. Their hired labour inputs were not used since a total labour series was used instead; marketing inputs grow because output grows rather than vice versa. The "feed and seed" series seemed inappropriate because the volume of pasture production could not be measured separately.[1]

Another factor influencing output which it would be desirable to include in the analysis are changes in technology. Unfortunately this is very difficult to quantify. One method which has been used on occasions to account for technology is to add a time variable — on the assumption that changes in technology take place at some constant rate over time.

More sophisticated techniques for isolating the contribution made by technology necessitate knowledge of the elasticity of production of the more orthodox factors of

1. Pasture production is to a considerable extent a substitute for purchased feed. As feed purchases cost more per unit of total digestible nutrients than pasture, shortfalls of pasture due to bad seasons will not be made good by purchases of equivalent quantities of other feeds. Hence changes in feed purchases would be expected to show a negative correlation with changes in output. It would be expected to change sign by the inclusion of a variable for the volume of pasture production—if such a variable could be estimated.

production — the very contributions we are trying to isolate.[2]

An alternative approach, which seems at least equally plausible, is to assume that the adoption of improvements in technology will be reflected in farmers' purchases of inputs or farmers' capital formation. A large number of the technical improvements in Australian agriculture involved additional expenditure for the purchase of capital goods (new farm machinery) or in the purchase of current inputs (fertilisers, agricultural chemicals, etc.). The alternative hypothesis then assumes that technical improvements are closely correlated with increased purchases of such inputs as agricultural chemicals, aerial topdressing services, etc. In this case it will not be possible to measure directly the contribution made by technical progress to agricultural output; instead we will obtain an estimate of the 'productivity' of capital services and of current inputs which will include the improvements made as a result of technical progress.[3]

2. The basic study along these lines is Robert Solow, "Technical Change and the Aggregate Production Function", Review of Economics and Statistics, Vol. 39, No. 3 (August 1957), pp. 312-20. An attempt to apply this model to U.S. agriculture has been made by L.B. Lave, "Empirical Estimates of Technological Change in United States Agriculture, 1850-1958", Journal of Farm Economics, Vol. 44, No. 4 (November 1962), pp 941-952. In addition, William McD. Herr has used this basic model for Australian agriculture; see his "Capital Formation and its Importance and Determinants" (Paper read before the Australian Agricultural Economics Conference, 1964).

3. Some justification for the use of this approach can be derived from Herr's findings. For 1922-59 Herr obtained a coefficient of determination (R^2) of more than 0.9 between his capital series and his technical change measure "indicating that over the period investment has been associated with a substantial portion of the technical progress and hence it likely represents an important agent for the introduction of new techniques. A similar regression for 6 observations from 1900 to 1950 for U.S. agriculture as estimated by Lave yield an R^2 of 0.56" (William McD. Herr, op. cit., p. 10).

(6.2.3)
$$Q_t = -507.0 + \underset{(0.121)}{0.0965}\, I_t + \underset{(3.35)}{7.54}\, C_L + \underset{(0.391)}{0.568}\, C_S - \underset{(0.334)}{0.311}\, C_R - \underset{(1.626)}{2.047}\, L_t \qquad (R^2 = 0.973)$$

where Q_t = Index of Farm Output seasonally adjusted,
I_t = "other" current inputs in current prices
C_L = capital (land),
C_S = capital in livestock herds,
C_R = capital (remainder),
L_t = labour.

Although the coefficient of multiple determination was very high ($R^2 = 0.973$), two regression coefficients (for labour and remaining capital) had the wrong sign and the standard errors of the regression coefficients were diappointingly large.

In the second equation time was introduced explicitly to allow for the possible constant upward shifting of the production function over time. The independent variable labour was dropped on the ground that a variable proportion of labour inputs may be contributing to current output — the remaining proportion being devoted to developmental work and not to current output. This equation is:

(6.2.4)
$$Q_t = 8.34 + \underset{(0.230)}{0.734}\, I_t + \underset{(0.979)}{0.842}\, C_W - \underset{(3.366)}{0.752}\, T \qquad (R^2 = 0.977),$$

where C_W = total capital,
T = time in calendar years (1948—49 = 49)

and the remaining symbols have the same meaning as in (6.2.3).

In this case the regression coefficient of the time variable had the wrong sign though it was not statistically significant. In addition the standard error of the regression coefficient of capital was not significantly different from zero.

Various other formulations were tried, including the introduction of lags for both capital and current inputs. However this did not improve the statistical fit significantly and frequently gave perverse signs of the regression coefficients. Nor did the use of log transformations and estimating a Cobb-Douglas type of production function improve matters. From a purely statistical point of view the most successful regression obtained was:

$$(6.2.5) \quad Y_t = -4.86 + \underset{(0.023)}{0.651}\, I_t + \underset{(0.087)}{0.828}\, S_t \qquad (R^2 = 0.988)$$

where Y_t = output index not seasonally adjusted,
I_t = "other" current inputs at constant prices,
S_t = seasonal adjustment index.

However in this form we obviously did not succeed in obtaining a useful estimate of the structural characteristics of the production relationships in Australian agriculture. Apart from the likely errors in measurements of the independent variables (in particular capital and labour), the most important reason for our failure to achieve useful estimates is probably to be found in the large measure of multicollinearity between the explanatory variables. The simple correlation coefficients between time, inputs, and total capital are all well above 0.9, giving rise to considerable indeterminacy of the estimates.

In non-technical terms, the separate effects of the variables were overshadowed by the tendency of all values (of output, inputs, and capital) to increase together. Hence, one variable — in this case current "other" inputs in constant prices — is able to represent the joint effects of a number of variables. According to the earlier discussion, the estimate for current inputs is probably more accurate than estimates for either capital or labour.

3. PASTORAL PRODUCTS, CEREALS AND DAIRYING — A SIX-SECTOR LINEAR SUPPLY MODEL.[4a]

A somewhat less aggregative approach than the foregoing concentrates on simultaneous systems of supply equations. Here we will be concerned with the following six sectors:

(1) Wool
(2) Lamb
(3) Wheat
(4) Coarse Grains
(5) Beef and Veal
(6) Dairying

For a complex of reasons associated with the suitability and availability of data (but especially to eliminate the influence of the disastrous drought of 1944—46), we chose the crop years 1947—48 to 1964—65 as our sample period. As an initial backdrop to our detailed supply analysis, we commence by sketching post-war movements in aggregate output of the products listed above.

Growth in wool production can be the result of an expansion of sheep numbers or of

4a. In compiling this section we have drawn freely upon material contained in Alan. A. Powell and F.H. Gruen: (i) "The Constant Elasticity of Transformation Production Frontier and Linear Supply Systems", International Economic Review (in press); (ii) "Problems in Aggregate Agricultural Supply Analysis: I—The Construction of Time Series for Analysis; II—Preliminary Results for Cereals and Wool", Review of Marketing and Agricultural Economics, Vol. 34, No. 3 (September 1966), and Vol. 34, No. 4 (December 1966) [in press]; (iii) "The Estimation of Production Frontiers; the Australian Crop/Pastoral Complex", Australian Journal of Agricultural Economics, Vol. II, No. 1 (June 1967) [forthcoming]. We have also drawn on material contained in "Trends in Output of Agricultural Products", a chapter in a book to be published by Sydney University Press in 1967 under the auspices of the Australian Agricultural Economics Society. Lionel E. Ward is a joint co-author of the last-mentioned study. All but four of the time series upon which analysis in the current chapter is based are tabulated in reference (ii); two readily accessible official series on meat output are cross referenced in the same place; finally, two further series involved in the analysis of the beef supply are tabulated in reference (iii).

an increase in wool cut per sheep. The steady, long-term increase in fleece weights per sheep was responsible for only a small part of the post-war expansion of wool production.[4b] Growth in sheep numbers was not uniform during the post-war period. There was a distinct slowing down in the annual rate of increase after 1957. In the 8 years to 1957, sheep numbers rose annually by an average of 4.1 percent, compared with an average increase of slightly less than 1 percent in the following 6 years. This contrast was largely the result of the very much more favourable wool prices ruling during the first period as compared to the second.

Lamb production has followed very different trends. During the height of the wool boom, lamb production dropped by about a third from the 1949 — 50 level of 152,000 tons. However it quickly recovered to around 145,000 tons in the mid 1950's and rose further to over 220,000 tons by 1963.

Of the three cereals considered here — wheat, oats, and barley — wheat is by far the most important, normally accounting for more than two-thirds of the total acreage sown to cereals.[5] Changes in wheat production can be broken down into changes in yields per acre and changes in area sown to wheat. While wheat yields have fluctuated significantly from year to year, the national average yield has increased by upwards of 60 percent over the last 30 years. Each year brought an average increase of nearly a quarter bushel per acre. This long-term trend reflects mainly the advances in plant breeding and the steady adoption of "best practice" techniques of cropping.

4b. C.M. Donald, "The Progress of Australian Agriculture and the Role of Pastures in Environmental Change" (Farrer Memorial Oration delivered at the University of Sydney, September 1964), Australian Journal of Science, Vol. 27, No. 7 (January 1965), pp. 187-198.

5. The 'coarse grains' aggregate upon which our analyses were based also included maize as a minor component.

In contrast to the steady, long-term increase in wheat yields, the area sown to wheat has shown pronounced long-term swings. Schematically these movements can be shown by giving the wheat acreage at the troughs and peaks of each swing.

Australian wheat acreages in selected years

Pre-war average (1936–37/1938–39)	— 13.5 million acres
War-time trough (1943–44)	— 7.9 " "
First post-war peak (1947–48)	— 13.9 " "
Post-war trough (1956–57)	— 7.9 " "
1964–65	— 18.2 " "

Of the other cereals, oats and barley are the most important. The production of both tended to rise between 1948 — 49 and 1960 — 61, subject to irregular annual fluctuations. In 1961 barley production amounted to 68 million bushels — almost 4 times the 1948 — 49 figure. Oat production reached a peak of 87 million bushels in 1958 — 59 — again almost 4 times the 1948 — 49 production.

Australian production of beef and veal increased about 100 percent between the immediate post-war period (1945 — 46 to 1947 — 48) and the most recent 3-year average (1963 — 64 to 1965 — 66). During most of this period, production trended upward, though this was interrupted after peak slaughterings in 1958 — 59 in response to very high beef prices ruling at that time. During the next 2 years beef production fell by about a third, only to recover fairly quickly in the next 2 years.

Total Australian milk production (including milk used for butter manufacture), has risen by about 40 percent since the end of World War II. Most of this increase is attributable to the rise in milk yields per cow rather than to an increase in dairy cow numbers. Since the early 1950's, yields per cow have increased at an average annual compound rate of 1.7 percent.

Data for Analysis — Prerequisites

Raw production statistics usually are not appropriate for empirical supply analysis. Patently, they may not reflect producers' intentions accurately, because of the erratic influence of climate. Again, production statistics to some extent include trends in productivity which are not likely to be very responsive to prices — the improvement of wheat yields over time provides an example. Moreover, productivity trends of this kind must be allowed for somewhere. If the output series are not adjusted in advance, explicit allowance must be made within the supply model itself. This suffers from at least two disadvantages. First, to the extent that they failed to be incorporated successfully into explicit shift variables (and thence were attributed to price influences) trends in productivity would cause a supply system to lack symmetry with respect to upward and downward changes in price. Second, the introduction of further parameters to be estimated in the ultimate (and most critical) stage of analysis may cause 'needless' embarrassment in the matter of degrees of freedom.[6] Hence, in our analysis of supply response below, we used corrected output indicators to allow for climate and autonomous trends in productivity.[7]

These very adjustments to quantity series dictated complementary adjustments to price series. For if intended output of grains is quoted in "acres", then price must be quoted in "dollars per acre", rather than in dollars per bushel. And if the intended output of wool is measured by number of fleeces, then its price will be measured in dollars per fleece. Moreover, we assume that the historical revenues per acre (or per fleece) would not enter the producers' price extrapolations in their crude form. If seasons were below average, then producers would realize that their revenue per acre (or per fleece) would have been greater if only they had achieved average physical productivity. Also, yields have been rising secularly over time; presumably producers would be aware of this and make some allowance for it in their estimates of future revenues. What we assume the grower does not take into account, however, is the falling marginal revenue schedule confronting his industry: as in the classical model of perfect competition we assume each producer to treat product prices as given — irrespective of seasons.

Onto price series generated from considerations of this sort, we have, with two exceptions, superimposed the Koyck/Nerlove distributed lag model of price expectations.[8] However, details of the generation of the expected price series themselves (as distinct from the adjusted actual price series upon which these are based)[9] shall be discussed presently.

The exceptions in our treatment of price expectations are wheat, and beef and veal. In the first case, we attempted to allow directly for the impact of institutional pricing complexities upon producers' price expectations. In the second, some attempt was made to separate short- from long-run price expectations; this separation is

6. Whilst the embarrassment may be unnecessary, the underlying statistical uncertainty may in reality be inevitable, depending upon the quality or otherwise of the information used to effect the prior adjustment of the series.

7. The corrected series involve lengthy tabulations of transformations from raw data; they are reported in Powell and Gruen, "Problems in Aggregate Agricultural Supply Analysis: I", op. cit.

8. Marc Nerlove, The Dynamics of Supply: Estimation of Farmers' Response to Price (Baltimore, The Johns Hopkins Press, 1958).

9. The 'adjusted actual price series' are tabulated by Powell and Gruen in "Problems in Aggregate Agricultural Supply Analysis: I", op. cit.

crucial for an industry in which potential future production is readily transmutable into current output.

One further feature of our treatment of prices must be noted. In conventional supply analysis, the units in which prices are recorded are of no consequence — thus price index numbers with arbitrary bases are just as suitable for analysis as money amounts per unit of output. However, it is our intention here to use a newly developed technique [10] in which the value shares of different products in gross revenue are critical. Thus, where our primary source of data was indexes of prices received by farmers compiled by the Australian Bureau of Agricultural Economics (BAE), we had to convert these series back to money terms. Ideally, we would have done so on the basis of average local values of production; i.e., recorded prices net of freight and marketing costs. However, for certain products, this was not feasible. As a result, we were forced to work with price series which correspond more closely with the concept of unit gross values of production.

Tools for Supply Analysis

The Australian rural sector provides several almost larger-than-life examples of the textbook situation of multi-product enterprises. The wool/cereals complex is the most celebrated case in point. Thus in the Agricultural and Pastoral Census of 1959—60, 85 percent of all wheat farms were also engaged in sheep enterprises.[11] A traditional tool for the analysis of product-mix decisions on the multiple enterprise farm is the iso-resource, or production possibility curve. While the mechanism of the shift around such a frontier in response to changing relative prices has received excellent textbook treatment,[12] an empirically very useful implication of this analysis seems to have been neglected. We refer to the symmetry of the derivatives which measure price responsiveness around a production frontier.

The use of the symmetry postulate in demand analysis is well known. Its emergence was inevitable once indifference curves had been discovered. Equally, and for mathematically the same reasons, symmetry of supply responses follows inexorably once the production possibility frontier has been accepted as a legitimate tool of analysis. For suppose we measure the responsiveness (around a production frontier) of the product-mix ratio, to changes in the marginal rate of transformation, by

$$(6.3.1) \qquad \tau_{12} = \frac{d\left[\frac{y_1}{y_2}\right] \frac{\partial y_1}{\partial y_2}}{d\left[\frac{\partial y_1}{\partial y_2}\right] \frac{y_1}{y_2}}$$

where the y's are outputs, and the subscripts are used to distinguish product 1 from product 2. Formula (6.3.1) defines the elasticity of transformation between products 1 and 2. Then, as Allen has shown, $\tau 12 \equiv \tau 21$.[13] That is to say, the transformation elasticity between products 1 and 2 is identically the transformation elasticity between products 2 and 1 (as indeed common sense would suggest). Whilst the situation requires more careful interpretation for a firm producing more than two products, it seems plausible to postulate that pair-wise symmetry between partial transformation elasticities might be preserved. This we

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10. Powell and Gruen, "The Constant Elasticity of Transformation Production Frontier", op. cit.

11. Commonwealth Bureau of Census and Statistics, Classification of Rural Holdings by Size and Type of Activity 1959-60 (Bulletin No. 7, Canberra), Table 3, p. 5.

12. See, e.g., Earl O. Heady, Economics of Agricultural Production and Resource Use (New York: Prentice-Hall, 1952), Ch. 8; C.E. Bishop and W.D. Toussaint, Introduction to Agricultural Economic Analysis (New York: John Wiley and Sons, 1958), Ch. II.

13. R.G.D. Allen, Mathematical Analysis for Economists (London: Macmillan, 1938), pp. 341-342.

did exploiting the consequently reduced number of parameters to be estimated within the context of the conventional linear supply systems. A detailed account of what this involves may be found elsewhere.[14] However, below we give a heuristic interpretation of our CET (constant elasticity of transformation) transform of a linear supply system.

Linear Supply System and Its CET Transform

Suppose we are concerned to fit a system of N linear supply equations,

(6.3.2)
$$y_{it} = \Gamma_{it} + \sum_{j=1}^{N} a_{ij}\,\pi_{jt} + \epsilon_{it} \quad (i=1,\ldots,N)$$

in which planned output (y_{it}) of the i^{th} product during t is composed of a price-inelastic part (Γ_{it}) plus a linear combination of the prices expected to prevail during t, π_{jt}; plus a random shock (ϵ_{it}). The price-unresponsive part of supply is free to move through time as investment and technology push the supply curves rightward;[15] however, the slopes $\{a_{ii}^{-1}\}$ of the supply curves, as well as the parameters $\{a_{ij}\}$ $(i \neq j)$ determining the movement of these curves in response to changes in the prices of other products, are fixed. This constitutes the simplest plausible model.

We have shown that a CET transform of this model is[16]

(6.3.3)
$$y_{it} = \Gamma_{it} + \sum_{j \neq i} \tau_{ij}\, x_{ijt} + \epsilon_{it}$$

where

(6.3.4)
$$x_{ijt} = \bar{y}_i \left[\frac{\bar{\pi}_j\, \bar{y}_j}{\bar{\pi}_j\, \bar{y}_j + \bar{\pi}_i\, \bar{y}_i} \right] \left\{ \frac{\pi_{jt}}{\bar{\pi}_j} - \frac{\pi_{it}}{\bar{\pi}_i} \right\}$$

In equation (6.3.4) superscript bars indicate sample means over the observed period. Equation (6.3.2) had N^2 price parameters $\{a_{ij}\}$; the exploitation of symmetry reduced the number of price parameters to $\frac{1}{2}N(N-1)$ partial transformation elasticities $\{\tau_{ij}\}$.

How does one interpret the variables x_{ijt} in equation (6.3.4)? Clearly, these have replaced raw price expectations π_{jt} with entities which reflect pair-specific relative prices. In this equation, the expression in 'curly' brackets measures the price of product j relative to product i by taking the difference of price-relatives for these products.[17]

The term within square brackets on the right-hand side of (6.3.4) gives an average measure of the share of product j in the total value of output of products i and j. Such a correction for value share results in this model from the fact that transformation elasticities are, in themselves, scale-free. By this we mean that the relative scales on which two enterprises are conducted does not, in itself, affect their basic degree of 'substitutability' as measured by a partial transformation elasticity. But of course the relative scales on which the products are produced is relevant for assessing the impact of a change in the price of one product upon the output of another. Our formulation ensures that if the price of a product whose relative share in income is large should rise by a given amount, this will not require an unduly high τ-value in order to 'explain' the response in the output of

14. Powell and Gruen, "The Constant Elasticity of Transformation Production Frontier", op. cit.

15. Thus the Γ_{it} themselves are envisaged as functions of further variables, the identities of which are made explicit below.

16. Powell and Gruen, ibid.

17. The price relatives each have the mean over the sample period of expected prices as base.

another product: for example, whilst we would expect a change in the price of wheat to have quite an impact on the output of coarse grains, part of this expected response must be attributed to the sheer size itself of the wheat industry (relative to coarse grains), rather than to the basic technological possibilities for transformation of potential wheat output into production of coarse grains.[18] The final element of the right-hand side of (6.3.4) — namely, $\bar{y}_i$ — merely ensures that what would otherwise have been a pure index number is converted back into the units in which the output of product i is measured, thus preserving dimensionality. It is clear that the expected signs of all τ_{ij}'s are negative. From equations (6.3.3) and (6.3.4) we see that negative transformation elasticities are necessary if a rise in the price of a competing product j is to reduce output of product i.

We cannot here go into details of the statistical methodology by which we fitted the model whose broad economic properties are described above. Suffice it to remark that a fairly minor adjustment to the least squares technique was necessary.[19]

Distributed Lags and the Shifting Frontier

We have deferred until now the problem of identifying the variables which shift the production frontier over time; i.e., the arguments of the functions Γ_{it} occurring in equation (6.3.2). For an analysis of the long run it is clear that we would need indexes of the flow of capital services, for these essentially will determine the schedule of production possibilities. (Whether it is possible or not to construct such indicators independently of output measurements is a moot point. In any event, their construction could not be attempted within this study: Australian data on the amount of agricultural capital available — let alone the flow of services from such capital — is very inadequate). For the analysis of annual data, however, we need to pin-point, with a reasonable degree of accuracy, the capacity of the system to expand various lines of production over a very short period. We are thus concerned with capacity in the very short run. An appropriate indicator of this short run capacity may be lagged production. On this view our linear supply system would be written

$$(6.3.5)\quad y_{it} = b_i + c_i\, y_{it-1} + \sum_j a_{ij}\, \pi_{jt} + \epsilon_{it}$$

where y_{it} is output during t; π_{jt} is price expected to prevail for product j during t from the viewpoint of (t-1); ϵ_{it} is a random term; and the a_{ij}, b_i and c_i are parameters. However, we wish to mention explicitly the possibility that lagged output y_{it-1} may be in some cases a less than adequate indicator of the frontier. In such cases we propose to introduce additional and/or alternative shift variables into the system.

The format (6.3.5) of the linear supply system has a number of advantages. First, it only attempts to explain the current level of output conditional upon information regarding last year's output. This is admittedly less ambitious than attempting to explain the level of output as a function of prices only; but, in view of the cumulative impact of droughts and other extraneous influences upon the level of output, this less ambitious approach at least has some prospect of success. Second, inclusion of last year's output establishes a formal equivalent between the linear supply system used here and the work of Nerlove.[20] For if

$$(6.3.6)\quad y_{it} - y_{it-1} = \gamma_i\,(y^*_{it} - y_{it-1}),$$

where y^*_{it} is the desired long-run equilibrium output from the viewpoint of time t,

18. The 'scale' and 'pure transformation' effects we have distinguished here are both components of a substitution effect; i.e., of a movement around a production frontier—they should not be confused with substitution and expansion effects of textbook fame.

19. For further details see Powell and Gruen, "The CET Production Frontier", op. cit.

20. Marc Nerlove, The Dynamics of Supply, op. cit.

and γ_i is the "coefficient of adjustment" of product i (reflecting technological 'stickiness' in the adjustment of output towards its desired long-run level), then (6.3.6) is equivalent to

$$(6.3.7) \quad \gamma_i y^*_{it} = b_i + \sum_j a_{ij} \pi_{jt} + \epsilon_{it} ,$$

in which $\gamma_i \equiv (1-c_i)$. The long-run supply equation is hence determined, γ_i giving the proportion of the eventual total adjustment occurring in the first year. Long-run elasticities hence may be estimated by dividing short-run estimates by an estimate of the appropriate γ_i.[21]

Distributed Lags and Price Expectations

For four of the six products considered here, we have adhered to an orthodox treatment of price expectations. (The exceptions are: wheat and beef and veal). Using the Koyck/Nerlove model of adaptive expectations we have written

$$(6.3.8) \quad \pi_{it} = \sum_{l=1}^{\infty} \beta_i (1-\beta_i)^{l-1} \; p_{i,t-l}$$

in which π_{it}, as before, is the price expected to prevail for product i at time t from the viewpoint of (t-1); β_i is the coefficient of expectations for product i, and $p_{i,t-l}$ is the actual price pertaining l years ago from the viewpoint of year t. Thus price expectations are assumed to be a weighted average of prices prevailing in the past.[22] However, on pragmatic grounds we truncated the distributed lag series after 7 years, so that prices occurring 8 or more years previously do not influence expected prices in the estimation of this model.[23]

All results in this study were obtained as conditional estimates for given arbitrary sets of values on the coefficients of expectations β_i, the latter being varied parametrically. In order to limit the range of possibilities we assumed that the coefficient of expectations for any given product (wheat excepted) is inversely proportional to the coefficient of variation of its actual price series. The rationale here is that the reliability of last year's price as an estimate of the longer run price level will be high for stable series, but less so for erratic ones. The coefficients of variation for the products concerned are shown in Table 6.3.1.

Special Treatment of Prices for Two Products

(a) Beef and Veal: Intra-annual decisions affecting the supply of these meats can be taken. Thus short-run production can be enhanced at the expense of future output by slaughtering animals rather than retaining them for breeding stock or for later slaughter. This being the case, an essential distinction that must be maintained in the case of beef and veal, is that between producers' short- and long-term price expectations. Empirically, this is a Herculean task; we attempted, albeit with limited success, to approximate the relevant short and long prices by a spot price (lagged 6 months), and a distributed lag series, respectively. In the latter case the initial lag was also 6 months, the coefficient of expectations being taken in line with Table 6.3.1. Thus not only are the two series far from independent — not necessarily a serious objection in itself — but are obviously also deficient in many other respects. Nevertheless, the estimated coefficients for these two prices in the beef equation turn out to

21. Implicit in the above treatment is the postulate that the only prices to which suppliers are responsive are their estimates of long-run or 'normal' price. (On this point see Nerlove, op. cit., pp. 45-59.) We shall modify this treatment below in the case of beef and veal.

22. Nerlove, ibid., p. 55.

23. The weights of lagged prices have been adjusted upwards to sum to unity.

Table 6.3.1

COEFFICIENTS OF VARIATION OF PRICE SERIES FOR FIVE PRODUCTS, 1940—41 TO 1961—62

	Wool	Lamb	Beef and Veal	Coarse Grains	Dairy Products
Coefficient of Variation	0.63	0.43	0.51	0.44	0.45
Ratio (relative to wool = 1)	1	0.68	0.81	0.70	0.71
Inverse Ratio	1	1.47	1.23	1.43	1.40

Sources: Tables given in Alan A. Powell and F.H. Gruen, "Problems in Aggregate Agricultural Supply Analysis: I — The Construction of Time Series for Analysis", Review of Marketing and Agricultural Economics, Vol.34, No.3 (September 1966) and Vol.34, No.4 (December 1966) (in press).

have the right signs and even statistical significance.[24]

(b) Wheat

All Australian wheat is compulsorily channelled through a statutory marketing authority, the Australian Wheat Board. Pricing arrangements are so complex that, in order to arrive at any price expectations series at all for wheat, we had to introduce very considerable lags. Thus the introduction of further (distributed) lags seemed highly artificial, and we have used our specially generated series without any attempt to imbed it within a Nerlovian framework of price expectations.[25]

Further Restrictions

Among our 6 products, there exist 15 pair-wise comparisons. Thus, in a model which imposed no constraints upon the set of price parameters beyond symmetry, 15 partial transformation elasticities $\{\tau_{ij} : i \neq j\}$ would be estimated. However, there are reasons for even further restricting the system by constraining some transformation elasticities to zero.[26] This was done partly because we expected certain cross supply elsticities (e.g., between wool and dairying) to be extremely low; and given this prior belief, a method which estimates all transformation elasticities makes very inefficient use of a strictly limited quantity of data. In other cases, elasticities were constrained to zero, e.g., between lamb and coarse grains, because some "outputs" are infact also intermediate products within the system. In further instances (wool and beef), the short-run supply elasticity was constrained to zero because initially we obtained incorrect signs (though statistically non-significant coefficients). Perverse signs involve exceptionally serious consequences for this particular model since, under the specification which enforces homogeneity in prices, cross plus own price elasticities for any given product must add identically to zero. In other words, a statistical accident resulting in a large (though statistically non-significant) coefficient of the 'wrong' sign on the price of a competing product, could lead to a totally unreliable picture of a product's own price elasticity. Finally we note that, for aggregate analysis, in certain cases the very concept of partial transformation frontiers could break down, since in the very short run, it might be impossible to visualise moving out of product 1 (wool) into product 2 (wheat) without varying the output level of a third product (mutton).[27]

Shift Variables — Their Impact on Supply

Before discussing empirical estimates of price responses, we must comment on the shift variables used. The identities of these variables and their estimated coefficients are given in Table 6.3.2. Although based on a particular arbitrary set of assumptions about the structure of price expectations — the coefficient of expectations for wool was

24. It is not proper to speak of the statistical 'significance' in this study. For this to be so we would need an independent set of data for each hypothesis we test. In fact, we have attempted to test a multiplicity of hypotheses using the same data. Moreover, we have based our estimates of standard errors of regression coefficients on classical least-squares formulae, which are not strictly applicable for our iteratively fitted generalised least-squares method. However, we conform to the common usage by using the word 'significance' synonymously with the apparent significance of the Student's t-value obtained by taking the ratio of parameter estimate to its apparent sampling standard deviation.

25. For a detailed discussion of the Australian wheat stabilization scheme, its operation, and our construction of two conjectural series on wheatgrowers' price expectations, see Powell and Gruen, "Problems in Aggregate Agricultural Supply Analysis: I", op. cit. Of the two series there tabulated, we have adhered to Series I throughout this study.

26. Formally, this constraint has two possible interpretations: (i) that the production frontier is right-angled; (ii) that the relative prices prevailing between the two products in question do not enter into the farmers' decision process. Inso-far as an interpretation is forced on us, we favour the latter.

27. Fortunately, at least in the example we have chosen, the third product in which the 'unwanted' variation is generated (mutton) does not belong to the system whose supply structure we are here attempting to estimate.

Table 6.3.2

ESTIMATED CONSTANTS AND COEFFICIENTS OF SHIFT VARIABLES FOR SIX-EQUATION SUPPLY MODEL* †

Equation for	Regression Constant	Variables Shifting	Supply Curve	Estimated Coefficient of Adjustment(γ)	R^2
Wool (a)	5.301 [1.087]	Drought Mortality Index (f) Lagged Output (a)	-0.5642 [0.972] 0.958 [23.836]	.0142	.978
Lamb (b)	0.047 [0.815]	Drought Mortality Index (f) Lagged Output (b)	-0.0096 [3.614] 0.9356 [8.475]	.0644	.866
Wheat (c)	0.7854 [0.597]	Lagged Output (c)	0.9526 [8.876]	.474	.886
Coarse Grains (c)	0.7907 [1.665]	Lagged Output (c)	0.8621 [8.612]	0.1379	.838
Beef and Veal (b)	-.8304 [4.384]	Drought Mortality Index (g) Long Run Beef Price †† Opening Inventory of Non-breeding Cattle (e)	-0.0273 [2.539] -0.0010 [2.106] .2922 [7.087]	not estimated	.888
Dairy (d)	1.3995 [4.225]	Lagged Output (d)	0.5714 [5.649]	.4286	.827

* All results conditional on an assumed coefficient of expectations (β) of 0.6 for wool. With the exception of wheat, and beef and veal, other β-values are in ratio shown in third line of Table 6.3.1. Wheat price series was specially derived from institutional considerations [see Powell and Gruen, "Problems in Aggregate Agricultural Supply Analysis: I", op. cit.]. Beef price is "short price" as measured by spot price, lagged six months.

† Student's |t|-values shown in square brackets (approximate test only).

†† "Long-run" expected price of beef measured by distributed lags (with initial lag 6 months) on actual prices. Coefficient of expectations for beef was the value equivalent to a wool value of 0.6, and was obtained from Table 6.3.1.

Units are:
- (a) millions of adult sheep shorn;
- (b) millions of tons carcass weight;
- (c) millions of acres;
- (d) millions of dairy cows;
- (e) millions of animals;

(f) Deviation of crude annual percentage mortality rate about a "normal" value of 6.3 percent.

(g) Deviation of crude annual percentage mortality rate about a "normal" value of 4.3 percent.

taken as 0.6 — our results are surprisingly insensitive to variations in such assumptions. Indeed, in terms of 'goodness of fit' as measured by the values of R^2 for the 6 equations, there is little or no basis for choice among assumptions ranging from 0.4 to 0.7 for wool's coefficient of expectations.[28]

(a) Wool: We expected that our output indicator for wool (number of adult fleeces shorn) would make less than a totally adequate allowance for the effect of drought. Hence we added to lagged output a drought mortality index as an additional shifter of the supply equation for wool. The latter variable's estimated coefficient, though not differing significantly from zero, has the expected sign. The coefficient on lagged output obtained in the case of wool is very high (0.986), with a Student's $|t|$-value in excess of 23.

(b) Lamb: The same drought mortality index was incorporated into the lamb equation, its estimated coefficient this time reaching statistical significance. Although possessing the 'right' sign, the quantitative impact of this variable is none-the-less slight; on the basis of these estimates, even a drought of 1951—52 proportions in the sheep industry would reduce lamb output by less than 2 percent of its average value over the sample period (1947—48 through 1964—65). Lagged output is again of great importance as an explanator of supply in the case of lamb, its coefficient of 0.94 having associated with it a Student's $|t|$-value in excess of 8.

28. These may be construed as plausible lower and upper limits in the following sense: If wool's coefficient of expectations (β), measured to the nearest first decimal place, were less than 0.4 (i.e., $\beta \leqq 0.3$), no more than fifty-one percent of the weights of historical prices upon expectations would accrue from the two most recent years. On the other hand, given Table 6.3.1 and the inverse proportionality rule we have adopted, 0.7 forms an upper bound in that adherence to our rule would cause the β-values for some products to exceed unity should a value so large as 0.7 be assumed for wool.

(c) Wheat: Lagged output was the only shift variable used in the wheat supply equation, its coefficient being estimated as 0.95, again with a $|t|$-value in excess of 8. This was the only equation in our system where there existed definite evidence of autocorrelation in the residuals (Durban and Watson's d-statistic = 1.07). Previous experience with smaller models suggested to us that the source of this problem lay not with the probability distribution of equation errors; rather, the equation had been mis-specified so as to neglect some important explanator, which itself exhibited a strong positive move ment over time. For short-term analysis we were able to come to terms with this problem by adding a series on current inputs as an additional shift variable;[29] however, since we intended to use our estimates for long-term projective work, and since we were only able to make the wildest guesses about the probable future course of the neglected variable, we retained lagged output as the sole shifter of the wheat supply equation. What this amounts to is trading off the risk of (almost surely) underestimating the wheat supply in the short-term (say the first 5 years), in order to avoid the likelihood of a serious overestimation in our longer term projections. Our thinking here was very much conditioned by the fact that our indicators of output for cereals are acreages, and the supply of land in Western Australia (and elsewhere) which can be opened up as virgin crop land is physically limited. Trial projections based on the assumption that the autonomous trend in acreages was to continue at its current rate would put wheat acreage in 1979—80 in excess of 32 million acres (this on the further assumption that commodity prices equal to the average of 1958—59 through 1961—62 were, apart from random shocks, to persist through the intervening period). This figure seems to us implausibly large, and we would prefer to regard it as an upper limit.

29. Powell and Gruen, "Problems in Aggregate Agricultural Supply Analysis: II", op. cit.

(d) Coarse Grains

Lagged output is the only shift variable employed here. Its coefficient at 0.86 is lower than those obtained for wool, lamb, or wheat; given the relative ease with which wheat can be replaced by coarse grains and given that coarse grains are on a much smaller scale than wheat, this might have been expected. Again a Student's $|t|$-value in excess of 8 was obtained.

(e) Beef and Veal

Our treatment of shift variables for this equation followed that for wool and lamb in that a drought mortality index was added; however, in two other respects the situation differs radically from any other equation in our simultaneous system. Lagged output was not used as a proxy to help locate the position of the short-run production frontier as was the case elsewhere, because better measures for this purpose were available from the published statistics. Clearly potential beef ouput depends on the number of cattle available for slaughter. Initially we attempted to incorporate into the beef and veal equation quite sophisticated index numbers of potentially slaughterable animals, including a version which took into account that graziers might be willing to slaughter some (say their older) breeding cows when the short/long price outlook warranted it. We also attempted to allow for the fact that dairy cattle would similarly be expendable should the spot price of beef rise sufficiently high relative to the expected price of dairy products. Suffice it to say that none of these experiments yielded results superior to the sole use of the opening inventory of non-breeding beef cattle. The estimated coefficient of this variable is 'significant', and quantitatively important; the drought index has the expected sign and reaches significance at a lower level, but has very slight quantitative impact in terms of the type of criteria introduced above in the case of lamb. The remaining shift variable was 'long run' price of beef and veal. Conceptually, we envisage the short-run schedule of potential beef production moving leftwards as the long price of beef increases. Thus slaughtering now increases current output as we have measured it (tons carcass weight), but this necessarily curtails future output to some extent. The more favorable the long term outlook, the less likely are current slaughterings, on this view. In fact, the coefficient of the long-term beef price as estimated by our equation is negative, and on the fringe of statistical significance. Given the exceptionally crude apparatus at our disposal for separation of long from short term price expectations — see the discussion of such above — even this limited degree of 'success' is perhaps surprising. The question of the extent to which future output is sacrificed through current slaughterings is one to which we shall return presently. For the moment we remark that an incipient problem of autocorrelated residuals was encountered in the estimation of the beef and veal supply equation, though in a less serious form than in the case of wheat.[30]

(f) Dairy Products

Lagged output was the only shifter used for this equation. With a value of 0.57, the coefficient of this variable (again significant) suggests considerable year-to-year flexibility in the short run.

Estimated Transformation Elasticities: Some Disappointments

Table 6.3.3 lists the five partial transformation elasticities which remained in our final analysis. While many τ_{ij}'s had been eliminated from *a priori* considerations — for example, that for dairy/wheat — several important partial transformation elasticities have been constrained to zero for no better reason than that the unconstrained estimates possessed the 'wrong' signs (though never

30. The Durbin-Watson statistic obtained was 1.67, falling right at the upper edge (1.69) of the indeterminate range.

statistical significance).[31] These included so patently competing a pair as beef and wool, and perhaps wheat and lamb. Aggregation problems may lie at back of these difficulties; certainly, there is scope for experiment with more sophisticated views of lags in production and in expectations than we could have hoped to employ in this study.

For all that, the expected wool/wheat relationship is verified by a significant transformation elasticity,[32] and the size (if not the Student's $|t|$-value) of the estimated partial transformation elasticity between wheat and coarse grains confirms our prior hunches. That the only element of annual flexibility in the beef supply should come from the dairy industry may be credible, but our failure to account in any measure for the competition which must prevail between beef and wool over a somewhat longer accounting period is a major weakness of this model; certainly, this would require ad hoc surgery in any application to commodity projections which involved radical changes in the beef/wool price ratio from values prevailing in our sample period. Beyond noting this weakness, there is little we can do. At all events, the estimated transformation elasticity between beef and veal and dairy products is our highest estimated transformation elasticity, and also possesses the most gratifying large Student's $|t|$-value for such a coefficient.

The surprisingly large degree of basic substitutability between dairying and lamb production probably stems mainly from the irrigation areas in which these two products compete most directly. The very low (and statistically tenuous) estimated transformation elasticity between wool and lamb was contrary to our price expectations; we expected more substitutability.

Estimated Price Elasticities of Supply

These five estimates of partial transformation elasticities $\{\tau_{ij}\}$ have been converted into the more conventional own and cross elasticities of supply in Table 6.3.4. Some idea of the power of the technique used here is gained when it is realised that five τ_{ij}-coefficients have been sufficient to generate six own plus nine cross elasticities of supply.

Although it is not our intention to use such for projections, for completeness we have also tabulated annual, 5-year, and long-run estimates of own price elasticities. These are given in Table 6.3.5, and are based on the Nerlovian concept of the "coefficient of adjustment" $\{\gamma_i\}$, as interpreted within our framework along the lines of equations (6.3.6) and (6.3.7). Our experience has suggested that, whilst our short and intermediate run estimates are insensitive to changes in assumptions about the structure of price expectations, the long-run estimates are very sensitive and should be treated with due caution.

It will be noticed that no attempt has been made to estimate intermediate or long-run own supply elasticities in the case of beef and veal. In a mechanistic sense, one can justify this by our exclusion of lagged output in the beef equation. However, some descriptive equation is needed to link our data on non-breeding beef cattle with annual production — otherwise our results could not be used for projection. For this purpose we have used the following equation, obtained by ordinary least squares from the sample period 1947—48 through 1962—63:

31. As evidence that our intentions towards the data were not totally dishonorable, we cite the fact that we suppressed on prior grounds the partial transformation elasticity between wool and dairying, even though in an unconstrained model this estimate was apparently highly 'significant', and of appropriate sign (though possessing a value sensibly very close to zero—i.e., -0.05).

32. As this coefficient was estimated successfully in our initial efforts, perhaps we can claim to have tested at least one hypothesis under appropriate conditions, and hence that the "significance" of this elasticity is real.

Table 6.3.3

ESTIMATED PARTIAL TRANSFORMATION ELASTICITIES

Partial Frontiers between:*	Estimated Elasticity (with Student's $\|t\|$-values in square brackets)
Wool/Wheat	-0.1547 [2.141]
Wheat/Coarse Grains	-0.2841 [1.451]
Beef/Dairy **	-0.2952 [5.164]
Lamb/Dairy	-0.2684 [2.805]
Lamb/Wool	-0.0531 [0.436]

* Partial transformation elasticities for all other pairs constrained to zero (for reasons discussed in text).

** Beef price is spot price, lagged six months

$$(6.3.9)\quad \theta_t = \underset{(0.1262)}{0.0115} + \underset{(0.3078)}{1.1431}\,\theta_{t-1} \underset{(0.0808)}{-0.01284}\, y_{t-1} - \underset{(0.0042)}{0.0112}\, D_{t-1} + \underset{(0.0024)}{0.0013}\, t \qquad (R^2 = .94);$$

Above, θ_t is the opening inventory of non-breeding beef cattle (tens of millions) at the beginning of year t, and y_{t-1} and D_{t-1} are the output of beef and veal (millions of tons slaughtered) and the drought index respectively in the previous year. In equation (6.3.9), t = 0 in 1948—49. The variable θ_t in (say) 1948—49, is the number of non-breeding beef cattle on hand at March 31st, 1948.[33] The autoregressive coefficient of θ_t on θ_{t-1} exceeds unity, and this makes interpretation of long-run elasticities for beef extremely hazardous. Unfortunately, further work on this puzzle could not be undertaken within the time limits imposed by our study.

33. The official series on θ_t are tabulated in reference (iii), cited in footnote 4a, supra.

Structural Coefficients

Table 6.3.2 and 6.3.6 together give estimates of all structural parameters of our six-equation model. In the latter table, we have shown linear coefficients $\{a_{ij}\}$ for expected prices, since it is in their linear form [equation (6.3.2)] that our equations are most suitable for projection.

4. OTHER MEATS

(a) Mutton

Table 6.4.1 gives price and production data for mutton.[34] Mutton production has shown substantial fluctuations in the post-war period. As a result of the wool boom,

34. Although we have not been able to obtain useful estimates of the supply elasticities for mutton, the price data are given in Table 6.4.1 since they are based on unpublished information and not otherwise available.

Table 6.3.4

ESTIMATED OWN AND CROSS SHORT RUN PRICE ELASTICITIES OF SUPPLY* † ‡

Product	Elasticity with Respect to the Expected Price of:						Sum
	Wool	Lamb	Wheat	Coarse Grains	Beef and Veal‡‡	Dairy	
Wool	+0.051	-0.006	-0.045	0	0	0	0
Lamb	- 0.047	+0.253	0	0	0	-0.206	0
Wheat	- 0.109	0	+0.181	-0.072	0	0	0
Coarse Grains	0	0	- 0.212	+0.212	0	0	0
Beef and Veal	0	0	0	0	+0.162	-0.162	0
Dairy	0	-0.063	0	0	-0.133	+0.196	0

* Elasticities evaluated at sample mean outputs and expected prices.

† All results conditional on an assumed coefficient of expectations (β) of 0.6 for wool. With the exception of wheat, and beef and veal, other β-values are in ratio shown in third line of Table 6.3.1. Wheat price series was specially derived from institutional considerations [see Powell and Gruen, "Problems in Aggregate Agricultural Supply Analysis: I", op. cit.]. Beef price is "short price" as measured by spot price, lagged six months.

‡ 'Short run' indicates an adjustment period of one year.

‡‡ Elasticities with respect to 'short run' price of beef with its 'long run' expected price held constant.

Table 6.3.5

ESTIMATED SHORT, INTERMEDIATE, AND LONG RUN OWN ELASTICITIES OF SUPPLY*

Product	Own Price Elasticity		
	Short Run**	Intermediate Run†	Long Run††
Wool	+0.051	+0.248	+3.592
Lamb	+0.206	+0.935	+3.199
Wheat	+0.181	+0.823	+3.819
Coarse Grains	+0.212	+0.805	+1.537
Beef and Veal	+0.162	not estimated	not estimated
Dairy	+0.196	+0.429	+0.457

* See footnotes to Table 6.3.4.

** 1-year adjustment period.

† 5-year adjustment period; Nerlovian estimate.

†† Infinite adjustment period; Nerlovian estimate.

mutton production dropped sharply in 1950—51. During the period of relatively high wool prices from 1952—53 to 1956—57, mutton production remained fairly stable at around 225,000 to 250,000 tons. In the next 3 years, output increased almost 50 percent. Since 1959—60 mutton production has again remained fairly stable at 360,000 to 370,000 tons.[35]

Mutton is essentially a by-product of the Australian sheep industry. Originally we intended to include mutton in the multi-sector supply model discussed in the preceding section. However, our attempts to derive quantitative estimates of the response of mutton production to changes in the mutton-wool price-relatives were completely unsuccessful. This may have been partly the result of problems of identification which arise in a particularly acute form for mutton; another possible reason for our failure is that, as a by-product, its production may respond to changes in the relative prices of two other products, wool and wheat. It may well be that significant fluctuations in the mutton supply are generated as farmers move out of wool into wheat, or vice versa. Such fluctuations may have little or nothing to do with the price of mutton relative to that of other commodities.

35. A detailed discussion of factors affecting Australian mutton production is given by M.L. Conroy and Z. Krumpholz, "The Prospects for Mutton", Quarterly Review of Agricultural Economics, Vol. 17, No. 2 (April 1964), pp. 55-65.

As a second-best alternative, we have attempted to derive a relationship between mutton production and some of the variables which appear in the multi-sector supply model given earlier. In particular, we have been able to account for most of the annual fluctuations in mutton output as a function of the number of adult sheep shorn, and a drought mortality index for sheep. The relevant equation is given below:

Table 6.3.6

EXPECTED PRICE COEFFICIENTS FOR LINEAR SUPPLY EQUATIONS*

Product[a]	Coefficient with Respect to the Expected Price[b] of					
	Wool	Lamb	Wheat	Coarse Grains	Beef and Veal	Dairy
Wool	+2.383657	-0.002994	-0.514417	0	0	0
Lamb	-0.002994	+.000172	0	0	0	-0.000830
Wheat	-0.514417	0	+0.208884	-0.094345	0	0
Coarse Grains	0	0	-0.094345	+0.107193	0	0
Beef and Veal	0	0	0	0	+0.000815	-0.002926
Dairy	0	-.000830	0	0	-0.002926	+0.015436

* Zero entries indicate coefficient constrained as such.

(a) For units, see footnotes to Table 6.3.2.

(b) Units for expected prices are:

(1) Wool: £ per fleece;
(2) Lamb: £ per ton of carcass weight;
(3) Wheat: £ per acre per annum;
(4) Coarse Grains: £ per acre per annum;
(5) Beef and Veal: £ per ton of carcass weight;
(6) Dairy: £ per cow per annum

(c) Short-run price. For coefficient of long-run price, see Table 6.3.2.

(6.4.1) $M_t = \underset{(0.0297)}{-0.0911} + \underset{(0.0002)}{0.0032}\, S_t - \underset{(0.0014)}{0.0065}\Delta S_t - \underset{(0.003)}{0.015}\, D_t$

$R^2 = 0.952$

where M_t = mutton production in year t (in million tons of carcass weight)

S_t = number of adult sheep shorn in year t (in millions)

$\Delta S_t = S_t - S_{t-1}$

D_t = Deviation of crude mortality rate from a 'normal' value of 6.3 percent

The period to which the figures relate is 1947—48 to 1964—65.[36]

36. The Durbin-Watson Statistic is 1.50—i.e. towards the upper end of the indeterminate range (0.93 to 1.69) at the 5 percent significance level.

(b) Pigmeats

Pig raising in Australia is not a specialised industry. In 1960, fewer than 3 percent of holdings carrying pigs were deriving the greater part of their earnings from pig breeding.[37] Dairy farming is by far the most important enterprise with which pig raising is associated, though it is sometimes a sideline for wheatgrowers and other cereal producers.

Prior to, and during World War II, pig production in Australia reached a level sufficient to allow substantial quantities of pork to be exported (an average of nearly 15,000 tons annually in the late 1930's). By the end of the war however, pig numbers

37. Commonwealth Bureau of Census and Statistics, Classification of Rural Holdings by Size and Type of Activity 1959-60, Bulletin No. 7—Australia (Canberra), Table No. 38.

Table 6.4.1

PRICE AND PRODUCTION DATA FOR MUTTON, AUSTRALIA: ANNUAL BASIS, 1947—48 TO 1964—65

Fiscal Year	(1) Production of Mutton (tons carcass weight)	(2) Current Series	(3) Series Lagged 6 Months
		Weighted B.A.E. Index of Prices Received For Mutton (a)	B.A.E. Index of Prices Received for Mutton (a)
1947—48	165,628	116	98
1948—49	181,270	96	112
1949—50	205,839	126	97
1950—51	161,833	208	157
1951—52	175,830	153	207
1952—53	249,007	137	143
1953—54	237,566	157	150
1954—55	240,530	162	158
1955—56	234,428	174	162
1956—57	223,910	176	187
1957—58	269,780	135	152
1958—59	310,381	125	125
1959—60	370,427	128	124
1960—61	367,556	159	149
1961—62	367,984	133	153
1962—63	362,659	139	131
1963—64	360,684	170	155
1964—65(b)	363,533	174	180

(a) Base: Average of 5 years ended June, 1950 = 100. [Semi-annual (1945 to 1952) and quarterly (1953 to 1965) B.A.E. Series have been weighted by official estimates of production for the corresponding periods. For source of production statistics, see source (1) below].

(b) Subject to revision.

Sources: (1) Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Bulletins Nos. 42—56, 1947—48 to 1961—62 (Canberra).
(2) and (3) Figures privately supplied by Bureau of Agricultural Economics, Canberra.

were declining and within a few years export had almost ceased. The irregular downward trend in output and sow numbers continued to 1952—53. As shown in Table 6.4.2, production has risen gradually since then. Total pigmeat production has currently (1964—65) reached the 1941—42 war time peak of 122,000 tons, but the increased output is all consumed domestically.[38]

The relatively small production of pigmeat in Australia is partly due to the nature and cost of the pig feed supply and partly due to the comparatively low prices for competing meats.[39] Whereas dairy farms have adequate supplies of low-cost skim milk, by comparison cereal grains are an expensive item for most farmers. Thus, expansion of many individual pig herds has been restricted by the amount of milk available on the farm. Although feed grain is readily available in the cereal growing districts, the opportunity cost of its use as animal feed has been high for most of the post-war period.[40] Another important component of pig feed in Australia is meat-meal which is used as a protein supplement. Meat-meal is both costly and relatively limited in availability.

In the past, there has been a substantial intra-seasonal fluctuation in output. This is mainly due to the reliance by many pig breeders on the skim milk supply from dairy farms. In recent years within-year fluctuations have been reduced in all States, but most notably in New South Wales. Evidence from the past one to two years indicates an increasing trend towards specialisation in the pig industry and location of these large piggeries close to the cheapest grain and meat-meal sources available.[41] A factor likely to hasten this trend is the changing pattern of management on the "butter-fed" dairies. In response to the rising level of returns from the processed by-products of butter manufacture, farmers are supplying more whole milk to the processors (rather than separating the milk on the farm) Specialising in pig raising should continue to reduce the seasonality of production; it is also likely to lower the average price of the product to the consumer and, possibly to reduce the supply response to price change.

The type of pigmeat produced from an animal depends on the stage of maturity at which it is slaughtered. The principal carcass types are the porker slaughtered for pork production at 70 to 100 lbs dressed weight, and the baconer slaughtered for bacon and ham between roughly 120 and 160 lbs dressed weight. However, pigs are often marketed outside the specified ranges for porkers and baconers. For example, some piglets are sold as "suckers" at 20 to 30 lbs dressed weight. At the other extreme, "backfatters" (or "choppers") are heavy-weight pigs carrying a high proportion of fat and comprising aged (usually) cull cows and boars.

Most of the year-to-year changes that have taken place in total pigmeat output are reflected in pork production, whilst bacon and ham output has been much more stable. This was attributed to the insufficient quantity of milk available to carry an increased number of pigs past the normal slaughter weight of porkers.[42] With the increasing

38. In 1959-60 to 1963-64, annual exports of pigmeat (mainly as pork) averaged about 500 tons.

39. By international standards, Australian consumption of pigmeats is relatively low. Probably because of this low level of consumption, demand responds readily to price changes (cf. Chapter IV.3).

40. Thus, the high level of production by the pig industry during the depression and early years of the war was largely due to the availability of large quantities of wheat at low prices.

41. One large piggery of 2,000 sows near Bendigo in Victoria at present produces 10 percent of that State's bacon requirements.

42. Although a continuous farm study by the Victorian Department of Agriculture has shown that it is more profitable to carry pigs through to prime bacon weight even when barley has to be purchased off the farm. [Agricultural Economics Branch, Department of Agriculture, Victoria, Pig Management Study 1964-65 (Melbourne 1965), pp. 7-8].

Table 6.4.2

PIG NUMBERS, PRODUCTION AND PRICES, AUSTRALIA,
1941—42 TO 1964—65

Year	Pigs on Farms, 31st March			Total Pigs Slaughtered to 30 June	Production of Pigmeat			Average Dressed Weight	Weighted Saleyard Price of:		B.A.E. Price Index of Pig Meats
	Sows	Other	Total		Pork	Ham and Bacon	Total		Porkers	Baconers	
	'000's				('000 tons carcass equivalent)			lbs	c./lb.		
Average 1941—42 to 1945—46	205.0	1364.0	1569.0	2024	44.0	72.0	116.0	128.37			74
1946—47	156.9	1116.0	1272.9	1601	27.2	67.7	94.9	132.6			84
1947—48	160.5	1094.0	1254.5	1558	25.7	64.1	89.8	129.1			99
1948—49	150.8	1046.0	1196.8	1684	35.3	58.5	93.8	124.8			108
1949—50	144.4	979.0	1123.4	1568	32.8	57.4	90.1	128.7			136
1950—51	155.0	978.5	1133.5	1529	31.2	54.2	85.4	125.1			163
1951—52	135.2	887.0	1022.1	1500	29.7	55.1	84.8	126.6			216
1952—53	141.1	851.4	992.5	1474	24.9	58.0	82.9	126.0			229
1953—54	177.8	1019.9	1197.6	1545	30.6	55.1	83.7	121.3	n.a.	n.a.	242
1954—55	176.5	1120.0	1296.5	1951	43.8	55.6	99.4	114.8	20.1	18.0	179
1955—56	163.1	1003.7	1165.8	1821	40.7	53.3	93.9	115.8	28.3	24.3	238
1956—57	197.8	1127.3	1325.1	1740	38.3	50.5	88.7	114.8	29.5	26.2	246
1957—58	191.3	1232.0	1423.3	2077	48.8	52.8	101.6	110.1	22.7	20.8	196
1958—59	178.6	1110.1	1288.7	2087	46.3	55.6	101.9	109.9	25.2	21.8	217
1959—60	211.4	1212.4	1423.8	2043	47.9	52.7	100.6	110.9	30.1	26.9	260
1960—61	236.1	1379.2	1615.3	2229	54.2	53.3	107.5	108.5	28.1	24.9	235
1961—62	236.2	1416.1	1652.3	2564	64.6	55.9	120.5	105.3	23.3	19.2	186
1962—63	208.0	1232.0	1440.0	2416	56.4	58.0	114.4	106.1	27.9	25.4	238
1963—64	224.0	1244.0	1468.0	2290	53.2	58.1	111.3	108.3	29.9	27.2	261
1964—65	252.0	1409.0	1661.0	2489	63.0	59.0	122.0	109.8			

n.a. not available prior to this date.

Sources: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I — Rural Industries (Canberra), 1941—42 to 1961—62.
Annual Production Committee, Technical Sub-Committee on Pig Production, Report of the Eleventh Meeting (Launceston, May 1965).
Commonwealth Bureau of Census and Statistics, private communication.
Bureau of Agricultural Economics, private communication — for price index of pigmeats.

proportion of pork produced, there was a significant decline in the average dressed weight of pigs slaughtered: from a war time level of nearly 130 lb, average carcass weight fell to 105 lbs in 1961—62. The decline in slaughter weight has also been due to baconers being marketed at a lighter weight. The decline has been arrested or reversed in all States and future averages should fluctuate between 105 and 110 lbs weight.[43]

Estimating the Supply Response

Changes in the size of the industry can be measured in terms of the number of sows on farms. A major problem in attempting to estimate supply responses for pigmeats in Australia is that no information is available about the quantity of the various types of grains and meat meals fed to pigs. Since there is a great range of feeds which are used in varying proportions as feed prices change, it has not been possible to construct an index of pig feed prices. Thus our discussion of pigmeat supply is necessarily sketchy and incomplete.

There is evidence that pigmeat prices affect the number of sows kept. Thus we derived the following relationship

(6.4.2) $$\text{Log } S_t = 1.633 + \underset{(0.087)}{0.275} \log P_{t-1} \qquad (R^2 = 0.383)$$

where S_t = number of sows at March 31st in year t (in thousands)

P_{t-1} = index of pig prices

This regression was run for the years 1947—48 to 1964—65. Deflating the index of pig prices by an index of all prices paid failed to improve the fit significantly, though an attempt to express the variables in the form of first differences led to some improvement in R^2. This relationship is given below:

(6.3.4) $$(S_t - S_{t-1}) - 4.312 + \underset{(0.215)}{0.842} (P_{t-1} - P_{t-2}) \qquad (R^2 = 0.491)$$

Because of the rise in grain prices in the early part of the period, it was believed that better results might be obtained by restricting the period of the regression to the years 1951—52 to 1964—65. This gave the following results:

(6.4.4) $$\text{Log } S_t = 0.2479 + \underset{(0.2815)}{0.8689} \log P_{t-1} \qquad (R^2 = 0.443)$$

where the variables have the same meaning as before. However there was a fairly high degree of autocorrelation in equation (6.4.4) ($\rho = 0.64$); hence we recomputed this regression with weighted first differences of the lagged data

(6.4.5) $$(\text{Log } S_t = 0.6 \log S_{t-1}) = 0.560 + \underset{(0.176)}{0.388} (\log P_{t-1} - 0.6 \log P_{t-2}) \qquad (R^2 = 0.306)$$

Autocorrelation is absent from the residuals of this equation ($\rho = -0.13$) and the coefficient of 0.388 is an efficient generalised least squares estimate of the coefficient of lagged pig prices. On the assumption that farmers decisions are affected only by last year's pig prices, the elasticity of supply is about 0.4

The number of pigs available for slaughter can be estimated reasonably accurately from the number of sows on hand at the annual Censuses in March. Thus we obtained the following relation:

(6.4.6) $$\text{Log } PS_t = 0.729 + + \underset{(0.067)}{1.130} \log [\tfrac{1}{2} (S_t + S_{t-1})] \qquad (\rho = 0.06,\ R^2 = 0.949).$$

43. Animal Production Committee, Technical Sub-committee on Pig Production, Report of the Eleventh Meeting (Launceston, May 1965), Table 3.

The almost stable level of bacon production since the late 1940's has been contrasted to the fluctuating output of pork during the same period.[44] It is difficult to determine any cross-elasticity of supply between the two classes of meat. Simultaneous determination of the respective price elasticities is difficult due to the extraordinarily high correlation between the two price series (for the period 1954—55 to 1963—64, r = 0.99). A further difficulty in determining a price elasticity of supply is that the response lag is uncertain and may vary from 1 to 2 years.[45]

Independent of price changes, the distribution of pigmeat production between pork and bacon can be estimated from linear functions of the two meats separately regressed on total pigmeat:

$$(6.4.7)\quad PK_t = -33.1529 + \underset{(0.0501)}{0.7934}\, PM_t \qquad (R^2 = 0.9654),$$

$$(6.4.8)\quad B_t = +33.1529 + \underset{(0.0501)}{0.2066}\, PM_t \qquad (R^2 = 0.6543),$$

PK_t = pork production in year t.
B_t = bacon production in year t.

for the period 1954—55 to 1964—65.

These equations indicate that for every 100-lb rise or fall in total pigmeat production, pork output has changed by 79 lb and bacon output by 21 lb.

44. Reference to "bacon" includes "bacon and ham". Similarly, "pork" includes "pork and other pig meats" of which pork represents about 75-80 percent.

45. A comparison of the changes in supply of bacon and pork due to movement of their respective saleyard prices was made by equally distributing the price lags over two years. Computing simple logarithmic coefficients of the price variable, pork showed a significant supply price elasticity of 1.32 and bacon an elasticity of 0.24—but with a standard deviation of the same magnitude.

5. FRUITS

(a) Canned Fruit

Fruit canning has been an established industry in this country since the nineteenth century. Following a depressed period during the Second World War, the industry achieved marked advances in total output (Table 6.5.1); markets have been found for this increase both locally and overseas. Currently, exports account for approximately 60 percent of total canned fruit production and represent just over 1 percent (nearly $24 million) of Australia's total export earnings. The canned fruit industry is essentially composed of two distinct sections, deciduous tree fruits, and pineapples.

(i) Deciduous Tree Fruits: Apart from the relatively small production of canned apples the canned deciduous fruit comprise peaches, pears and apricots.

Deciduous fruit in Australia is largely produced on mixed enterprise farms with other horticultural crops, wheat, sheep, and cattle as the most common subsidiary forms of land use. In Victoria, most production comes from the Goulburn Valley; in New South Wales, from the Murrumbidgee Irrigation Area (M.I.A.); and in South Australia, from the Murray Valley. Production is principally confined to these three South Eastern States with Victoria producing nearly 70 percent of the total output of canned deciduous fruits in 1963—64.[46] (Appendix Table A6.5.1). The expansion of output in the last 20 years has not been accompanied by an equivalent rise in total fruit acreage; instead, yields per bearing acre rose markedly and the rise in the proportion of the total crop canned has been substantial. Two events of importance to the canned fruit supply during this period warrant special mention. First, in the season of 1951—52

46. Victoria has dominated the industry to this extent since World War II.

Table 6.5.1

ANNUAL CANNED FRUIT OUTPUT, AUSTRALIA 1940—41 TO 1964—65
('000 standard cases[(a)])

Year	Peaches	Pears	Apricots	Mixed Deciduous Fruits	Pineapples	Tropical Fruit Salad	Total
1940—41	1659	785	288	-	361		3093
1941—42	1348	595	182	-	225		2350
1942—43	1140	709	216	18	373		2456
1943—44	1343	602	328	34	111		2418
1944—45	1293	615	139	36	117		2200
1945—46	1021	641	234	30	164		2090
1946—47	1474	818	272	65	214		2843
1947—48	1650	880	397	26	425		3378
1948—49	1209	1006	453	38	504		3210
1949—50	1363	1000	647	48	569		3627
1950—51	1467	1150	505	109	499	75	3805
1951—52	1913	1277	882	178	208	29	4487
1952—53	1770	1262	630	148	754	70	4634
1953—54	2565	1718	1271	111	1109	167	6941
1954—55	2172	1835	846	156	1347	266	6622
1955—56	1788	1817	789	162	1164	212	5931
1956—57	1477	2166	802	317	924	222	5908
1957—58	2292	2229	891	309	1162	409	7292
1958—59	1710	2022	449	178	1328	387	6074
1959—60	2045	2415	576	202	1107	534	6879
1960—61	1675	2621	334	190	800	383	6003
1961—62	3259	3006	918	441	1052	567	9243
1962—63	3339	2653	846	442	885	580	8745
1963—64	3333	3207	443	616	1150	551	9300
1964—65	4330	2455	798	894	(b)	(b)	8477(c)

(a) A "standard case" comprises 24 No. 2½ size cans (30 ozs.) or their equivalent.

(b) Not available.

(c) Incomplete.

Sources: Commonwealth of Australia, Annual Report of the Australian Canned Fruits Board, 1941 to 1964 (Canberra),
Commonwealth of Australia, Australian Canned Fruits Board, Interim Report Six Months Ended June 30, 1965 (Canberra).

Table 6.5.2

BEARING AND NON-BEARING ACREAGES OF PEACHES, PEARS AND APRICOTS, AUSTRALIA, 1940—41 TO 1963—64
(Acres)

Year	Peaches		Pears		Apricots	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
1940—41	18911	6853	18368	5036	9687	2241
1941—42	19581	7258	17731	4979	10026	2661
1942—43	18719	6390	17593	4603	9728	2409
1943—44	20815	6181	18254	4171	9978	2375
1944—45	20263	6201	18419	4150	9874	2426
1945—46	20471	6117	18484	4132	10137	2308
1946—47	21931	6265	19888	2142	10601	2583
1947—48	22294	6180	19839	2946	10538	2641
1948—49	22125	6228	19662	2972	10745	2819
1949—50	21656	5662	18854	2725	10526	2751
1950—51	21048	5149	18839	2898	10533	2769
1951—52	20694	4909	18346	2611	10692	2590
1952—53	19552	4203	18573	2831	10510	2389
1953—54	19490	4195	18436	2604	10592	2289
1954—55	19655	4424	18461	2786	10819	2287
1955—56	18670	4784	18522	3508	10813	2274
1956—57	16885	5135	17484	4015	10192	2301
1957—58	17065	6386	17454	4535	10029	2660
1958—59	14260	10955	17805	5209	9466	2637
1959—60	14666	11710	17871	5813	9374	2685
1960—61	15066	11817	17785	6150	9187	2758
1961—62	19678	9949	18455	6883	9376	2085
1962—63	22207	8019	19997	5948	9896	1951
1963—64	23032	7205	20284	5586	10029	1861

Sources: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I — Rural Industries (Canberra), 1940—41 to 1961—62.
Commonwealth Bureau of Census and Statistics, Statistical Bulletin, The Fruit Growing Industry, Nos. 19 and 20 (Canberra), 1962—63 and 1963—64.

there was a big increase in the minimum price offered growers for fresh canning fruit:[47] prices of all three fruits rose by more than 50 percent in the year. Inflation of prices was general at this time, but the immediate increase in real prices for canning fruit exceeded those available from alternative markets. The response from growers was an increase in the proportion of total fruit offered to canneries. Secondly, the winter of 1956 was marked by serious flooding on the plains of the River Murray and its tributaries,[48] causing heavy fruit tree losses — particularly among peaches. This resulted in a particularly low output of canned peaches in 1955—56 and 1956—57. During the following years, annual plantings of young trees were high (particularly peaches and pears) and the total bearing acreage was seriously depleted. The bearing acreage of 1954—55 was not reached again until 1961—62 (Table 6.5.2). This big increase in plantings during the late 1950's was more than sufficient to replace those lost in 1956, and in recent years the bearing acreage has been increasing rapidly.[49] Further expansion of the area planted to fruit trees will depend on economic considerations. There is little likelihood of irrigation facilities becoming a limiting factor.

Peaches are the most commonly grown of the deciduous fruits used for canning in each of the three South Eastern states (Table A6.5.2). While as much as 10 percent of the total output of canned peaches consisted of freestone varieties in the mid-fifties, due to consumer and processor preference for the yellow-flesh cling peach varieties, the proportion diminished to 3 percent in 1963—64.[50] The freestone peaches have more important outlets as dried and fresh fruit. The heavy tree replacement of the past 8 years provided the opportunity to introduce new varieties and increase the proportion of varieties which proved satisfactory.

The average yield of canning peach varieties has also been raised by the introduction of improved cultural practices. In 1952 the average yield of fresh fruit from bearing trees (6 years and older) in the Goulburn Valley (Victoria) was 4.2 tons per 100 trees.[51] In the late fifties, the same region averaged around 8 tons per 100 trees.[52] Substantial increases in yields have also occurred in New South Wales and South Australia.[53] Increases in yields may have been overstated due to the substantial production from young trees not classified in the bearing age group. However, even a

47. Subsequent reference to "fresh fruit" will imply that the fruit is destined for the canneries, unless explicitly stated to be otherwise (e. g. fresh retail trade).

48. The Murray River constitutes the boundary between New South Wales and Victoria and provides irrigation for most of Australia's canning fruit orchards which lie in the states of Victoria, New South Wales and South Australia. The Murrumbidgee and Goulburn Rivers are important tributaries of the Murray which provide additional irrigation water for fruit growing.

49. Despite the high prices (including bonus payments) received for the reduced crop in 1956 and 1957, special government assistance was also available to enable orchardists to replace lost trees.

50. Disposal of the output is confined largely to the domestic market. Of 100,000 standard cases of canned freestone peaches produced in 1963-64, only 28 percent were passed as suitable for export trade.

51. F.M. Read, "A Census of Goulburn Valley Canning Fruit Trees", Journal of the Department of Agriculture, Victoria, Vol. 50, No. 12 (December 1952), p. 11.

52. Bureau of Agricultural Economics, The Canning Fruit Growing Industry—An Economic Survey, 1961, p. 9.

53. For New South Wales we have relied on: B. Owen French, Some Trends Revealed by the 1963 M. I. A. Fruit Tree and Grape Vine Census, Irrigation Research Committee, February 1965. Statistics relevant to South Australian fruit production are largely drawn from unpublished reports made available by the South Australian Department of Agriculture.

conservative assessment would suggest a yield increase of well over 50 percent in the last 10 to 12 years.[54]

The Goulburn Valley of Victoria produces about 90 percent of Australia's total production of canned pears. Current yields of canning pears in this district average around 9 tons per 100 bearing trees, compared with a $6\frac{1}{2}$ ton average 12 years ago. Average yields in other States are probably lower, but strict comparisons are difficult due to the unavailability of production data specific for Williams pears. Apart from a small percentage of Packham pears, William Bon Chretien is the only variety used for canning. Unlike clingstone peaches, Williams pears are also sold for fresh fruit consumption; this market provides an important alternative outlet for growers not contracted to canneries. In addition, part of the pear crop is marketed in dried form, especially in South Australia.

Canned apricots comprise only about 12 percent of the total canned deciduous fruit pack, and of the three fruits, is the only one for which output has remained relatively static over the last 10 to 15 years.[55] Possible reasons are: consumer bias against canned apricots because of inclusion of immature fruit in the domestic pack; the existence of a large and possibly growing backyard production of apricots and prevalence of "home-bottling"; lastly the important alternative outlets for canning varieties of apricots in the fresh fruit, dried fruit, and jam markets.

Apricot yields fluctuate widely but have risen by 30 to 40 percent in the last 12 years. New South Wales and South Australia now average nearly 6 tons per 100 trees and Victoria slightly less.

Changes in the proportion of apricots canned reflect responses of an economic nature (Appendix Table A6.5.3). This is less true of pears and peaches where most of the canned output is of one variety, or group of varieties, and most of the fresh and dried output comes from other varieties (and from other districts). The proportion of the total Australian apricot crop canned varies from year to year, but the average of 24 percent of the past 6 years (1958—59 to 1963—64) is well above the previous 7 years (38.5 percent). Falling demand and improved alternative prospects, particularly drying, have contributed to the decline. One factor influencing year-to-year fluctuations is crop size. Alternative outlets are often satisfied first and hence a low yield leaves a disproportionately small amount for canning. Recent poor seasons (1963—64) in some traditional canning regions have added to the relative decline in canned output.

As shown in Table 6.5.1, 6 to 8 percent of the total output of canned deciduous fruit consists of canned mixed fruits. These composite packs included canned two-fruits, fruit cocktail, and fruit salad (excluding tropical fruit salad). The major ingredients are peaches and pears and for statistical purposes they are each regarded as comprising 50 percent of the mixed fruit pack.[56]

54. Normally, exclusion of a reasonable number of "bearing" young trees compensates for the inclusion of the very old trees with declining yields and warranting replacement. The age distribution of the orchards in recent years has included high proportions of young trees, and fewer old trees. This partly explains the lower South Australian figure—peach trees are classified as bearing at 4 years in that state, and 6 years in other states.

55. Production may be increasing in South Australia where new plantings are not only being maintained at a high rate, but show some trend towards preferred canning varieties.

56. Victoria produces nearly 70 percent of all canned mixed fruits, but production is at present confined to relatively few canneries. Annual production depends on the availability of peaches and pears, and output has risen substantially in the past 3 years (Table 6.5.1). Despite retail prices higher than for peaches and pears, satisfactory clearances of mixed fruits have been achieved, including 30 percent to overseas markets.

(ii) Pineapples: This fruit is grown and canned almost entirely in Queensland. The 1963—64 area was about 11,000 acres, which constituted the first annual increase in 5 years (Table 6.5.3). A 2-year price slump, commencing in 1958—59, brought about a 30 percent drop in the area planted to pineapples in the next 4 years. The subsequent price recovery restored output, but there has been an important change in plantation size. In 1958—59, 2,300 commercial growers averaged nearly $6\frac{1}{2}$ acres compared to 1,050 growers in 1963—64, averaging $10\frac{1}{2}$ acres.[57]

Yield increases since the War have been substantial and consistent, with present production per acre being about 11 tons compared to between 6 and 7 tons just after the War. About half the crop is canned; the remainder is processed as juice[58] or conserves or sold as fresh fruit. The proportion canned varies with the price offered and the size of crop. Fresh fruit sales remain fairly stable.

Canning of other tropical fruits occurs mostly as ingredients of tropical fruit salad. Pineapples are believed to contribute 60 percent of the bulk of this product and of the remainder, pawpaws (papayas) are the major constituent. Bananas, orange juice, and passion fruit[59] are included in smaller proportions. Tropical fruit salad was first marketed in the early 1950's and from the outset proved popular. Present annual output of approximately 550,000 standard cases is insufficient to meet domestic and overseas demand at prevailing prices. The factor restricting production has been the availability of suitable pawpaws, but recent increases in supplies of this fruit may allow future market requirements to be more closely met.[60]

Fresh Fruit Prices: Prices paid to growers for fresh fruit by canneries are largely determined by the Fruit Industry Sugar Concession Committee (F.I.S.C.C.). The Committee specifies minimum prices annually just before the opening of the fruit season, and processors must pay growers at least these prices to qualify for a rebate on their sugar purchases.[61] Factors considered in reaching the agreed prices include: (a) the state of the overseas and domestic markets in terms of stock carryover and sales prospects; (b) the estimated size of the impending local crop; and more recently, (c) the movement in cost of production indexes. Canneries (and other processors) are free to offer growers a higher price. This may be in the form of a committed price at the beginning of the season or more normally, the promise of an unspecified bonus at the end of the season. Victoria is often the only State in which growers receive higher payments, but even in this State many canneries pay only the set minimum.[62] The three largest canneries

57. Commonwealth of Australia: 33rd Annual Report of the Fruit Industry Sugar Concession Committee (Canberra, 31st August, 1964), p. 13.

58. Some of the juice output occurs as a by-product of the canning process.

59. Passion fruit are also canned alone in small quantities.

60. Commonwealth of Australia: 37th Annual Report of the Australian Canned Fruits Board, 1962-63 (Canberra), p. 21.

61. The F.I.S.C.C. was constituted under the Sugar Agreement 1956-61 (amended 1962 and 1963) between the Commonwealth and Queensland Governments and approved by the Commonwealth Sugar Agreement Act 1956. Under the provisions of the Act, fruit processors may apply for domestic and export sugar rebates to enable them to compete on the world market. (The domestic price of sugar is usually high by world comparison). To qualify for the domestic rebate the processors must pay growers a set minimum price for their fruit. This minimum price is usually established yearly by the F.I.S.C.C. for all types and varieties of fruit used in processing. The present domestic rebate is $A10 per ton of sugar content in the preserved fruit. The export rebate is varied according to the world price of sugar. These domestic and export rebates are paid from funds provided by the sugar industry.

62. More canneries pay above the minimum when the crop is insufficient to meet canners' needs. Conversely, some canners will pay less than the minimum if the demand for fruit is weak and the minimum price considered artificially high. In paying less than the minimum, these processors forego the sugar rebate.

Table 6.5.3

ACREAGE, FRESH FRUIT PRODUCTION AND CANNED OUTPUT OF PINEAPPLES, AUSTRALIA, 1940—41 TO 1963—64

Year	Acreage		Raw Production		Canned Output	Proportion Canned
	Bearing	Non-bearing	Total	Per Bearing Acre		
	acres		'000 bus. (a)	bushel	'000 std. cases (b)	percent
1940—41	5630	1779	2186	338	361	23.7
1941—42	5275	1394	2044	387	225	15.8
1942—43	5641	1532	1969	349	373	27.1
1943—44	5299	1834	2026	382	111	7.8
1944—45	4901	2332	1591	325	117	10.5
1945—46	5260	2645	1767	336	164	13.3
1946—47	5058	3116	1654	327	214	18.5
1947—48	6348	3114	2232	352	425	27.2
1948—49	6700	2644	2291	342	504	31.5
1949—50	7050	2564	2572	365	569	31.6
1950—51	7193	2284	2721	378	544	28.6
1951—52	5748	3827	1944	338	225	16.5
1952—53	6454	4025	2406	373	796	47.3
1953—54	7367	4769	3263	443	1209	53.0
1954—55	8683	4461	3672	423	1507	58.7
1955—56	8829	4072	4412	500	1292	41.9
1956—57	8082	4251	3635	450	1057	41.6
1957—58	8543	4964	4029	472	1407	49.9
1958—59	10045	4778	5195	517	1560	42.9
1959—60	9489	3143	4741	500	1427	43.0
1960—61	8098	2988	3893	481	1030	37.8
1961—62	7285	3264	3915	537	1892	50.9
1962—63	7179	3316	4126	575	1233	42.7
1963—64	7517	3569	4445	591	1481	47.7

(a) A bushel of pineapples weighs approximately 42 lbs.

(b) Includes an adjustment equal to 60 percent of canned tropical fruit salad.

Sources: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I — Rural Industries (Canberra), 1940—41 to 1961—61. Commonwealth Bureau of Census and Statistics, Statistical Bulletin, The Fruit Growing Industry, Nos. 19 and 20 (Canberra), 1962—63 and 1963—64.

(all of which are cooperatives), producing 50 percent of the State's output, pay bonuses, which in some years increase the price received by 25 percent (annual bonus payments in recent years are given in Table 6.5.4). Canneries paying bonuses usually only accept fruit from certain orchards, so there is little opportunity for other growers to shop for higher prices (except from alternative marketing outlets).

A knowledge of annual bonus payments is therefore essential (in Victoria at least) to assess the gross returns of a large number of growers. On a long-term basis, the magnitude of the bonuses will play an important part in determining the growers' replacement policy. However, in the short run, these orchards are mostly committed to supply their fruit to a certain cannery. Thus, on a year-to-year basis, the bonuses are an ex-post payment unlikely to influence each season's supplies to canneries. The minimum prices offered are responsible for any short-run supply response.

Table 6.5.4 gives the minimum prices set by the F.I.S.C.C. since 1945—46. The general level has not changed markedly since the early 1950's, except for two years of high prices following the 1956 floods and a temporary recession in 1959—60. If viewed in real terms, prices should be deflated by rises in production costs. Between January 1959 and June 1964 the price of inputs to canning fruit growers rose by approximately 7 percent.[63] Some changes in the volume of inputs used have further raised the costs of production per acre.[64] However due to increasing yields, the average real net returns per acre are probably at least being maintained. Conclusions are difficult to draw because of our limited knowledge of bonus payments and our inability to isolate costs of fruit growing on the mixed farming enterprises of New South Wales and South Australia.[65] Minimum prices for all deciduous canning fruits rose in 1965.

The minimum price for pineapples to be paid by canneries has remained the same for 4 of the past 5 years, but actual returns realised by growers varied appreciably during this period.[66] Since 1960, the trend has been upwards and the prospects are that present average returns will at least be maintained. Consumption of canned pineapple in Australia has risen, probably due to strong promotion campaigns.

Supply Analysis

Variations in the output of canned fruit are closely related to annual changes in fresh fruit production. This is because canning takes a significant proportion of each fruit's total production, and because other outlets may be satisfied in preference to canning operations when crops are below average size. There is also evidence of some response to the minimum prices laid down annually by the Fruit Industry Sugar Concession Committee.

The existence of a limit to processors' capacity to handle a fruit crop has manifested itself occasionally. Some minor difficulties have occurred at the peak of some seasons, but only in the 1964 peak crop did this cause serious loss to the growers. Restrictions that do exist are mainly due to the lack of trained personnel to staff additional shift work. Plant capacity generally is still adequate. The main problem for processors

63. Bureau of Agricultural Economics: Changes in Incomes, Costs of Production and Other Financial Data of Canning Fruit Growers—Survey Period to 1963-64 (Canberra, November 1964).

64. The 1963-64 B.A.E. study details increases of 16 to 17 percent per property, but this includes expanded acreages of canning fruit on the average property.

65. Bureau of Agricultural Economics, op. cit.

66. The apparent failure of canneries to exceed the F.I.S.C.C. minimum on a number of occasions is partly explained by the establishment of the minimum for a yearly period, and partly by making some payments below the minimum.

Table 6.5.4

MINIMUM PRICES PAYABLE FOR CANNING PEACHES, PEARS, APRICOTS AND PINEAPPLES 1945–46 TO 1964–65, AND AVERAGE BONUS PAYMENTS, 1955–56 TO 1963–64 (a)

Year	Peaches (b)		Pears (c)		Apricots		Pineapples (d)		
	Minimum	Bonus	Minimum	Bonus	Minimum	Bonus	Canning Minimum	Prices Actual (e)	Wholesale Price Fresh Fruit Markets (f)
	$"s per ton (fresh weight)								$'s per tropical case
1945–46	32	n.a.	30	n.a.	34	n.a.	30.0	n.a.	n.a.
1946–47	32	n.a.	30	n.a.	34	n.a.	30.0	n.a.	n.a.
1947–48	36	n.a.	32	n.a.	38	n.a.	33.0	29.20	1.37
1948–49	36	n.a.	32	n.a.	40	n.a.	33.0	29.30	1.56
1949–50	40	n.a.	34	n.a.	44	n.a.	37.0	40.38	1.94
1950–51	50	n.a.	41	n.a.	52	n.a.	37.0	55.66	2.81
1951–52	74	n.a.	66	n.a.	80	n.a.	60.0	24.12	3.33
1952–53	78	n.a.	66	n.a.	84	n.a.	60.0	27.40	2.95
1953–54	82	n.a.	70	n.a.	88	n.a.	60.0	68.04	2.79
1954–55	82	n.a.	72	n.a.	80	n.a.	50.0	46.94	2.44
1955–56	92	50	82	34	90	36	50.0	58.50	2.87
1956–57	112	-	96	-	90	-	50.0	67.54	3.23
1957–58	112	40	96	20	90	20	50.0	62.14	3.07
1958–59	92	30	76	30	70	20	45.0	34.46	1.96
1959–60	80	24	76	24	60	24	40.0	47.30	2.31
1960–61	88	36	84	24	76	24	57.4	65.04	3.22
1961–62	88	28	84	24	86	24	68.0	56.76	3.36
1962–63	88	10	84	10	86	10	56.0	62.46	3.08
1963–64	82	26	84	20	86	20	56.0	71.10	3.54
1964–65	94	n.a.	92	n.a.	86	n.a.	56.0	n.a.	n.a.

n.a. Not applicable.

(a) Bonus payments quoted are the average of those paid to growers supplying fruit to the canneries concerned. Figures are not available prior to 1955-56.

(b) Prices quoted for clingstone varieties, clear centres. In recent years other clingstone varieties receive 4/ton less, freestone varieties 20 to 24 less.

(c) Price quoted for Williams pears. Packham pears, the only other variety canned, receive 20 to 24 ton less.

(d) For the calendar year of the second year quoted.

(e) Average return to the grower at point of railing.

(f) Annual average price of fresh pineapples at the Brisbane Wholesale Markets.

Sources: Minimum payments: Commonwealth of Australia, Annual Reports of the Fruit Industry Sugar Concession Committee, 1946 to 1964.
Bonus payments: Australian Canned Fruits Board, private communication.
Actual payments: Department of Primary Industry (Division of Marketing) Brisbane, private communication.

is the disposal of the canned output; unless markets greatly expand in the future, quotas will likely have to be established well below the total quantity available for canning — from a large crop.

Annual production of fresh fruit can be discussed in terms of bearing fruit trees and the yield of fruit per bearing acre. Variations in yield are primarily a function of local weather conditions (principally frost, hail, and wind), pests, diseases, and the size of the previous season's crop.[67] The general long-term increase in yields is attributable to a number of technical factors, in particular to improved varieties, sounder orchard management, and better cultural practice.

Changes in the bearing acreage from one year to the next are related to the number of trees planted some years before,[68] and the number of trees removed during the year. Fruit tree removals are dictated in part by the current and expected future level of returns to growers. Similarly, plantings are likely to be strongly influenced by expected future returns. Current economic conditions therefore usually have a delayed impact on the bearing acreage and on the level of output. Unfortunately, annual plantings and removals are not recorded, although there are some regional surveys which indicate the age distribution of younger trees. These age distributions disclose the abnormally heavy plantings over the years after the 1956 floods. Empirical estimates of the influence of economic factors on fruit tree planting and replacement policy are therefore difficult to obtain. Supply analyses were conducted for each of the four fruits under study.

Apricots: A number of regression equations were obtained (Table 6.5.5) from the data given in Appendix Table A6.5.4. As shown in equation 6.5.1, some 62 percent of the annual variation in canned apricot output can be explained in terms of two variables — total production and the current minimum price of fresh apricots. Inclusion of a trend variable — as in equation 6.5.2 — considerably increases the amount of variation explained and at the same time reduces the standard error of the estimate. The negative coefficient of the trend variable reflects the long-term decline in the proportion of the apricot crop which is canned.[69]

Equation 6.5.3 presents the previous relationship in logarithmic form. Thus, a 1 percent decline in fresh fruit supply is accompanied by a 2 percent reduction of canned output. An attempt was also made to examine the factors which influence total apricot production. Bearing acreage and a time variable account for about 45 percent of the variations in apricot production (equation 6.5.5). The trend variable is a substitute for yield per acre. This is justified by equation 6.5.6, which estimates the annual increase in average yield to be 3.2 bushels per acre (R^2 = 0.58).

Movements in bearing acreage could not be satisfactorily explained with the existing aggregate data. A closer examination of regional surveys based on average removal and replacement rates may permit reasonable, objective estimates of future bearing and non-bearing acreages.

67. The importance of this factor varies from variety to variety and from region to region. It would be of little importance for pineapples.

68. For example, 6 years for peaches. This figure is used as a convenient guide for Census purposes. "Bearing age" relates to a hypothetical level of yield potential which may be reached at any age from 4 to 8 years, depending on the rate of growth of the particular trees.

69. An interesting feature of equation 6. 5. 2—as compared to equation 6. 5. 1—is the rise in the coefficients (and statistical significance) of the other two variables. Equation 6. 5. 2 suggests that a £1 per ton rise in the price of fresh apricots for canning will increase canning output by 24, 500 cases, whereas the earlier equation suggested a rise of only 12, 300 cases. Non-inclusion of a trend variable may be preferable for projections, but the estimates of equation 6. 5. 1 are apparently biased downwards due to the exclusion of variable (trend) which is correlated with the residuals. In using equation 6. 5. 2 for projections it may be appropriate to assume no further decline in the proportion canned.

Table 6.5.5

SUMMARY OF REGRESSIONS - APRICOTS

Equation Number	Data Form	Independent Variable	Constant	Coefficients (and Standard Deviations) of Independent Variables				Standard Error of Estimate	R^2
				Fresh Fruit	Current Price	Trend (b)	Bearing Acreage		
6.5.1	Actual	Canned output	-580.746	0.53975 (0.234)	12.290 (4.530)			175.920	0.6237
6.5.2	"	"	698.330	0.8816 (0.1496)	24.583 (3.431)	-40.150 (7.121)		102.873	0.8794
6.5.3	Logarith-mic	" (a)	0.2940	2.1368 (0.397)	1.284 (0.193)	-3.5865 (0.739)		0.0787	0.8774
6.5.4	Actual	Percent crop canned	55.746	0.01953 (0.0067)	1.1158 (0.1538)	-1.723 (0.319)		4.6117	0.8323
6.5.5	Logarith-mic	Fresh fruit production	-2.1390			1.1327 (0.3328)	0.8324 (0.644)	0.0474	0.4526
6.5.6	"	Yield per acre	0.0914			1.1887 (0.2432)		0.0462	0.5841

(a) Logarithms to base 10.

(b) Period 1945-46 to 1963-64 where trend = 46 in 1945-46.

Source: Appendix Table A6.5.3.

Peaches: Only the States of Victoria, New South Wales, and Tasmania publish statistics on production and acreage of canning and non-canning peach varieties. Aggregated data for all Australia are unsatisfactory because of the inclusion of lower yielding freestone varieties not used in canning. Since Victoria and New South Wales produce 75 to 80 percent of Australia's canned peaches, the empirical work has been confined to peach statistics from these two States (Appendix Table A6.5.4).[70]

Canned output is almost entirely determined by fresh fruit production and current grower prices (equations 6.5.7 and 6.5.8 in Table 6.5.6). The results indicate that a consistently high proportion of the canning peach crop is delivered to the canneries. Hence the important estimate is of fresh fruit availability.

Realistic estimates of future yields must take account of the heavily biased age composition of the present peach tree population. Assuming no disturbances to a stable replacement policy, average yields should rise for a few years when most trees will be in peak production. Yield should be at least maintained until the middle 1970's. A cyclical pattern will then emerge as the trees planted in the late 1950's produce declining yields and face replacement by 1980. The extent to which technology will operate in raising yields independently of age composition is difficult to assess.

Bearing acreage will be similarly determined by the shifting age pattern, but allowance must be made for economic or other external factors likely to affect the area of new plantings during the next 10 years. The current planting rate is low. Present average net returns and the prospect of an increasingly competitive market offer no early stimulus to growers to expand. This factor and the high proportion of young trees suggest a continuation of the present low planting rate into the next decade.

70. There appears to be an overstatement of the acreage planted for canning peaches, but a bearing acreage—fresh production—canned output relationship is provided which is otherwise unavailable. For projection purposes the results can be applied to the more accurate regional surveys. Canned peach production in South Australia is briefly noted in Ch. VI 5.(a)(ii) when dried peach output in that state is examined.

Pears: The data available for pears are similar to those for peaches, but it is difficult to draw a reliable distinction between canning and non-canning varieties. Therefore, aggregated data for all pears grown in Australia were used (Appendix Table A6.5.5). The proportion of the total crop canned is now quite stable, after rising quickly to 50 percent by the mid 1950's. Using raw data (equation 6.5.10) or logarithmic transformations (6.5.11), fresh fruit and current minimum price provide excellent estimates of canned output. Inclusion of a "time" variable only served to considerably reduce the coefficients of the other variables due to its high correlation with fresh fruit production (R^2= 0.93).

Fresh fruit production has risen steadily as a result of increasing yields per acre (equation 6.5.13) which have largely obscured any dependence on bearing acreage (equation 6.5 12). After a slow decline for 15 years, bearing acreage is now increasing quickly. This growth will continue for 3 or 4 years until all trees planted in the 6 years to 1962 have reached bearing age. The pattern of expansion will be similar to that for peaches, except that peak production will not be reached until the early 1970's and will then be maintained well past 1980. New plantings are unlikely to receive any early stimulus unless it arises from the fresh fruit export market and this appears remote. Fairly sound estimates for future bearing acreage in the major canning areas should be obtained by taking account of recent trends in plantings shown in regional surveys.

Pineapples: The available data for pineapples (Table 6.5.3) are amenable to

Table 6.5.6

SUMMARY OF REGRESSIONS - PEACHES AND PEARS

Equation Number	Data Form	Dependent Variable	Constant	Coefficients (and Standard Deviations) of Independent Variables				Standard Error of Estimate	R^2
				Fresh Fruit	Current Price	Trend (b)	Bearing Acreage		
6.5.7*	Actual	Canned output	-1068.17	1.3063 (0.0980)	17.4624 (4.7140)			165.905	0.9442
6.5.8*	Logarithmic	" "(a)	-0.8529	1.1027 (0.0808)	0.3495 (0.0778)	144.213 (29.280)		0.0338	0.9491
6.5.9**	Semi-log (log trend)	Percent crop canned	-214.683		0.2782 (0.1080)			2.4987	0.9359
6.5.10**	Actual	Canned output	-1147.59	0.5690 (0.0519)	15.562			161.411	0.9685
6.5.11**	Logarithmic	" " (a)	-1.4818	1.1227 (0.1538)	0.4301 (0.0958)			0.0428	0.9611
6.5.12**	"	Fresh fruit production	-2.9599			2.5427 (0.2590)	0.5081 (0.5280)	0.0430	0.8695
6.5.13**	"	Yield per acre	-2.1857			2.6142 (0.2467)		0.0427	0.8753

(a) Logarithms to base 10.

(b) For period 1946-47 to 1963-64 where trend = 1946-47.

*Equation for peaches.

**Equation for pears.

Source: Appendix Tables A6.5.4 and A6.5.5.

regression analysis because the fruit is grown in a single, fairly uniform region with a plant life-cycle considerably shorter than that for other fruits grown for canning. As shown in Table 6.5.7, canned pineapple output depends largely on the total production of fresh pineapples (equation 6.5.14). Neither current prices actually received by growers or prices lagged one year made any significant contribution to the estimation of canned output (equation 6.5.15 and 6.5.16).[71] Similarly, current prices on the fresh retail market have little apparent influence on the disposal of the pineapple crop.[72]

The total quantity of fresh pineapples produced annually is explained almost wholly by variations in the bearing acreage and a time trend, which may be interpreted as representing the long-term rise in yield over time (equation 6.5.18). The consistency of the long-term rise in yields over time is illustrated in equation 6.5.19. Since pineapple plantations reach bearing age in 12 to 18 months, the bearing area in year t is closely related to the non-bearing acreage of the previous year ($r = 0.83$). Factors influencing removals in year t would absorb some of the remaining unexplained residual variation (30 percent).

The net return to growers during the previous 12 months is the principal factor affecting the decision whether to plant pineapples. In equation 6.5.20, the average price received for canning pineapples explains 55 percent of the yearly change in non-bearing acreage. Since the fresh retail market sales of pineapples account for a similar quantity to that sold for canning, equation 6.5.21 uses a single price variable derived by applying equal weights to the canning and fresh retail prices. The changes from the previous equation is negligible.[73] Using data in a first-difference form yielded no additional information.

(b) Dried Fruits

(i) Vine Fruits

Australia is the third largest producer of dried vine fruit after the United States and Greece. Production in this country has been fairly constant around a mean annual output of about 80,000 tons since 1947. Deviations have been more a result of yield variability than any other physical or economic factor. The bulk of this output (nearly 80 percent) is sold overseas, the United Kingdom being the principal market. The dried vine fruit pack in Australia consists mainly of sultans (75 to 80 percent), with currants and raisins in approximately equal proportions. The U.S. pack is mostly raisins, but this product is equivalent to the Australian sultana.[74] Greece, the major exporting country, packs a high proportion of currants.

In Australia, sultans are dried from sultana grapes, currants from Zante currant grapes and raisins from Gordo Blancos and Waltham Cross grapes. The major producing areas for dried fruit are on the irrigated lands adjacent to the Murray River in Victoria, South Australia and New South Wales. The most important district is Sunraysia in Victoria (65 to 70 percent of output — Table 6.5.8). Sultana grapes are the most

71. There appears to be however, a significant response by growers to the F.I.S.C.C. minimum price lagged one year (equation 6.5.17). This could be due to the greater publicity given to trends in the minimum price.

72. Curvilinear functions were also used to explain the relationship between canned output and fresh fruit, but did not provide a superior explanation to the function linear in logarithms (equation 6.5.14). Due to plant limitations, threat of over-supply or other factors, it was considered possible that canned output would approach a maximum with supplies of fresh fruit well in excess of normal.

73. Canning prices and fresh retail prices are jointly determined and their positive correlation during the post-war period is high ($R^2 = 0.93$).

74. The Australian sultana has a lighter colour than the United States raisin because of a difference in drying techniques (considered more fully in a later discussion). The Australian raisin has its U.S. equivalent in the lexia, but the latter is not seeded.

Table 6.5.7

SUMMARY OF REGRESSIONS — PINEAPPLES

Equation Number (a)	Dependent Variable	Constant	Coefficients (and Standard Deviations) of Independent Variables							Standard Error of Estimate	R^2
			Fresh Fruit	Prices paid by canneries (b)		Lagged F.I.S.C.C. Minimum Price	Trend (c)	Bearing Acreage	Average Canning Market Price (lagged) (d)		
				Current	Lagged						
6.5.14	Canned output 1948-49 to 1963-64	-3.4084	1.8058 (0.1663)							0.0999	0.8805
6.5.15	"	3.1473	1.6634 (0.2325)	0.1725 (0.2583)						0.1102	0.8259
6.5.16	"	-3.0094	1.6028 (0.2442)		0.2298 (0.2414)					0.1082	0.8321
6.5.17	Canned output 1946-47 to 1963-64	-3.0633	1.4291 (0.1784)			0.7195 (0.2271)				0.0798	0.9284
6.5.18	Fresh fruit 1946-47 to 1963-64	-3.9289					1.7228 (0.1894)	1.1460 (0.1055)		0.0254	0.9731
6.5.19	Yield per acre 1946-47 to 1963-64	-0.6509					1.8878 (0.1512)			0.0262	0.9069
6.5.20	Non-bearing acreage 1948-49 to 1963-64	2.7063			0.6015 (0.1521)					0.0750	0.5461
6.5.21	"	2.6578							0.6363 (0.1562)	0.0738	0.5607

(a) All functions fully logged to base 10.
(b) Refers to the average price paid to the grower (at grower's rail-siding).
(c) Trend = 47 in 1946-47.
(d) Market price refers to the average price of fresh pineapples at the Brisbane Wholesale Markets.

Sources: Tables 6.5.3 and 6.5.4.

Table 6.5.8

PERCENTAGE DISTRIBUTION OF DRIED VINE FRUIT PRODUCTION IN THE MAJOR VINE-GROWING AREAS OF AUSTRALIA, 1946—47 TO 1963—64
(percent)

Year	Sunraysia	Mid-Murray	South Australia	Western Australia
1946—47	69	7	16	8
1947—48	65	10	21	4
1948—49	68	7	20	5
1949—50	73	7	16	4
1950—51	62	8	25	5
1951—52	68	11	16	5
1952—53	61	10	26	3
1953—54	63	10	25	2
1954—55	70	7	20	3
1955—56	51	16	29	4
1956—57	66	14	17	3
1957—58	67	13	18	2
1958—59(a)	66	13	20	1
1959—60(a)	69	12	17	2
1960—61(a)	69	14	14	3
1961—62(a)	69	14	15	2
1962—63(a)	66	13	19	2
1963—64(a)	68	13	17	2

(a) Estimated percentages from the Commonwealth Bureau of Census and Statistics.

Sources: Bureau of Agricultural Economics, The Economics of Dried Vine Fruit Production in the Sunraysia District, 1958—59 (Canberra, 1960), Table No. 2.
Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I — Rural Industries (Canberra), 1958—59 to 1961—62.
Commonwealth Bureau of Census and Statistics, Statistical Bulletin), The Fruit Growing Industry, No.'s 19 and 20 (Canberra), 1962—63 and 1963—64.

important variety, but most properties also grow drying grapes for currants or raisins. Many farmers are engaged solely in vineyard operations; others conduct a diversified range of enterprises including stone fruit, citrus, and livestock.[75]

A hundred miles to the south-east, Swan Hill is the centre of the Mid-Murray grapegrowing district which produces about 15 percent of dried vine fruit (including a small quantity from the M.I.A. in New South Wales). Sultanas, currants, and raisins are produced on the Mid-Murray properties, but there has been some decline in sultana production due to the unreliability of the drying weather. Dried output as a whole however, is being maintained. Yields are nearly as high as in Sunraysia. One significant point of comparison is that the Mid-Murray region contains nearly twice the Sunraysia acreage of wine grapes.

South Australia is the major vine-producing State in the Commonwealth, but 15 to 18 percent of the total dried vine fruit production comes from the Renmark-Berri region near the Victorian border. Yields for drying grapes are lower than in Sunraysia and in the Mid-Murray. This is partly due to the heavier soil type in the regions which is less suited to grapes than are the lighter Mallee soils of Sunraysia. Another factor reducing the average yield is that only about 70 percent of the vineyards in the district are irrigated. Few raisins are produced in South Australia, but currant output is relatively high and represents nearly 40 percent of the Australian currant production. "Specialist" vineyards are common in South Australia, but grapes are also grown on properties with stone fruit or citrus.

Grape yields have fluctuated considerably but the general trend in post-war years has been upwards. An important contributing factor was the increase in the area (and proportions) of vines grown under irrigation.[76] Annual variation in average yields is largely a function of weather (frost, hail, and rain incidence in particular). Another cause is the tendency of some varieties, particularly sultanas, to bear a heavy crop one year and a lighter crop in the following year. Yield variation occurs between varieties[77] and also within a particular variety according to the purpose of growing the grapes. For example, sultanas grown for drying require a high sugar content and those grown for table consumption should be a large grape and uniform bunch, while sultanas for wine making are cultured to produce the greatest possible bulk crop. This type of differentiation is necessary for all dual-purpose grapes. A factor influencing the yield of dried fruit per acre is the sugar content of the grapes. Sultanas grown in the Sunraysia district have a high sugar content and fewer fresh grapes are required to produce a ton of dried sultanas.[78] In general, fresh weight yields of drying grapes from Sunraysia average 7 tons per bearing acre, from the Mid-Murray district close to $6\frac{1}{2}$ tons, and between 5 and 6 tons in the Murray Valley of South Australia. Yields for the fresh market are much lower, while wine grapes come from a large number of varieties with a wide yield variation.

75. Bureau of Agricultural Economics, The Economics of Dried Vine Fruit Production in the Sunraysia District, 1958-59 (Canberra) Part II.

76. In the long run, vines watered by flood irrigation have a shorter productive life. However, this is compensated by the quicker maturity of young vines and the higher average yields harvested.

77. Gordos are a high yielding variety, and the increased plantings of these grapes have been partly responsible for the rise in average annual yields.

78. From Table 6.5.9, the average ratio of fresh weight to dry weight is 3.90 to 3.95. Apart from regional variation, this ratio also varies from season to season. Conversion rates of 3.75 and 3.25 have been used for sultanas and gordos respectively by the Bureau of Agricultural Economics in their 1963 survey of the dried vine fruit industry. These figures are at variance with our own findings from aggregated data, and may only be appropriate for selected properties.

Table 6.5.9

ANNUAL BEARING ACREAGE AND PRODUCTION OF GRAPES FOR DRYING, AND THE OUTPUT OF DRIED FRUIT, AUSTRALIA, 1946—47 TO 1963—64

Year	Bearing Acreage	Production of Grapes for Drying	Grape Yield per Bearing Acre	Total Dried Vine Fruit Output	Dried Fruit Yield per Bearing Acre	Fresh Grapes to Produce 1 Ton Dried Fruit
	acres	tons				
1946—47	57259	254484	4.44	65197	1.14	3.90
1947—48	59206	322381	5.45	84828	1.43	3.80
1948—49	56473	252906	4.25	64904	1.15	3.90
1949—50	55478	256672	4.63	67856	1.22	3.78
1950—51	58800	222300	3.78	56127	0.95	3.96
1951—52	54797	184334	4.95	71965	1.25	3.95
1952—53	60903	382048	6.27	100733	1.65	3.79
1953—54	64157	348151	5.43	89915	1.40	3.87
1954—55	64799	324568	5.01	80752	1.25	4.02
1955—56	63534	238175	3.75	58871	0.93	4.04
1956—57	59692	312633	5.24	79857	1.34	3.91
1957—58	60483	348869	5.77	90554	1.50	3.85
1958—59	61088	343627	5.62	87256	1.43	3.94
1959—60	59845	278118	4.64	69790	1.17	3.98
1960—61	56128	324959	5.79	81652	1.45	3.98
1961—62	56624	380033	6.71	96498	1.70	3.94
1962—63	58683	281549	4.80	70508	1.20	3.99
1963—64	58967	407335	6.19	102983	1.75	3.95

Sources: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I — Rural Industries (Canberra), 1946—47 to 1961—62.
Commonwealth Bureau of Census and Statistics, Statistical Bulletin, The Fruit Growing Industry, No.'s 19 and 20 (Canberra), 1962—63 and 1963— 64.

A large part of the total Australian acreage of vines consists of dual-purpose varieties. Of these, sultanas are the most important; they are widely grown for drying, winemaking or, to a lesser extent, for table grapes. Similarly, gordos are grown for raisin or wine production, and malagas are extensively grown for table grapes, as well as raisins. Some growers take advantage of the choice available and vary the disposal of their crop among the different types of markets.[79]

The choice of product, dried fruit, wine, or fresh fruit production, depends on the relative market prospects, current returns from processors, seasonal conditions and the size of the harvest. An important factor favouring sale to wineries is that payment is made in cash, whereas growers delivering to drying sheds receive only a proportion of their ultimate return at the time of delivery. The remainder is determined by the sales of the dried fruit, and is paid by instalments. Further, growers drying their grapes have the additional risk of adverse weather during the drying.

Lack of drying facilities or absence of a nearby winery or packing shed make it impracticable for many growers to exercise any choice of outlet for their crop. However, evidence of diversion of vines from one purpose to another is provided by the offsetting shifts in bearing acreage of grapes for wine and grapes for drying which have occurred since 1949 (Table 6.5.10). Again, "between 1957 and 1963 the quantities of dual-purpose varieties processed by wineries fluctuated between 37,300 and 91,300 tons, and accounted for between 29 percent and 46 percent of the total quantity of grapes purchased by wineries".[80] Corresponding figures are not available from drying processors, but the output fluctuations cannot be explained solely by yield variation.[81] The tendency to supply different markets and to change the direction of disposal of grapes is particularly marked in South Australia. A 1963 survey of the dried vine fruit industry showed that in the 3 years to 1962 — 63, an average of 37.6 percent of cash receipt of dried vine fruit farmers in South Australia was from the sale of grapes to wineries, compared with 49.9 percent from the sale of dried fruit.[82]

Prices received by growers for their dried fruit are entirely determined by the sale of the product on the wholesale market. On delivery to the packing shed an initial "shed-door" payment of about $60 per ton (dry weight) is received from the agent. This is approximately 25 to 30 percent of the estimated final price.[83] Subsequent monthly payments are usually between $10 to $20 per ton. The size of the monthly instalment and the period over which payment is received for one season's crop depends on the time taken by agents to dispose of the crop on the domestic and export markets; growers have waited up to 2 years to receive final payment.

The domestic marketing of dried fruit is administered by the Australian Dried Fruits Association (A.D.F.A). A two-price scheme operates in which domestic prices are fixed above export parity. By placing a quota on domestic sales, all growers and processors are assured an equal share of the alternative markets. Returns from all markets are equalised. The prices shown in

79. The Commonwealth Bureau of Census and Statistics classify vines as drying, table or wine varieties, according to post-harvest data. Thus, vines included under "used for drying" one year, may be listed under "used for wine" the following year if there was in fact, a change in use. Pruning, thinning and other cultural practices are varied to promote the desired characteristics required for a particular usage.

80. N.D. Honan, "The Outlook for the Wine Grape Industry: Australia", Quarterly Review of Agricultural Economics, Vol. 17, No. 3 (July 1964), p. 141.

81. N.D. Honan, loc. cit.

82. Bureau of Agricultural Economics, A Survey of the Dried Vine Fruit Industry, 1963 (Canberra).

83. The "shed-door" payment has varied between agents during the last few years, depending on their ability to make larger cash payments.

Table 6.5.10

BEARING AND NON-BEARING ACREAGE OF VINES GROWN FOR PURPOSE OF DRIED FRUIT, WINE OR TABLE USE, AUSTRALIA, 1946—47 TO 1963—64
(Acres)

Year	Dried Fruit		Wine		Table Use		Total	
	Bearing	Non-Bearing	Bearing	Non-Bearing	Bearing	Non-Bearing	Bearing	Non-Bearing
1946—47	57259	2191	58215	3096	8348	1203	123819	6490
1947—48	59206	3320	56095	4412	8076	1222	123374	8948
1948—49	56473	4562	58939	5604	8318	1376	123721	11541
1949—50	55478	4100	59279	6986	8170	1378	122917	12464
1950—51	58800	4755	57796	5991	7913	1249	124509	11995
1951—52	57497	4204	60724	5042	7172	1066	125393	10312
1952—53	60903	6124	56227	4696	7722	946	124852	11766
1953—54	64157	5146	55262	4679	7839	1029	127258	10854
1954—55	64799	4380	54265	3913	8097	1031	127161	9324
1955—56	63534	3797	54633	2944	8965	928	127132	7669
1956—57	59692	3612	56055	2693	8636	933	124383	7238
1957—58	60483	3138	55877	2527	8172	840	124532	6505
1958—59	61088	2781	54542	3073	8226	1016	123856	6870
1959—60	59845	2391	54838	3948	8161	1070	122844	7409
1960—61	56128	2229	56918	5300	8745	1188	121791	8717
1961—62	56624	2506	57044	6831	8441	1322	122109	10659
1962—63	58683	2874	54750	5287	8547	1407	121980	11574
1963—64	58967	2922	56146	7559	8794	1412	123907	11893

Source: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I — Rural Industries (Canberra), 1946—47 to 1961—62.
Commonwealth Bureau of Census and Statistics, Statistical Bulletin, The Fruit Growing Industry, Nos. 19 and 20 (Canberra), 1962—63 and 1963—64.

Table 6.5.11

RETURNS TO GROWERS FOR GRAPES GROWN FOR DRYING (SUNRAYSIA) AND WINE MAKING (SOUTH AUSTRALIA), 1949—50 TO 1964—65
($'s/ton dry weight or fresh weight)

Year	Sultanas		Gordos		Currants	All Dried Vine Fruit (dry wt.) (b)
	Drying (dry wt.)	Wine-making (fresh wt.)	Drying (dry. wt.)	Wine-making (fresh wt.) (a)	Drying (dry wt.)	
1949—50	135.20	n.a.	144.34	n.a.	128.98	133.74
1950—51	220.82	n.a.	213.52	n.a.	182.68	209.36
1951—52	207.70	48.00	215.00	52.00	183.44	204.48
1952—53	199.30	28.00	188.58	34.00	174.74	193.84
1953—54	184.16	30.00	134.12	30.00	157.60	172.42
1954—55	184.44	30.00	127.82	30.00	188.24	178.62
1955—56	200.68	30.00	141.26	30.00	187.84	193.36
1956—57	230.94	33.00	179.36	30.00	202.68	223.66
1957—58	255.42	35.00	202.38	32.00	222.82	246.22
1958—59	255.36	35.00	252.42	32.00	224.60	251.12
1959—60	226.18	36.00	219.54	34.00	236.26	226.40
1960—61	229.66	40.00	202.00	38.00	200.60	222.68
1961—62	192.68	40.00	201.92	39.00	232.84	196.68
1962—63	232.14	38.00	219.34	38.50	240.10	230.18
1963—64	238.60	40.00	232.50	40.00	236.50	237.30
1964—65	n.a.	40.00	n.a.	40.00	n.a.	n.a.

n.a. Not available.

(a) Approximately $ 12 per ton more is paid for gordos from non-irrigated vineyards.

(b) Estimated values for dried vine fruit returns.

Sources: Australian Dried Fruits Association, private communication.
Wine Grapegrowers' Council of South Australia, private communication.

Table 6.5.12

PRODUCTION OF SULTANAS, RAISINS AND CURRANTS, AUSTRALIA, 1946 — 47 TO 1963 — 64
(tons)

Year	Sultanas	Raisins and Lexias	Currants	Total Vine Fruit
	(a)			
1946—47	51703		13494	65197
1947—48	66006		18822	84828
1948—49	46831		18073	64904
1949—50	54099		13757	67856
1950—51	40698		15429	56127
1951—52	60319		11646	71965
1952—53	83437		17296	100733
1953—54	76044		13870	89915
1954—55	69538		11164	80752
1955—56	45524		13347	58871
1956—57	69329		10578	79857
1957—58	78762		11787	90554
1958—59	67458	8580	11268	87256
1959—60	51430	10321	8039	69790
1960—61	60908	7673	13091	81672
1961—62	79849	8842	7807	96498
1962—63	56049	7628	6831	70508
1963—64	83157	8448	11378	102983

(a) Statistics before 1959 do not distinguish between raisns and sultanas.

Sources: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I — Rural Industries (Canberra), 1962—63 and 1963—64.

Table 6.5.11 are an average for the Sunraysia district, but they adequately reflect payments made by packing sheds in other districts. Prices paid are net of packing shed charges. The Dried Fruits Control Board is responsible for the marketing of dried vine fruits overseas. The primary implement of control is the machinery of export licensing.

Production costs of dried fruit in Australia are high and the industry's ability to successfully compete on the world market is possible by the two-price scheme and the existence of commonwealth preferences — particularly in the United Kingdom and Canada which at present receive close to 90 percent of the exported crop.[84] Numerous factors contribute to the industry's relatively high costs. Wages are high, compared with Turkey and Greece, while the cost of mechanization is high in comparison with the United States. The most important factor however, is the need to use more elaborate drying techniques because climatic conditions are too uncertain.[85] Fixed capital costs are high in Australia's major dried grape regions because extensive irrigation is required. Irrigation costs are higher than in California, whereas Turkey and Greece rely on natural rainfall. Geographical location of packing sheds at some distance from the coast are an additional disadvantage. Relative to the other major producing countries of the world, none of these cost factors is likely to change significantly in the near future.

A 5-year Stabilisation scheme which was adopted in 1964 will provide Federal Government financial support for the dried fruits industry, in the event of net returns to growers falling to the estimated costs of production for each variety, less \$10 per ton.[86] The support was sought in view of the industry's present reliance on protective trading measures and the expected subsidised exports from some competing countries.

Production of dried vine fruit can be accurately estimated from a given quantity of fresh grapes. The ratio of fresh grapes to dried output in recent years has been fairly constant around 3.95 but before 1959 the ratio fluctuated between 3.78 and 4.04. Comparing movements in the ratio with per acre yields suggests that the ratio is higher when crops are lighter. This is probably due to the higher water content of grapes from a light crop. The other factor contributing to year-to-year variation in the fresh fruit to dried fruit ratio is the sugar content. This depends on climatic factors rather than crop size. Future ratios can be expected to fluctuate between 3.95 and 4.00. This figure is higher than the average for the early post-war years because of the increased proportion of vineyards using irrigation. Data are not available to permit estimation of fresh-to-dry conversion ratios for the individual kinds of dried fruit.

Total output of dried vine fruit since World War II has shown only a slight tendency to rise. Of the individual fruits, average currant production is now definitely lower

84. The United Kingdom tariff preference for currants is £2 per ton, and for sultanas and raisins, £8. 10. 0 per ton. The Canadian preferences are high at 3 cents per lb (£31 per ton) for raisins (≡ sultanas) and 4 cents per lb (£41 per ton) for currants.

85. "In Australia, sultanas are packed, dipped, placed on covered racks, 'finished off on hessian in the sun, then filled into sweat boxes. In California, for instance, grapes are picked from the vines and thrown on paper trays, left to dry in the sun and then placed in sweat boxes. " (Department of Primary Industry, "Export Marketing of Dried Vine Fruits", Canberra, 1960, p. 3).

86. That is, the Government guarantees returns to the grower will be above the estimated cost of production in that year, less \$10 per ton. Costs in 1964 for example were estimated at \$218. 50 per ton for sultanas, \$227. 00 for currants, and \$202 for raisins. Growers contribute to a stabilisation fund when returns exceed these costs by \$10 per ton, but individual contributions cannot exceed \$20 per ton. The fund has a ceiling of \$1 million for currants and raisins, and \$4 million for sultanas. Grower contributions are not required for a particular fund when the crop concerned is below a prescribed minimum—50, 000 tons of sultanas, 8, 000 tons of currants, 6, 000 tons of raisins. Conversely, maximum quantities eligible for guarantee purposes are 75, 000 tons, 13, 000 tons and 11, 000 tons respectively.

than 15 years ago and the decline is expected to continue, particularly in Eastern Australia, because of the difficulty experienced in producing a good quality product. Separate data for raisin and sultana production are only available since 1960 (Table 6.5.12). Raisin production has been fairly constant, whilst sultana production has increased, probably because if its greater suitability to environmental conditions.[87]

The quantity of fresh grapes available for drying depends on the crop yield, bearing acreage and the decision of growers in selecting the outlet for disposal of their crop. Grape yields from drying varieties have fluctuated considerably during the post-war years, but there is an indication of a gradual upward trend in yield per bearing acre (Table 6.5.9). Only 27 percent of yield variation is explained by a trend factor, but the coefficient is statistically significant and indicates an annual yield increase of just under 0.1 tons of fresh grapes per bearing acre:

$$(6.5.24)\quad Y_t = 0.3818 + \underset{(0.0360)}{0.0878}\, t \qquad (S_{Y \cdot t} = 0.793,\ R^2 = 0.270),$$

where Y_t = yield of fresh grapes per bearing acre in year t (in tons),

t = trend factor for period 1946—47 to 1963—64, t = 47 in 1946—47.

The function was repeated using a 3-year moving average of yield (Y_t) as the dependent variable. The method eliminated the extreme variability of the yield data and the results do not contradict those obtained from equation 6.5.24:

$$(6.5.25)\quad Y_t = 0.3374 + \underset{(0.0198)}{0.0867}\, t \qquad (S_{Y \cdot t} = 0.364,\ R^2 = 0.579).$$

where t = 48 for 3-year period 1946—47 to 1948—49.

Bearing acreage has fluctuated over a small range since World War II, but the trend, if any, has been slightly downwards. Since bearing acreage data of vines used for drying purposes are collected from post-harvest statistical returns, changes in bearing acreage depend not only on removals and previous plantings, but also on the diversion of dual-purpose varieties from one use to another. Although returns are not fully realised until 1 or 2 years after the crop is harvested, current price appears to be the factor most likely to indicate the effect of returns on grape disposal. In the post-war period some short-run movements in bearing acreage of vines for drying have been due to changes in current prices paid for dried vine fruit and by wineries (Tables 6.5.10 and 6.5.12). For example, it is very likely that the drop of 3,700 acres in bearing area of drying grapes from 1959—60 to 1960—61, can be partly attributed to the rise in price offered by the wineries and a corresponding decline in market prospects for dried grapes. In 1962—63 a movement in the opposite direction occurred. At the beginning of the season, wineries indicate to individual growers the quantity of grapes they will take during the forthcoming harvest. Growers may dry the remainder, or possibly market some as fresh fruit. Diversion of grapes to drying purposes by "normal" wine group growers is less likely because of the cost of constructing drying racks, the tedious drying technique, and the uncertainty of final returns.

Economic factors influencing non-bearing acreage are difficult to assess without a knowledge of annual plantings of grape vines. The data in Table 6.5.9 fail to show any marked response by growers to movements in returns for drying grapes. Any influence that exists appears to lag 2 or 3 years. Two important factors are probably responsible. First, the dried fruit industry has for many

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87. The high cost of installing the necessary seeding machines has also affected the output of raisins. This is undertaken by distributors rather than packing sheds.

years had an uncertain future because of its dependence on export sales in a highly competitive international market. Satisfactory clearances of the dried fruit crop have only been possible through the continued protection of Commonwealth tariff preferences. Second, vines have a long productive life (30 to 40 years) hence replacement tends to be a long-term decision. Some informal control of growers in the industry is exercised by the A.D.F.A. This factor has limited the expansion of drying vines on established properties. It is doubtful whether growers would co-operate to the same extent in the event of more favourable circumstances. The availability of irrigation facilities and supplies has not been responsible for any restriction in acreage expansion. With the approaching completion of the Snowy Mountains Hydro-Electric Scheme,[88] irrigation water supplies will not be a limiting factor in the next 10 to 15 years.

(ii) Tree Fruits

During World War II dried fruits were in strong demand from the armed services. Their production offered an outlet for fresh fruit normally destined for export, especially apples and pears. The return of peacetime conditions brought a fall in demand and improved markets for canning and fresh fruits. (One exception was prunes, for which there are few alternative markets).

In comparison to vine fruits, tree fruit drying is a minor sector of the total fruit industry. Domestic requirements absorb about 60 percent of total output and the rest is exported. (These exports account for a negligible share of the world trade in dried tree fruits). Prunes and apricots are the principal fruits used for drying while apples, peaches, and pears are dried in relatively smaller quantities. Figs and nectarines contribute less than half of 1 percent to the total output (Table 6.5.13). Prices received by growers are determined in a manner similar to that for vine fruits. Proceeds of sales to domestic and overseas markets are pooled to obtain an equalised return for all growers.

Prunes: Quantitatively, the prune is the most important of Australia's dried tree fruits. Most production is in New South Wales, from the Young district (240 miles west of Sydney) and from the Murrumbidgee Irrigation Area. Of the 2,484 acres of bearing trees (in early 1964) at Young, most are over 40 years old, but production from these trees continues to rise. There are only 273 acres of non-bearing trees. In contrast, the M.I.A. has 928 bearing acres of comparatively younger prune trees, and 653 acres of non-bearing trees. Most trees in the M.I.A. are irrigated, but at Young the majority of properties rely on natural rainfall.

A number of alternative outlets exists for the prunes, but none are of any consequence compared to the dried product. Only rarely, when plums are in short supply (e.g., in Brisbane in 1963), are returns to prune growers sufficient to warrant marketing the largest of their prunes on the fresh fruit market. Normally a prune is too small for the fresh fruit market. Jam factories purchase a few prunes and a small tonnage is used for prune nectar, but the price paid is only a little better than that paid for the lowest grade dried product. Plum brandy distilleries use dehydrator waste and rejected fruit for which they pay only a nominal price.

Due to a sharp rise in yield per acre, the last 5 years have seen a marked increase in the total production of fresh prunes (Table 6.5.14). Prior to 1960 there had been no evidence of any sustained upward trend of average yield. Whether yields will increase beyond present levels is uncertain; however,

88. The Snowy Mountains Hydro-Electric Scheme is an extensive project to divert eastward flowing water in the Alps to a westward course by a system of tunnels which eventually distribute the water into the Murrumbidgee and Murray Rivers.

Table 6.5.13

PRODUCTION OF DRIED TREE FRUITS, AUSTRALIA, 1941—42 TO 1963—64
(tons)

Year	Apricots	Apples	Figs	Nectarines	Peaches	Pears	Prunes (a)	Total
Average								
1941—42 to 1945—46	1411	1658	77	28	457	329	2722	6682
1946—47	1292	1357	42	12	379	318	1983	5383
1947—48	1002	1443	117	65	583	179	3232	6621
1948—49	1088	1043	46	53	409	322	2004	4965
1949—50	1040	263	44	23	286	136	2285	4077
1950—51	881	760	47	23	321	152	2825	5009
1951—52	620	871	32	19	236	116	2455	4349
1952—53	997	609	72	37	334	98	3469	5616
1953—54	1437	1154	63	71	624	139	3912	7400
1954—55	1665	659	15	48	562	61	2449	5460
1955—56	1257	760	43	34	290	50	2905	5339
1956—57	1163	448	46	23	154	32	2398	4264
1957—58	709	409	67	57	588	152	2820	4802
1958—59	2035	420	62	72	1042	146	3273	7050
1959—60	1983	250	63	55	750	264	3789	7154
1960—61	1936	423	29	21	131	44	4354	6938
1961—62	1674	529	16	37	569	212	3325	6361
1962—63	2220	358	12	41	670	448	5284	9033
1963—64	2334	312	23	24	791	277	4825	8586

(a) Includes a small percentage of dried plums.

Sources: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I - Rural Industries (Canberra), 1946—47 to 1961—62.
Commonwealth Bureau of Census and Statistics, Statistical Bulletin: The Fruit Growing Industry, Australia, No. 20 - Season 1963—64 (Canberra).

Table 6.5.14

ACREAGE, PRODUCTION, YIELD PER ACRE AND PRICE OF PRUNES FOR DRYING: NEW SOUTH WALES, VICTORIA AND SOUTH AUSTRALIA[(a)]: 1946—47 TO 1963—64

Year	Area of Prunes		Production of fresh prunes (b)		Production of Dried Prunes	Ratio of Fresh Prunes to Dry Prunes	Prices Paid Grower $/ton Dry Weight (c)
	Bearing	Non-bearing	Total	per bearing acre			
	acres		tons				
1946—47	3885	679	6974	1.80	1983	3.52	
1947—48	3697	716	12794	3.46	3232	3.96	
1948—49	3658	729	7025	1.92	2004	3.50	
1949—50	3360	822	6948	2.07	2285	3.04	
1950—51	3391	860	9769	2.88	2825	3.46	
1951—52	3280	797	7512	2.29	2455	3.06	
1952—53	3380	802	9642	2.85	3469	2.78	349.24
1953—54	3483	783	11641	3.34	3912	2.97	274.70
1954—55	3549	751	8205	2.31	2449	3.35	185.30
1955—56	3549	782	9000	2.54	2905	3.10	231.18
1956—57	3511	670	7205	2.05	2398	3.00	338.86
1957—58	3509	777	8589	2.45	2820	3.04	344.42
1958—59	3441	677	9410	2.73	3273	2.87	336.76
1959—60	3484	718	10717	3.08	3789	2.82	273.38
1960—61	3484	805	12512	3.59	4354	2.87	304.10
1961—62	3515	812	9820	2.79	3325	2.95	336.12
1962—63	3423	795	14153	4.13	5284	2.67	(d)
1963—64	3463	712	12000	3.46	4825	2.48	(d)

(a) Only a few prunes are grown in other Australian States and they are not used for drying purposes.

(b) Estimated from data published in bushels, fresh weight (assuming 1 ton = 39 bushels).

(c) Prices quoted are those fixed by the A. D. F. A. for "B" grade D'Agen prunes, net of dehydration charges. No prices available prior to 1952–53.

(d) Pool not finalised, but expected to be lower than 1961 – 62.

Sources: Commonwealth Bureau of Census and Statistics, Statistical Bulletin: The Fruit Growing Industry, Australia, Nos. 3-20 — Seasons 1946—47 to 1963—64 (Canberra).
Prices obtained from private communication with Mr. R. Sweedman of the N.S.W. Department of Agriculture at Young.

yields attainable from irrigated Californian prune orchards suggest that a further rise in yields is at least possible.

The proportion of the total prune crop which is dried has probably risen since the war. The quantity of fresh prunes used for drying each year is not known, but on the average $2\frac{1}{2}$ tons of fresh prunes are required to produce 1 ton of the dried product. The general trend of the fresh to dried prune ratio (Table 6.5.14) has been downwards, suggesting that an increased proportion is being used for drying purposes. In 1963—64 this ratio was 2.5, implying virtual total use of the prune crop for drying.[89] This factor and the rise in average yields have been jointly responsible for the recent rapid increases in output of dried prunes. Because of the lack of alternatives, it appears unlikely that current returns for prunes have much short-term influence on the quantity of prunes available for drying. The response of supply to price is also weakened by the uncertainty of the final return.[90]

Detailed figures for annual plantings of prune trees are not available, but the small year-to-year changes in total non-bearing acreage gave little indication of any observable long-run price effect on prune tree replacement policy. Tree removals are another indicator of price response. The decline in total bearing acreage in the early post-war years reflected the decreased demand for dried tree fruits. This was common to all tree fruits, but growers of other fruit varieties were able to divert their fruit to alternative uses. That prune growers endeavoured to do the same is shown by the high fresh prunes to dried prunes ratio of the late 1940's.[91]

Apricots: Virtually all of Australia's dried apricots are packed in the Renmark-Berri region of South Australia.[92] In that State the quantity of fresh apricots dried is now 5 to 6 times the amount used for canning. Unlike prunes, the quantity of apricots available for drying is determined to a large extent by the alternative returns offered by the canning and fresh fruit markets. Apart from relative prices, the production of dried apricots is affected by the size of the apricot harvest, the amount of labour available for drying,[93] and weather conditions.

In Table 6.5.15 the quantity of South Australian apricots distributed among the several outlets has been estimated by converting the processed products back to a fresh fruit base.[94] The amount passing through the fresh retail market and used for jam, glaceeing, etc., is expressed as a residual between total production and the

89. The conversion ratio of 2.5 for fresh fruits to dried fruit is only an approximation. The figure varies slightly between regions and from year-to-year.

90. In August 1965, the pool was still to be finalised for the 1963 crop, a lag of $2\frac{1}{2}$ years.

91. Some estimates of future acreage trends for the M.I.A. to 1974-75 are given in B. Owen French, op. cit. No extension at Young is foreseen in the immediate future. In fact, bearing acreage at Young should soon decline with the eventual replacement of a large number of old trees.

92. Victoria and New South Wales were important producers during and after the war, but output from these two States has almost ceased (Appendix Table A6.5.6). One reason for the specialisation in South Australia is provided by the more reliable drying weather.

93. At present all fruit for drying is cut by hand. An important technological advance will be the development of an efficient mechanical cutter which will handle fully ripe, soft fruit. Such a machine will eliminate labour requirements and thereby greatly reduce the cost of drying.

94. Assuming 1 ton of dried apricots is equivalent to 5.5 tons of the fresh fruit and 68 standard cases of canned apricots is produced from 1 ton of fresh apricots.

Table 6.5.15

TOTAL PRODUCTION, DISPOSAL AND INDEXED PRICES FOR APRICOTS, SOUTH AUSTRALIA, 1946—47 TO 1963—64

Year	Quantity of Fresh Apricots:(a)				Index of Price Received by Growers (b)	
	Dried	Canned	Consumed Fresh, etc.	Total	Dried	Canned
	tons					
1946—47	6627	970	2423	10020	84.9	87.1
1947—48	4922	1073	4145	10040	91.3	97.4
1948—49	5197	2029	2752	9978	101.1	102.5
1949—50	4592	2543	2181	9326	122.7	112.8
1950—51	4372	2896	3769	10847	155.9	133.3
1951—52	2942	4336	3743	11021	194.5	205.1
1952—53	5142	3587	2814	11543	195.3	215.3
1953—54	7067	6174	1976	15217	193.4	225.6
1954—55	8800	2278	1943	13021	175.2	205.1
1955—56	6765	5851	1797	14413	188.0	230.7
1956—57	6325	6880	3642	16847	196.5	230.7
1957—58	3822	2778	4400	11000	234.1	230.7
1958—59	10890	1441	3189	15520	217.3	179.4
1959—60	10720	720	3733	15173	192.4	153.8
1960—61	10532	2050	3852	16434	220.7	194.8
1961—62	9130	3510	4881	17521	223.7	220.5
1962—63	12127	3191	3551	18869	224.6	220.5
1963—64	12787	1955	4452	20195	(c)	220.5

(a) Columns estimated by using the following conversion rates: 1 ton dried apricots = 5.5 tons fresh apricots; 68 standard cases of canned apricots = 1 ton fresh apricots; 46 bushels of fresh apricots = 1 ton fresh apricots. Quantity consumed fresh, etc., was calculated as a residual.

(b) Average of 4 years to 1949-50 = 100.

(c) Not available.

Sources: Production figures as for Table 6.5.14.
Price index for dried fruit is calculated from price information supplied by the Renmark Fruit Growers, Co-op. Ltd. The index for canned fruit is derived from the minimum F.I.S.C.C. price to be paid growers (Table 6.5.4).

quantity used for drying and canning.[95] The response of fruit growers to changing returns from the respective markets is estimated in equations 6.5.27 and 6.5.28. Prices used were the current F.I.S.C.C. minimum prices for canned apricots and the equalised return for dried apricots lagged by 2 years to allow for the period before growers are certain of their returns from the dried market. Further, changes in fruit disposal may also be affected by the change in total quantity available.

The results are given below:

$$(6.5.27)\quad \log Y_1 = -1.06643 + \underset{(0.2634)}{0.90204} \log X_1 - \underset{(0.2348)}{1.18126} \log X_2 + \underset{(0.2991)}{1.34939} \log X_3 \qquad R^2 = 0.9116$$

$$(6.5.28)\quad \log Y_2 = -1.22067 - \underset{(0.5296)}{2.48655} \log X_1 + \underset{(0.4718)}{2.87953} \log X_2 \ \underset{(0.6010)}{0.88251} \log X_3 \qquad R^2 = 0.7814,$$

where Y_1 = quantity of fresh apricots used for drying in South Australia,
Y_2 = quantity of fresh apricots used for canning in South Australia,
X_1 = index of price received for dried apricots lagged 2 years,
X_2 = index of minimum F.I.S.C.C. price for canning apricots,
X_3 = total harvest of apricots in South Australia, for 1948—49 to 1963—64.

All the elasticity coefficients are highly significant and the measure of explanation provided by the variables is fairly high.[96]

Peaches: Australian production of dried peaches is also confined largely to South Australia, although Victoria was a prominent producer until the mid-1950's. Yellow freestone peaches (mainly the Elberta variety) are used for drying and growers are able to choose from three principal outlets—canning, fresh retail markets, and drying.[97] No change is foreseen in the relative importance of the fresh-fruit retail market. The fruit is not popular with the canneries, and growers at present receive $26 per ton less than for cling peaches. Their use for this purpose is declining.[98] Returns for drying peaches have been adequate to encourage a short-run increase in the output of dried peaches, but insufficient to ensure a long-term expansion of the industry.

An accurate estimate of the factors responsible for the year-to-year changes in dried peach output is virtually impossible due to a lack of data to indicate the total quantity of yellow freestones produced annually. In terms of total peach crop, 27 percent were used for drying in 1963—64. Using total peach production (X_3) as an independent variable, output of dried peaches (Y) shows a clear response to changes in prices (lagged 1 year) offered by dried fruit packers (X_1) and current cannery prices (X_2):

95. The fresh market sales of apricots are extremely variable, but usually range from 5 to 15 percent of the total crop. The fresh market is considered unlikely to achieve importance. [South Australian Department of Agriculture, Trends in Stone Fruit (Adelaide, 1965)]. A not inconsiderable quantity of fresh apricots is processed for juice or nectar production. In the 1964-65 season, 750 tons of fresh apricots in the Berri district were so processed. This is an expanding outlet for apricots and should become an increasingly important alternative market for apricot growers. Most growers prefer to dry the greater proportion of their crop, and use the alternative disposals as occasion demands.

96. An analysis of the data in first-difference form also gave a very satisfactory estimate of the factors affecting year-to-year change in the quantities used for drying. However, apart from the fact that the use of first-differences were not necessary—the residuals of the original equation were not autocorrelated—the first-difference estimates are less suitable for long-range forecastings.

97. Yellow freestone peaches are also used for nectar production, but the tonnage is relatively small.

98. In 1965, 100,000 standard cartons of freestone peaches were canned, or about 12 percent of the South Australian canned peach pack. Growers received $A68/ton fresh weight.

$$\log Y = -0.01609 + \underset{(0.8221)}{2.18610} \log X_1 - \underset{(0.7128)}{1.75768} \log X_2 + \underset{(0.2658)}{1.01766} \log X_3, \quad (6.5.29)$$

$$R^2 = 0.7419$$

Total peach production has increased substantially in the past 20 years. Initially, these increases included a large amount of freestone peaches, but since the mid-1950's clingstone peaches have become the predominant varieties.

6. POULTRY PRODUCTS

(a) Eggs

All mainland States attempted to control egg marketing by establishing their own State Egg Boards. The regulations imposed by the respective Boards vary among States, but their common purpose is to enforce the sale of virtually all eggs through the same marketing channel. Prior to new Commonwealth legislation in 1965, the State Boards imposed levies on producers to meet administration expenses (3 to 4 cents per dozen)[99] and to meet the loss in revenue incurred when "excess" production was sold for export or "broken out" for pulp and powder products. This latter charge amounted to a price equalisation device, which in peak production months approached 10 cents per dozen in some States.

Gross returns to producers for quality eggs usually range between 45 and 55 cents per dozen. With deductions taking up to 25 percent of their returns, many producers found ways to evade the Egg Boards and so gain the full wholesale price for their eggs. Estimates of the proportion of eggs produced outside the control of the State Egg Boards vary between 45 and 55 percent, but statistics are only available for "controlled" or commercial production. Of the uncontrolled eggs, nearly half are probably from small backyard flocks, many of which are consumed "on the property". The remaining unrecorded production is sold direct to shops or customers without the knowledge of the respective Boards,[100] or is sold interstate outside the jurisdiction of the Egg Boards of the state of origin. The quantity involved in this trade "... is probably no less than 30 million dozen per year.[1]

The large number of eggs sold on the domestic market outside the control of the State Egg Boards has been a major cause of concern for the Egg Boards and has led to the introduction of a scheme initially proposed by the Council of Egg Marketing Authorities of Australia (C. E. M. A. A.). Since July 1965, the pool deduction imposed by the State Boards has been replaced by a Federal levy under which all commercial egg producers with more than 20 hens (over 6 months old) pay 3¼d (or \$0.027) a bird every 2 weeks.[2] The proceeds of the levy are paid into a Poultry Industry Trust Fund from which payments are made (on the recommendation of C.E.M.A.A.) to State Governments for financial assistance to their poultry industries. By forcing all producers to share costs of surplus egg disposal, it is envisaged that many small part-time producers previously evading the State Egg Boards will discontinue production. Apart from removing the source of some "unrecorded" eggs, there should also be a reduction in seasonality of production. Discouragement of uncontrolled interstate trading is being aided by a greater degree of co-operation

99. These include handling, grading, and packaging charges and the cost of distributing eggs to the retail market.

100. In all States provision exists for producers to sell direct to retailers or casual customers provided they are licenced to do so and pay the Egg Board the normal deduction for price equalisation.

1. Commonwealth of Australia, Seventeenth Annual Report of the Australian Egg Board for the Year 1963-64 (Canberra, March 1965), p. 4. Free interstate trade is guaranteed under Section 92 of the Commonwealth Constitution.

2. Exempted from the levy are all Northern Territory egg producers and in other States, hens used for producing broiler chickens (they are registered but not levied).

among the State Egg Boards in establishing more uniform prices for eggs in all States. After operating for 6 months there is evidence that the scheme will achieve both aims.

The State Egg Boards are able to co-ordinate their activities through the operation of the Australian Egg Board, constituted under the Egg Export Control Act, 1947—54. The main responsibility of the Australian Egg Board is to administer the overseas sales of surplus eggs in either shell or pulp form. Although New South Wales is represented on the Board, that State continues to export its own surplus production.

Recorded egg production fluctuated considerably in the last 20 years. The war-time needs of the armed services and the food shortage in Britain during and immediately after the war led to a rapid expansion of the industry through the forties.[3] A big increase in output from the United Kingdom and European countries after the war virtually ended Australian exports to these countries. Exports of shell eggs which totalled nearly 20 million dozen in 1954—55 fell to just over 2 million dozen in 1959—60.[4] Overseas markets which still exist are only gained by selling at well below local prices. Thus, production of eggs above domestic requirements brings a diminishing average return to the producer.

In addition, per capita consumption of eggs in Australia fell sharply during the immediate post-war years. From a level of 267 eggs per capita in 1946—47, consumption fell to 205 eggs in 1954—55 and the last decade brought only a slight increase (213 in 1963—64). Although recorded output of eggs from 1949—50 to 1959—60 was considerably lower than in the early post-war years, production has risen again since 1960 (Table 6.6.1).

Time series data showing year-to-year changes of flock numbers in Australia cannot be obtained. Apart from the large proportion of "unrecorded" producers, the States vary considerably in their registration requirements.[5] The total number of adult (over 6 months) hens in Australia has been estimated to be currently about 20 million, of which close to 10 million are registered with, or supply eggs to, the various State Boards.[6] New South Wales is the major egg producing State in Australia — 56.7 million dozen in 1963—64 from 5.34 million hens registered at May 1, 1964. At the same date, 2.45 million hens were registered with the Victorian Board for a production in 1963—64 of 25.0 million dozen eggs. It has been characteristic of the egg industry that a high proportion of the (recorded) eggs produced come from small or part-time producers. The last few years, however, have brought a clear trend towards more specialisation — particularly in New South Wales. In May 1961, of the total laying flock registered in New South Wales nearly half were on farms with fewer than 2,000 birds. By May 1964 the corresponding figure was only 28 percent. During the same period, the proportion of birds on properties carrying more than 10,000 hens rose from 6.3 percent to 24.0 percent.[7] In comparison,

3. From a recorded production of just over 80 million dozen eggs in 1942-43, annual production rose to 120 million dozen in 1946-47 and remained near that level until 1948-49.

4. Exports of egg pulp fluctuate from year to year, but average overseas sales have not declined to the same extent as shell eggs.

5. Tasmania and Western Australia have no regulations requiring registration of flocks, South Australian egg producers are required to register flocks of over 50 hens, Victoria over 40, and New South Wales over 20 hens. Despite the introduction of the C.E.M.A.A. plan, State registration laws continue to operate. Eventual uniformity with the Commonwealth legislation is anticipated.

6. Early returns of birds registered under the new Commonwealth Poultry Levy legislation are at present incomplete.

7. Bureau of Agricultural Economics, The Egg Situation, No. 7 (Canberra, November 1962) and No. 9 (Canberra, December 1964), Table No. 5.

the average Victorian poultry farm remained much smaller; 62 percent of hens came from farms with fewer than 2,000 hens in May 1964 against 71 percent in May 1961; properties with more than 10,000 layers accounted for only 5.6 percent of the total in 1964.[8]

The importance of part-time producers in the egg industry probably contributed to the marked fluctuations in egg production. Short-run changes in recorded egg production are affected by the net price received by the producer. The State Egg Boards set the wholesale and retail prices of eggs mainly on the criterion of the quantity available for sale.[9] The price received by the farmer is what remains after deductions for packaging and grading and, until July 1965, the pooled deduction for price equalisation. The amount deducted varies between States — in 1963—64, the range was 7.79 cents per dozen in Victoria to 10.87 cents per dozen in South Queensland. The gross and net returns per dozen quoted in Table 6.6.1 are derived as an average for all eggs sold by State Egg Boards in Australia.

A second, but probably less important factor influencing poultry farmers' production decisions is the cost of feed — about 70 percent of total variable costs. Wheat is a major component of manufactured mixed rations and a broad indication of cost movements is given by the price of wheat for stock feed (Table 6.6.1).

Two other factors influenced the long-run trend of egg production: (a) the number of eggs per layer has risen due to a number of technological improvements in feeding, management, disease control, etc. However, the annual output per bird varies considerably among farms and only the best layers perform to average standards established in Europe and North America.[10] Poultry management studies in New South Wales showed an average in 1958—59 of 182 eggs per layer (range 146 to 217), and in 1960 —61, 197 eggs (range 176—218).[11] Similar studies in Victoria showed a rise from 189 eggs per layer in 1955—56 to 205 in 1959—60 and 209 in 1961—62.[12] The studies in both States were of full-time poultry enterprises. Part-time producers generally failed to reach these standards and consequently the average for all layers is well below the above figures.[13] (b) Rising real wages have encouraged many part-time producers to leave the industry. This trend is offset by the long-run expansion of the larger producers.

Empirical Analysis: With no suitable data for flock numbers, recorded commercial production of eggs was chosen on the regressand for estimating the structural coefficients of factors influencing the egg industry. Two regressors for which time series exist are the price for eggs received by the farmer (lagged 1 year — current prices are endogenously determined within the structure) and the cost of wheat for stockfeed — lagged 1 year. Since egg and

8. Victorian Egg Board, private communication.

9. There has frequently been a substantial price differential between States, but since 1963-64 closer interstate co-operation has brought greater price uniformity. In 1963-64 the gross return varied from 44.308 cents per dozen in South Australia to 47.341 cents in Western Australia. In 1962-63 however, the range was $0.358 to $0.458 per dozen.

10. In 1962-63 rates of lay were estimated to average 195 eggs per hen in the United Kingdom, more than 200 eggs in the Netherlands and Belgium and over 200 in the United States. Commonwealth Economic Committee, Dairy Produce (H.M S.O., London, 1964), p. 82.

11. Bureau of Agricultural Economics, Poultry Management Study 1958-59 and 1960-61 (Canberra). The studies were discontinued in 1961.

12. Agricultural Economics Branch, Department of Agriculture, Victoria, Poultry Management Studies 1955-56, 1959-60, 1961-62.

13. Based on recorded production and bird registrations in New South Wales and Victoria, the average for the two States appears to lie between 120 and 130 eggs per bird annually. Due to Board evasion by registered producers this would be slightly underestimated.

Table 6.6.1

RECORDED EGG PRODUCTION AND PRICES, COST OF WHEAT, AUSTRALIA, 1945—46 TO 1964—65

Year	Recorded Egg Production	Egg Pulp Production	Average Price to Producers		Price of Wheat for Stockfeed
			Gross	Net (a)	
	'000 doz.	tons	cents/doz.		cents/bu.
1945—46	111,950	13,717	16.6		39.2
1946—47	121,620	16,118	16.8		39.2
1947—48	118,476	20,004	19.2		60.6
1948—49	119,109	20,106	21.9		66.7
1949—50	114,587	16,524	24.7		66.7
1950—51	105,993	15,437	28.3		78.2
1951—52	101,034	13,944	39.7		120.0
1952—53	103,594	16,155	43.7		139.1
1953—54	107,101	20,310	44.9	37.7	141.2
1954—55	110,002	16,559	41.0	33.5	141.2
1955—56	104,018	14,652	43.7	36.6	134.6
1956—57	106,032	15,963	45.7	37.1	138.0
1957—58	102,839	13,229	43.9	35.0	143.3
1958—59	94,629	9,071	46.4	38.1	146.7
1959—60	107,540	14,925	46.7	36.9	150.0
1960—61	119,009	19,691	46.1	34.5	153.3
1961—62	120,717	19,809	41.5	30.1	158.3
1962—63	110,315	13,290	42.3	32.7	159.6
1963—64	111,226	11,103	46.0	36.7	145.9
1964—65	124,111	n.a.	43.1	32.4	146.7

(a) Gross price less Board deductions for administration and price equalisation purposes. Not available prior to 1953-54.

Sources: Commonwealth of Australia, Seventeenth Annual Report of the Australian Egg Board for the Year 1963—64 (Canberra, March 1965), pp. 5 and 6.
Commonwealth of Australia, Australian Egg Board, Interim Statement 1964—65 (Sydney, December 1965), pp. 2 and 3.

wheat prices appear to affect the year-to-year change in egg production rather than cause deviations from a long-term average or trend, the data was expressed in first differences and the following regression obtained:

$$(6.6.1) \quad E_t = 1441.63 + \underset{(100.32)}{327.94}\, PE_{t-1} - \underset{(83.85)}{197.96}\, PW_{t-1} \quad (R^2 = 0.523),$$

where E_t = egg production year t, less production year t-1 ('000 dozen),

PE_{t-1} = index of egg prices year t-1 less egg prices year t-2,

PW_{t-1} = index of cost of feed wheat year t-1 less cost in year t-2, for period 1952—53 to 1964—65

The coefficients of equation 6.6.1 can be used to derive elasticities. At the average price ruling for eggs and for stockfeed wheat these were +0.668 (±0.204) and -0.485 (±0.205) respectively. It is doubtful whether these results can be used for future projections because of the changes which are taking place in the industry. The trend towards larger-scale units in the industry is likely to reduce egg output fluctuations and make supply less price responsive. In addition, the introduction of the C.E.M.A.A. Plan may reduce the size of fluctuations of commercial growers' prices.

(b) Broilers

During the early post-war years a small number of farmers in New South Wales and Victoria raised young chickens on a relatively large scale, to supply a fairly substantial poultry export market.[14] By 1952 these producers were no longer able to compete on the world market, due to higher production costs in Australia[15] and increasingly efficient production overseas. Following this initial set-back, the chicken industry began to redevelop on a technically sounder foundation with the production of broiler chickens bred specifically for meat purposes. The growth of the broiler industry during the 1950's was not as spectacular as that experienced overseas — particularly North America, the United Kingdom, and parts of Europe[16]— but nevertheless expansion did take place throughout the period. The rate of growth accelerated after 1959 and has continued to be vigorous. Australia's annual per capita poultry consumption (around 12 lbs) is still much lower than in some other countries (38 lbs in the United States, 24 lbs in the United Kingdom). The broiler industry in this country must be regarded as being still in an early stage of development, even though the relatively cheaper supply of other meats makes it unlikely that Australian per capita consumption will reach U.S. levels in the foreseeable future.

A number of factors retarded the early development of the broiler industry in Australia. Quarantine restrictions on the import of poultry livestock (including eggs) prevented breeders from taking advantage of the improvements achieved overseas in the breeding of broiler chickens. A second factor — partly resulting from the first — is the relatively high feed conversion ratio experienced on most Australian poultry farms — 3.0 to 3.5 lbs of poultry feed to produce 1.0 lb (live weight) of chicken. In the United Kingdom the equivalent ratio is 2.5—2.7 : 1.0, and in the United States the ratio is even lower. A further lowering of

14. The chickens were not genetically bred for meat production, but were simply young cockerels of the laying breeds. The farms were generally operated without the application of sound scientific and management techniques.

15. As shown in Table 6.6.1 the price of wheat for stockfeed in Australia rose substantially in 1952 due to the lifting of a Government subsidy.

16. From 630 million broilers produced in 1950, production in the United States rose to 1700 million by 1959 and over 2000 million in 1962. United Kingdom production rose, from an estimated 40 million broilers in 1955, to 80 million in 1959 and 120 million in 1962.

the Australian ratio depends not only on genetic gains and improved feed rations, but also on the costs of the new feed mixes relative to the old. It has been suggested that many Australian producers could lower the feed conversion ratio by as much as 0.5, but it has been uneconomic for them to do so because of the high relative feed costs of different grains. This is due to the wheat pricing machinery which has recently raised the domestic price of wheat above export levels. Wheat comprises 60 to 70 percent of most broiler rations. Since feed costs account for 60 percent of total variable costs, any substantial reduction in the price of wheat would contribute considerably to a reduction of broiler prices.[17]

The major difficulty in discussing the supply of the Australian broiler industry is the absence of reliable statistics. Time series output and price data do not exist and an estimate of the current (1964—65) level of production by the industry can only be prepared from different State sources. Three States (New South Wales, Tasmania, and Western Australia) at present collect official statistics on broiler production, and other States are expected to follow suit soon.

Three methods are used in estimating broiler output: (a) Returns from slaughtering establishments indicating the number of birds processed. This is the approach of the Commonwealth Statistician and should provide the most reliable data — although some difficulty has been experienced in gaining the full co-operation of all slaughterers. (b) Estimates have been obtained for some States (e.g., by the Chicken Meat Councils of Victoria and Western Australia) from a knowledge of the total sales of broiler feed by feed merchants. On the assumption that 10 lbs of feed is required to produce a marketable broiler at 9 to 12 weeks, an approximation can be made of the number of broilers produced. (c) Sales by hatcheries of chickens for meat production give a further indication of broiler production in some States.

From these sources an estimate of broiler production by States has been obtained for 1964—65 which should be reasonably accurate. Australia's total output for the year is estimated at 41.8 million broilers of which some 18.6 million came from New South Wales. Victoria produced around 9.6 million and Queensland, the other major producer, about 7.8 million. Western Australia (2.8 m), South Australia (2.5 m) and Tasmania (0.5 m) contributed the remainder. These figures appear to be approximately double the output in 1960—61. In all States a relatively few large-scale enterprises (of over say, 20,000 birds) are producing most of the total number available for slaughter. This trend should continue and the expected increase in bird population will probably be housed on fewer farms. Again, only a small number of slaughtering establishments handle practically all of the wholesale marketing of broiler chickens. These processors receive practically all their chicken through contract arrangements with the growers. Sales by auctions have ceased to be an important outlet for broilers, although many culled hens are still sold through the auction market. Wholesale marketing is mostly under each firm's brand name, but at least one major company has introduced custom-packing.

Farm, wholesale, and retail prices are normally fairly stable during the year; but they have nevertheless declined substantially over the long run — particularly since 1959. From a level of 28—30 cents per lb (live weight) in 1959, the average farm price declined to a current figure of about 20 to 23 cents per lb (compared to the present United

17. There is little likelihood of any significant fall in the price of wheat for stock feed, but some reduction in poultry feed price is expected from the introduction of new protein extraction plants. The large processors are able to extract protein cheaply from feathers and waste offal and make it available to feed merchants. Some large-scale producers may be able to reduce feed costs by growing their own grain requirements.

States farm price of about 13 to 15 cents per lb). Indiciations are that the rate of decline in farm price has recently slowed down.[18]

In summary, the broiler industry has developed in response to the rapidly growing demand of the domestic market. Falling production costs in the industry enhanced the scope for the industry's product and will continue to be an important factor in future development. However, there appears little possibility that costs can be lowered sufficiently to permit re-entry into the export market; changes in domestic demand will therefore continue to be mainly responsible for determining the growth of output.

7. MISCELANNEOUS PRODUCTS

(a) Cotton[19]

Cotton production in Australia has been subject to great fluctuations which can be traced back partly to world events affecting the level of world cotton prices, and partly to State and Federal Government policies which, by various means, raised the prices for locally produced cotton. Price guarantees were introduced in the early 1920's. After 1926 these were replaced by a bounty. These measures resulted in a rapid expansion of acreage and output until the second World War, when the area planted reached a peak of almost 70,000 acres. As a result of competition for resources, the industry declined substantially during the war and early post-war period. By 1950, the Australian cotton acreage had fallen below 3,000 acres.

Under the Cotton Bounty Act 1951 a guaranteed price (of $9\frac{1}{2}$d lb or $0.079 per lb of seed cotton) was re-introduced by the Commonwealth Government. In October 1952 the guaranteed price was increased by almost 50 percent (to 14 d or $0.1167 per lb of seed cotton), while the period of the guarantee was gradually extended until the end of 1963. In that year the cotton bounty scheme was renewed, though in a substantially revised form. Under the 1951 Act and its amendments, the price of seed cotton to growers was guaranteed and individual freight and ginning costs were an allowable charge before the determination of the bounty rate. Under the Raw Cotton Bounty Act 1963 (which came into force on January 1st 1964) a basic rate of bounty of 16.125 d (or $A0.13432) per lb of raw cotton of the grade known as "Middling White 1 inch" was established. At the same time a graduated scale of payments for other grades was determined though these were to be determined annually by the Minister for Customs and Excise. The bounty was payable on all grades of cotton above the grade known as "Strict Good Ordinary". At the time of passing the Bill, the newly determined bounty schedule assured a return on seed cotton (net of freight and ginning costs) comparable to that assured previously. In other words, growers

18. D.T. McDonnell, "Contract Farming of the Broiler Industry, (paper presented to the Australian Agricultural Economics Society Conference, Melbourne, February 1966).

19. The cotton growing industry in Australia has been the subject of considerable debate in recent years. The more important references, which have been used to prepare this summary:
J.J. Basinski, Cotton Growing in Australia, An Agronomic Survey (Commonwealth Scientific and Industrial Research Organisation, Canberra 1963).
Commonwealth of Australia, Bureau of Agricultural Economics, Cotton Growing in Australia, An Economic Survey (Canberra 1963).
J.J. Basinski, "The Cotton Growing Industry in Australia", The Journal of the Australian Institute of Agricultural Science, Vol. 31, No. 3 (September 1965) pp. 205-222.
J.G. Ryan, "Cost-Size and Revenue Relationships in the Cotton Growing Industry of South-Western New South Wales", Review of Marketing and Agricultural Economics, Vol. 33, No. 2 (June 1965), pp. 53-100.
R.A. Patterson "The Economic Justification of the Ord River Project", 38th Congress, Australian and New Zealand Association for the Advancement of Science, 20th August, 1965.
D.R. Gallagher and W.F. Musgrave, Location and the Australian Cotton Industry, Faculty of Agricultural Economics, University of New England, March 1966.
W.J. Kerridge, "Cotton: The Effect of Current Trends on Producer Prices", Quarterly Review of Agricultural Economics, Vol. 19, No. 2 (April 1966), pp. 57-72.

producing the same quality of cotton as they were producing in the past (on average) would receive a price of $A0.1167 per lb of seed cotton, net of freight and ginning costs — as long as import prices remained at 1963 levels. However within this average important differences in returns, according to quality of cotton produced and location of farms, have been introduced.

The new system of protection is more rational than the previous one because: (1) It encourages the production of higher yielding varieties of seed cotton and of seed cotton which produces a better quality lint. Instead of receiving a fixed price per lb of seed cotton, irrespective of raw cotton yield and quality, payment under the new Act is made according to the quantity of raw cotton produced and there are differentials for different qualities of cotton. While the bounty is fixed at $A0.13432 per lb of "White Middling 1 inch" cotton until 1968, the bounty rates for other grades can be varied annually and returns on different qualities can be adjusted. The rates for all cotton below "Middling" grades and for all cotton with a staple length of less than 1 inch have been reduced in 1965. These grades are generally unsuitable for spinning. The bounty rates for the other grades have been increased. As a result, the production of low-grade cotton has become less profitable and that of grades suitable for spinning and knitting more profitable than in 1964. (2) Under the new system, individual freight and ginning costs have to be met by growers. This is designed to discourage cotton production in areas remote from existing ginneries, or alternatively, to encourage the establishment of ginneries in the proximity of large, compact areas of production.

Two other features of the new bounty system are of economic importance: First, the rate of bounty is payable over and above the "import parity" price of the various grades. Hence, growers' returns will also be influenced by variations in world cotton prices.[20] Second, the bounty assistance granted under the 1963 Act is limited to $A 4 million annually. As a result of the very rapid rise in production in the last two years, bounty payments at the unchanged 1964—65 average rate would require approximately $ $6\frac{1}{2}$ million.[21] The 1965—66 bounty rates per lb of raw cotton are therefore likely to be considerably lower than those ruling in earlier years.

Table 6.7.1 sets out some historical details regarding acreage and production of seed cotton. Until recently Queensland has been the only State growing cotton on a commercial scale. Within Queensland the Dawson-Callide region has been the most important cotton growing area, accounting for about 75 percent of the State's output. Most of the crop in the Dawson-Callide region is grown by dry-farming (until 1964 the area irrigated for cotton was less than 10 percent of the total acreage). Because of erratic climatic conditions, yields and quality of cotton produced in this region have been very variable. In the past, spinners criticised Australian cotton for short staple length and for the annual fluctuations of quantities of each grade of cotton produced. There has been some growth in the irrigated cotton acreage in the Dawson-Callide region. The quality of cotton grown on irrigated land has been higher and more uniform. While yields under irrigation have averaged 850 lbs of seed cotton in the 5 years ended 1962—63, this is considered disappointingly low in comparison with recent results achieved on local experiment farms and under commercial conditions in other States and overseas.

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20. Import parity prices are calculated on the basis of weekly Liverpool spot prices for the various grades. Freight and other charges are added.

21. The exact bounty rates payavle in 1965-66 are not yet available since total production estimates (given in Table 6.7.1) are still preliminary and in some cases, forecasts. In addition, actual bounty payments for 1964-65 have not yet been finalised. The above estimate of $ $6\frac{1}{2}$ million is based on Kerridge, op. cit. p. 72.

Table 6.7.1

ACREAGE AND PRODUCTION OF SEED COTTON, BY STATES
AUSTRALIA

Year	Queensland		New South Wales		Western Australia		Australia[a]	
	Area	Production	Area	Production	Area	Production	Area	Production
	acres	m. lb	acres	m. lb	acres	m. lb	acres	m. lb
Average 3 years ending:								
1938—39	60,454	14.9					60,454	14.9
1948—49	7,528	2.3					7,528	2.3
Years:								
1950—51	4,480	1.4					4,480	1.4
1951—52	5,866	2.2					5,866	2.2
1952—53	8,965	5.1					8,965	5.1
1953—54	8,377	3.6					8,377	3.6
1954—55	13,290	5.4					13,290	5.4
1955—56	11,338	3.8					11,338	3.8
1956—57	10,364	3.4					10,364	3.4
1957—58	10,493	4.0					10,493	4.0
1958—59	20,132	9.5					20,132	9.5
1959—60	36,847	15.4	97	0.1			36,944	15.5
1960—61	26,888	10.4	201	0.1			27,089	10.5
1961—62	35,330	12.9	1,956	0.5			37,286	13.4
1962—63	28,465	7.9	2,359	3.0			30,824	10.9
1963—64	13,550	6.2	10,947	8.1	1,526	2.2	26,023	17.3
1964—65(b)	22,000	10.0	18,897	45.9	5,475	9.7	46,372	65.6
1965—66(b)	9,000	12.2	32,500	98.1	8,400	17.0	49,900	127.3

(a) Incomplete; excludes small unrecorded area and production in Victoria and Western Australia between 1957-58 and 1962-63.
(b) Preliminary estimates and forecasts.

Sources: Commonwealth Bureau of Census and Statistics, Yearbook of the Commonwealth of Australia (Canberra);
Commonwealth Bureau of Census and Statistics, Rural Land Use and Crop Production (Statistical Bulletin No. 21 — Season 1963—64, Canberra);
Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I — Rural Industries (Canberra);
W.J. Kerridge, "Cotton: The Effect of Current Trends on Producer Prices", Quarterly Review of Agricultural Economics, Vol. 19, No. 2 (April 1966) p. 60—62.

The area sown to cotton in Queensland has declined since 1962—63, the decline being particularly marked in 1965—66. This is probably partly the result of the new method of financial support which penalises geographically scattered areas and the production of lower quality cotton.

Since 1959—60 there has been a very substantial growth in cotton production in New South Wales. Production has been entirely from irrigated areas. Up to now two main areas have been important: first the Namoi-Gwydir region (also sometimes referred to, in this context, as the Wee-Waa-Narrabri region) and secondly the southern irrigation areas of the Murrumbidgee, where cotton has been grown in both the Murrumbidgee Irrigation Area (around Leeton and Griffith) and in the more recently established Coleambally Irrigation Area. Over 80 percent of the New South Wales cotton acreage at present is in the Namoi-Gwydir region where some large-scale specialist cotton growers from the United States have set up operations. The area sown to cotton has expanded dramatically and average yields have also improved markedly in the last 2 years. However these were years of below-average rainfall which happen to suit irrigated cotton production. Average yields per acre have fluctuated in spite of irrigation — in the main because the occurrence of rainfall at critical times of the year led to flooding in some areas and to difficulties at harvest time. It is difficult to judge how much of the recent improvement in yields is the result of better techniques and how much is due to better climatic conditions. At present it seems possible that the location of the industry may move further west to avoid or reduce the likelihood of rainfall disrupting harvesting operations. So far yields have been about 100 percent higher in the Namoi-Gwydir region than in the more southern areas.[22]

22. Basinski, op. cit., J. A. I. A. S., p. 208. According to Kerridge the gap in average yields has been even greater. Kerridge, op. cit., p. 60.

In the Murrumbidgee Irrigation Area and in the Coleambally Irrigation Area, cotton probably competes mainly with rice production, though linseed, grain sorghum and safflower are also possible alternatives.[23] At current yields and prices, rice appears to be more profitable, but since rice acreages are controlled by the New South Wales Water Conservation and Irrigation Commission, some farmers in these two districts may expand cotton acreages in the absence of a water allocation for rice growing.

In Western Australia, cotton has been grown for the first time under commercial conditions in 1963—64 by a group of settlers who draw their irrigation water from the diversion dam erected on the Ord River. Yields in the first year of commercial production were around 1,300 lbs of seed cotton per acre; in the 1964—65 season they increased to between 1,700 and 1,950 lbs of seed cotton per acre.[24] However, it is too early to arrive at any conclusions about yields which might be expected in succeeding years.

(b) Tobacco

Apart from cotton, tobacco growing has been Australia's fastest-growing rural industry in recent years. At present it is carried out on some 1,500 holdings. Acreage has increased from about 8,000 in 1951—52 to nearly 30,000 in 1962—63, and production increased from 7.5 million lb to about 27 million lb during the same period. The gross value of production amounted to over $32 million in 1962—63. Statistics illustrating the expansion of the industry are presented in Table 6.7.2.

The main tobacco growing State in Australia is Queensland, where tobacco growing

23. Ryan, op. cit., pp. 91-94.

24. Yield figures given by Kerridge (in terms of lbs of raw cotton) suggest the lower level, whilst Paterson gives a higher figure. Kerridge, op. cit., p. 61; Patterson, op. cit., p. 22.

Table 6.7.2

TOBACCO AREA, PRODUCTION, AVERAGE YIELD PER ACRE, GROSS VALUE OF PRODUCTION, AND AVERAGE AUCTION PRICES : AUSTRALIA

Period	Area	Production	Yield per Acre	Gross Value of Production	Average Auction Price
	acres	'000 lb (dry)	lb (dry)	$'000	cents per lb
Average of years ending					
1938—39	10,067	5,109	507	873.4	n.a.
1948—49	4,018	3,298	821	1,092.0	n.a.
Years					
1951—52	8,199	7,554	921	4,758	68.5
1952—53	7,922	6,485	819	5,156	83.7
1953—54	8,246	7,669	930	7,632	108.1
1954—55	9,659	6,822	706	6,152	126.7
1955—56	11,305	6,106	540	9,188	112.1
1956—57	12,171	8,745	716	12,404	103.7
1957—58	13,204	11,567	876	15,840	103.4
1958—59	15,151	13,970	922	22,430	110.7
1959—60	19,654	19,357	985	26,102	114.6
1960—61	29,213	29,862	1,022	24,244	93.3
1961—62	26,627	22,578	848	30,022	116.7
1962—63	29,381	27,148	924	32,600	112.3
1963—64	28,356	33,079	1,167	27,000	102.6
1964—65*	26,586	22,000	828	n.a.	n.a.

* Estimates.

n. a. - Not available

Sources: Commonwealth Bureau of Census and Statistics, Yearbook of the Commonwealth of Australia (annual, Canberra); Rural Land Use and Crop Production (Statistical Bulletin No. 21, Season 1963—64, Canberra); Commonwealth of Australia, Department of Primary Industry, Canberra, Tenth Annual Report of the Tobacco Industry Trust Account, for year ended 30th June, 1965.

Table 6.7.3

TOBACCO, CIGAR AND CIGARETTE FACTORIES : PRINCIPAL MATERIALS USED AND ARTICLES PRODUCED : AUSTRALIA

Year	Stemmed Leaf Used				Manufactured Products			
	Australian	Imported	Total	Australian Leaf as Percentage of Total	Tobacco	Cigars	Cigarettes	Total
	'000 lb	'000 lb	'000 lb	%	'000 lb	'000 lb	'000 lb	'000 lb
1938—39	4,489	16,011	20,500	21.9	16,305	238	6,731	23,274
1950—51	3,775	24,558	28,333	13.3	20,967	179	10,679	31,825
1951—52	3,664	26,131	29,795	12.3	21,615	175	11,749	33,539
1952—53	4,223	28,140	32,633	12.9	22,334	129	13,879	36,342
1953—54	4,866	33,076	37,942	12.8	23,400	173	18,303	41,876
1954—55	4,482	36,053	40,535	11.1	21,466	151	22,859	44,476
1955—56	5,204	37,399	42,603	12.2	18,836	132	27,162	46,130
1956—57	5,299	40,860	46,159	11.5	18,917	114	30,513	49,544
1957—58	7,155	38,372	45,527	15.7	18,192	119	32,748	51,059
1958—59	8,792	40,179	48,972	18.0	17,087	109	35,255	52,451
1959—60	11,533	38,186	49,720	23.2	15,262	106	39,391	54,759
1960—61	14,733	37,650	52,383	28.1	15,259	132	42,844	58,235
1961—62	18,051	32,337	50,388	36.4	13,011	(a)	42,899(a)	55,516
1962—63	20,276	30,680	50,956	39.8	11,553	(a)	45,346(a)	56,899
1963—64	20,156	30,639	50,795	39.7	10,046	(a)	46,040(a)	56,086

(a) Cigars and cigarettes not recorded separately; cigars included in figures for cigarettes.

Sources: Commonwealth Bureau of Census and Statistics, Manufacturing Industries, No. 26 - Tobacco, Cigars and Cigarettes (annual, Canberra); Principal Factory Products Australia (annual).

has been carried out since the earliest days of settlement. The crop is grown in the north of the State (mainly in the Mareeba district), in the coastal region around Bundsberg, the Beerwah-Glasshouse Mountains district, and in a southern inland area near the New South Wales border of Inglewood and Texas. In Victoria, tobacco is grown in the Ovens and King River valleys. In 1963—64 Queensland and Victoria accounted for almost 90 percent of the total Australian tobacco area. The crop is also grown in New South Wales, and until recently in Western Australia. Appendix Table A6.7.1 shows the distribution of the tobacco growing industry among the States in Australia.

The quantity of locally produced leaf has been, until recently, small in relation to total domestic requirements, and mainly of qualities which could only be used for blending with imported leaf. It is only in the last 5 to 6 years that the proportion of Australian-produced leaf used in manufacture exceeded 20 percent. Table 6.7.3 sets out recent statistics of the quantity of locally grown tobacco leaf, the quantity which is imported and the quantities of manufactured tobacco products in Australia.

The local tobacco growing industry is heavily protected by import duties. The present duty is $0.86 per lb on unmanufactured, unstemmed tobacco leaf used in the manufacture of cigarettes, and $0.65 per lb on leaf suitable for the manufacture of cut tobacco.[25] Since 1936 the Commonwealth Government has adopted the practice of granting a tariff rebate to manufacturers on imported tobacco leaf, provided that they undertake to incorporate a certain minimum percentage of Australian-grown leaf in their manufactured products. Manufacturers complying with this provision obtain a rebate of $0.14 per lb on imports of unmanufactured, unstemmed tobacco leaf used in the manufacture of cigarettes, and $0.15 per lb on leaf for use in the manufacture of cut tobacco, regardless of the source of imports. The prescribed minimum percentage to quality for duty rebate has been increased substantially over the years, from 3 percent for cigarette leaf and 5 percent for leaf used for cut tobacco in 1951—52 to 43 percent for both in 1963—64. Appendix Table A6.7.2 sets out the declared percentages for the years 1950—51 to 1963—64 along with the actual quantity and proportion of Australian-grown leaf used in manufacture.

Because of the incidence of the duty and of the duty rebate, manufacturers purchase Australian leaf at prices above world parity for equivalent grades.[26] It is difficult to make an accurate comparison between the relative costs to manufacturers of imported and locally-purchased leaf. Such an attempt is made in Table 6.7.4; however it ignores some of the differences in costs. There are, first the cost of re-drying for Australian leaf (including a weight loss of about 6 percent) and second the difference in the interest cost of holding stocks. Costs of holding local stocks are higher as duty on imported leaf is only payable when it is withdrawn from customs bond. As a result, the differences in costs to manufacturers are somewhat smaller than is suggested by Table 6.7.4.

25. Import duties on unmanufactured, unstemmed tobacco from Rhodesia and Nyasaland have been $0.78 on tobacco suitable for cigarette manufacture, and $0.575 per lb on tobacco used for the manufacture of cut tobacco. These lower duty rates have been the result of a trade agreement negotiated in June 1955 with the Federation of Rhodesia and Nyasaland. Australia's principal undertaking was to grant an exclusive tariff preference to the Federation on unmanufactured tobacco, a concession formerly accorded only to Southern Rhodesia under a previous agreement. The Federation, in turn, accorded preferential tariff treatment on a wide range of Australian export products. Following the dissolution of the Federation in December 1963, the agreement has been applied on a provisional basis to each of the three constituent territories, Southern Rhodesia (now Rhodesia), Northern Rhodesia (now Zambia) and Nyasaland (now Malawi). The agreement continues subject to 6 months' notice.

26. Until 1961-62 the total quantity of Australian leaf used annually by all local manufacturers regularly exceeded the prescribed minimum percentage. Since 1962 certain minimum stock holding requirements have been added before a manufacturer qualifies for concessional duty payments.

Table 6.7.4

IMPORT PRICE OF UNMANUFACTURED, UNSTEMMED TOBACCO, AVERAGE AUCTION PRICE OF AUSTRALIAN-GROWN TOBACCO LEAF, AND ESTIMATED TOTAL ANNUAL SAVINGS THROUGH DUTY REBATE

Year	(1) Import Price f.o.b. Port of Shipment	(2) Import Price c.i.f. Australia Excluding Duty (a)	(3) Import Price c.i.f. Australia Including Duty, Before Duty Rebate	(4) Import Price c.i.f. Australia Including Duty, After Duty Rebate	(5) Average Auction Price of Australian-Grown Tobacco Leaf	(6) Estimated Total Annual Saving Through Duty Rebate
	cents per lb					$'000
1959 — 60	71.9	75.5	144.9	130.5	114.6	4,940
1960 — 61	70.5	74.2	144.1	129.1	93.3	4,710
1961 — 62	69.5	73.1	143.0	128.6	116.7	3,878
1962 — 63	70.0	73.5	143.3	129.7	112.3	3,790
1963 — 64	68.7	72.2	143.0	128.7	102.6	3,930

(a) Import price, f.o.b. port of shipment, plus weighted average freight cost.

Source: Commonwealth Bureau of Census and Statistics, Imports Cleared for Home Consumption (annual, Canberra).

Method of Calculation:

(1) Import price, f.o.b. port of shipment, calculated from total quantity and total value ($A, f.o.b. port of shipment) as published in Commonwealth Bureau of Census and Statistics, Imports Cleared for Home Consumption.

(2) Freight (insurance, etc.) costs per lb added to column (1) at rate of $35 (U.S.) from American Gulf ports, and $A20.52 from South African ports, per 1 ton measurement; freight costs obtained by private communication, from one of leading Australian importers, and several Australian shipping companies.

(3) Import price including duty, before duty rebate; calculated from C.B.C.S., Imports Cleared for Home Consumption, where total duty collections — less duty rebate — are published for each country of origin, together with rate of duty per lb, before duty rebate.

(4) Calculated as for (3); total quantity of import, and total duty collections after duty rebate are given for each country of origin, in Imports Cleared for Home Consumption.

(5) Source: as for Table 6.7.2.

(6) Calculated from (3) and (4).

With the present range of types and qualities grown in Australia, there is a limit to the extent to which Australian-grown tobacco leaf could be absorbed by the local manufacturing industries to produce tobacco and cigarettes of the standard required by Australian consumers. The problem of quality has plagued the tobacco growing industry in Australia throughout its history. It has become more important in recent years with a marked shift in demand from cut tobacco to cigarettes, and a very substantial increase in local production of tobacco leaf. Research is being conducted to adapt local production to meet the needs of the local market.

The expansion of Australian tobacco production in the early 1950's was associated at first with rising prices and strong demand. Prices reached a peak in the 1954—55 season (leaf sold in 1955) at 152d or $A1.267 per lb. From the mid-fifties onwards, difficulties were experienced in the disposal of the whole crop. Production increased rapidly, at an annual average rate of about 38 percent in 1954—55 to 1960—61. In comparison, total stemmed leaf used in manufacture during the same period increased by an annual average of only 4.4 percent. The proportion of Australian leaf used in manufacture increased from 11.1 percent in 1954—55 to 28.1 percent in 1960—61. The increase in the use of Australian-grown leaf was almost entirely absorbed in the manufacture of cigarettes. While the proportion of Australian leaf used in the manufacture of cut tobacco was initially relatively high and that of leaf used in cigarette manufacture rather low (the respective figures were 19.1 percent and 8.4 percent in 1955—56), by 1960—61 the proportion of Australian leaf used in cigarette manufacture rose to 29 percent, while that used in the manufacture of cut tobacco increased to 25.9 percent. Statistics giving the quantities of imported and Australian-grown tobacco leaf used in the manufacture of cut tobacco, cigars, and cigarettes are shown in Table 6.7.5.

In 1960—61, production increased by almost 50 percent over that in 1959—60. Average auction prices for Australian tobacco leaf at the 1961 sales fell to 112d or $A0.933 per lb, or very much below the average price of 137.5d or $A1.146 per lb in the previous season. This fall occurred in spite of a substantial increase in the minimum percentages of Australian leaf required to qualify for duty rebate (from 22.0 to 23.5 percent for cigarettes and cut tobacco respectively to 28.5 and 24.5 percent). Although the amount of locally produced leaf purchased by manufacturers in 1960—61 increased by 23 percent over the previous season, the proportion of unsold leaf rose by 23.2 percent, or the highest level for 10 years. The tobacco growing industry in Western Australia was particularly affected. By 1963—64 no more tobacco was grown in that State.

In 1961—62 a drop in production brought rejection rates back to just under 3 percent, but in 1964 poor clearances and reduced prices again resulted in greatly reduced returns to growers. In the light of poor clearances and reduced price in 1964, proposals for the establishment of a marketing stabilisation scheme were submitted to the Federal Government by representatives of tobacco growers. After lengthy negotiations between Commonwealth and State Governments and representatives of the tobacco growing and manufacturing sectors of the industry, early in February 1965 the Commonwealth Government formally approved the introduction of a stabilisation plan for the Australian tobacco industry. The main features of the plan are the establishment of an annual marketing quota of 26 million lb of tobacco leaf (at present representing about 50 percent of total factory requirements in Australia) which will be sold under an agreed grade and price schedule, providing for an average minimum price of 125d. or $A1.042 per lb. The annual quota will be divided among the three tobacco-producing States, Queensland, New South Wales and Victoria. State quotas will, in turn, be divided among indi-

Table 6.7.5

TOBACCO, CIGAR AND CIGARETTE FACTORIES: STEMMED LEAF USED
AUSTRALIA, 1952—53 TO 1963—64

Year	Tobacco Manufacture				Cigarette Manufacture				Cigar Manufacture				Total Stemmed Leaf Used			
	Australian grown	Imported	Total	Australian leaf as per cent of total	Australian grown	Imported	Total	Australian leaf as per cent of total	Australian grown	Imported	Total	Australian leaf as per cent of total	Australian grown	Imported	Total	Australian leaf as per cent of total
	'000 lb			%	'000 lb			%	'000 lb			%	'000 lb			%
1952—53	3,021	15,364	18,385	16.4	1,202	12,904	14,105	8.5	—	143	143	—	4,223	28,410	32,633	12.9
1953—54	3,120	15,892	19,012	16.4	1,746	17,032	18,778	9.3	—	152	152	—	4,866	33,076	37,942	12.8
1954—55	2,587				1,895								4,482	36,053	40,535	11.1
1955—56	2,939	12,458	15,397	19.1	2,264	24,799	27,064	8.4	—	141	141	—	5,204	37,399	42,603	12.2
1956—57	2,895	12,837	15,732	18.4	2,405	27,900	30,305	7.9	—	123	123	—	5,299	40,860	46,159	11.5
1957—58	3,244	11,560	14,805	21.9	3,190	26,676	30,586	12.8	—	136	136	—	7,155	38,372	45,527	15.7
1958—59	2,807	11,494	14,301	19.6	5,986	28,528	34,514	17.3	—	157	157	—	8,792	40,179	48,972	18.0
1959—60	3,086	9,740	12,826	24.1	8,447	28,303	36,750	23.0	—	143	143	—	11,533	38,186	49,720	23.2
1960—61	3,302	9,447	12,749	25.9	11,431	28,030	29,462	29.0	—	172	172	—	14,733	37,650	52,383	28.1
1961—62	3,656	7,231	10,887	33.6	14,395	25,106(a)	39,501	36.4	—	(a)	(a)	—	18,051	32,337	50,388	35.8
1962—63	3,643	6,002	9,645	37.8	16,633	24,678(a)	41,311(a)	40.3	—	(a)	(a)	—	20,276	30,680	50,956	39.8
1963—64	3,342	4,998	8,340	40.1	16,814	25,641(a)	42,455(a)	39.6	—	(a)	(a)	—	20,156	30,639	50,795	39.7

(a) Leaf used for cigars included in quantity shown for cigarettes.

Sources: Commonwealth Bureau of Census and Statistics, Manufacturing Industries, No. 26 — Tobacco, Cigars and Cigarettes (published annually, Canberra) and Principal Factory Products, Australia (published annually).

vidual growers. The provisions of the scheme commenced to apply to the 1965 sales (starting in March 1965) and are planned to continue for the following four seasons ending with the 1967—68 crop. In the period before the necessary legislation can be passed, an Interim Committee administers the scheme.

It was announced early in 1965[27] that new minimum percentages of Australian-grown tobacco leaf, to be used in manufacture in order to qualify for the usual duty rebate, will apply as from 1st July 1965. The new rates (for cut tobacco and cigarettes) were 45 percent from 1st July to 30th September 1965, 47 percent from 1st October to 31st December 1965, and 50 percent from 1st January 1966 onwards. As mentioned earlier, with the present factory requirements in Australia, the rate of 50 percent, if complied with, would enable the absorption of the maximum annual quota of 26 million lb of Australian-produced leaf envisaged in the stabilisation plan.

While no final figures of average auction prices realised in 1965 are as yet available, indications are that they have been generally lower than in 1964. The new schemes, especially the grade and price schedules established for the 1965 selling season, have not received ready acceptance by the leading manufacturers. Leaf rejections have again been heavy, and at the end of the selling season some 380,000 lb of leaf (of an estimated value of $200,000), which has been graded as suitable for inclusion in the annual quota, remained unsold. It was only after the Government used its power to refuse customs certificates for duty rebate, that manufacturers agreed to take up the rejected leaf at prices set by the interim stabilisation committee. However, 1964—65 was an exceptionally adverse season for the tobacco crops. It is believed that this, has accounted at least partly, for the heavy rates of rejections, and lower general level of prices.

27. The Australian Financial Review, 19 February, 1965.

(c) Rice[28]

Although small areas of upland rice have been planted for many years in coastal areas of Northern Queensland, commercial rice growing has been confined almost entirely to the irrigation settlements of Southern New South Wales, in particular the Murrumbidgee Irrigation Area, the Coleambally Irrigation Area and the Irrigation Districts drawing their water from the Murrumbidgee and the Murray.[29] In this region no farms are devoted entirely to rice growing. Rice is produced mainly in conjunction with wool growing and fat lamb production, although wheat, oats, vegetables and beef fattening are also common additional enterprises.

The supply of irrigation water is under the direct control of the New South Wales Water Conservation and Irrigation Commission. The Commission confers periodically with representatives of the Rice Co-ordination Committee[30] and the State Department of Agriculture to determine the acreage which can be planted by each settler. Normally individual grower allocations for rice remain virtually static from year-to-year at 50 acres in Irrigation Districts and at 60 to 80 acres in Irrigation Areas. However, occasional changes have been made in growers' acreage allocations and for the 1958—59 crop many growers with 100-acre rice acreage allotments had their allocation reduced to 80 acres.

28. We are indebted to Mr. P.C. Druce, Deputy Chief, Division of Marketing and Agricultural Economics, N.S.W. Department of Agriculture for helpful comments.

29. Prospects for rice growing are being investigated in other parts of the continent, especially in Northern Australia (at Humpty Doo near Darwin and on the Ord and Fitzroy Rivers in the north of Western Australia). A joint Australian-American firm, Territory Rice Ltd., carried out commercial scale operations near Humpty Doo between 1954-55 and 1959-60. However the contribution to the total volume of Australian production made by areas outside New South Wales has so far been insignificant.

30. The Committee comprises representatives of the New South Wales Rice Marketing Board, Ricegrowers' Co-operative Mills and the New South Wales Rice Growers' Association.

This rigid control of acreage by means of water allocation has been exercised from an early stage of the history of the rice-growing industry, although the emphasis on the objectives of control has shifted over time. During 1930—40, the expansion of irrigated rice acreage was very rapid, and acreage was controlled primarily to avoid straining the limited water resources. Since 1959—60, the emphasis has shifted to keeping supplies of rice in line with prospective local and export markets and maintaining returns to growers at "reasonable" levels.

During World War II, rice production was expanded to meet the food demands of the South Pacific areas, whose normal sources of supply were cut off by enemy action. As shown in Table 6.7.6, these efforts led to an increase in area and production in 1942—43 and 1943—44. However, plantings were not maintained at this level in the immediate post-war years, and it was only in 1955—56 that acreage again reached, and passed, the 1943—44 level. From 1955—56 until 1961—62, acreage restrictions imposed by the New South Wales Water Conservation and Irrigation Commission have kept the annual area sown to rice between 45,000 and 50,000 acres.

Since 1961—62, the Coleambally Irrigation Area has been developed, south of the Murrumbidgee Irrigation Area. The total acreage under rice increased by about 4,000 acres each year since this time. The New South Wales Water Conservation and Irrigation Commission plans to develop the area at the rate of 70 farms per year for 6 years from 1960—61. The planned long-term land use was for sheep and beef only and rice was permitted over an establishment period — to provide farmers with an immediate return to offset the high initial costs of development. The maximum rice allotment issued in this area was 60 acres per farm and the period of allotment was originally for 6 years.[31] In 1964—65, of the total 63,000 acres planted to rice in New South Wales, 36,000 acres were in the Murrumbidgee Irrigation Area, 16,000 acres in the Coleambally Irrigation Area, and 11,000 acres in other Irrigation Districts.

Australian rice production is predominantly of the short-grain, soft (Japonica) variety. The main variety grown in New South Wales at present is "Caloro II" derived from a Californian importation. Short-grain varieties are usually heavy yielders but they are not generally appreciated in Asia where long-grain, hard (Indica) varieties are preferred. Since 1962—63 the New South Wales Rice Marketing Board has been encouraging the production of long-grain rice by guaranteeing a return of $100 per ton compared to a return of about $54 for short-grain varieties in recent years. So far there has only been a limited response from commercial growers. However, the Chairman of the New South Wales Rice Marketing Board estimated recently that by 1970 perhaps 30 percent of Australian production will be of the long grain varieties.[32] The underlying objectives in fostering the expansion of production of these varieties are partly to meet actual and potential competition on the local market from imported long-grain rice,[33] and partly to widen

31. However the first group of settlers in the Coleambally Irrigation Area have already had their period of allotment increased and it seems likely that Coleambally farmers will be allowed to continue growing rice unless there is a marked decline in export prices.

32. The Australian Financial Review, 9 July 1964.

33. It is only since 1961-62 that imports have become appreciable, steadily rising from 925 tons in that year to about 1,330 tons in 1964-65. However, compared to total consumption in Australia, importations are still small, comprising about 3 percent of total milled rice available for domestic consumption and stock changes in 1964-65 (after requirements for seed have been deducted). The domestic industry is protected by an import duty of $1\frac{1}{8}$d, or $A0.009 per lb from the British preferential area and $1\frac{1}{2}$d, or $A0.013 per lb from other sources. In addition primage duties of 5 percent (B.P.T) and 10 percent (M.F.N) respectively are payable on most imports.

Table 6.7.6.

RICE: NUMBER OF HOLDINGS, AREA, PRODUCTION, AVERAGE YIELD AND GROSS VALUE OF PRODUCTION, AUSTRALIA

Season	Number of Holdings	Area Planted	Production (paddy) Total	Production (paddy) Average Yield per Acre	Gross Value of Production (a)
		acres	'000 tons	tons	$'000
Average 5 seasons ended:					
1938–39	313(b)	22,823	42.7	1.87	896
Years					
1939–40	324	24,100	34.8	1.44	826
1940–41	329	24,500	42.0	1.71	948
1941–42	331	23,600	41.1	1.74	1,012
1942–43	348	34,200	57.8	1.69	1,518
1943–44	364	40,600	75.3	1.85	1.966
1944–45	330	24,600	31.7	1.29	832
1945–46	329	28,370	51.3	1.81	1,344
1946–47	353	32,000	55.8	1.75	1,784
1947–48	351	26,210	50.2	1.91	1,900
1948–49	406	32,690	51.4	1.58	2,064
1949–50	444	37,540	70.9	1.89	3,306
1950–51	462	36,890	77.2	2.09	4,342
1951–52	452	35,590	57.1	1.61	4,216
1952–53	498	34,490	74.3	2.15	6,676
1953–54	542	38,860	76.3	1.96	6,396
1954–55	574	38,690	95.3	2.46	6,860
1955–56	621	41,180	88.6	2.15	6,812
1956–57	653	50,480	79.9	1.58	6,138
1957–58	742	46,770	106.1	2.27	8,090
1958–59	779	47,050	124.1	2.64	9,462
1959–60	852	48,950	126.2	2.58	8,900
1960–61	787	46,120	112.5	2.44	8,240
1961–62	878	50,190	132.1	2.63	7,664
1962–63	956	54,930	133.7	2.43	7,676
1963–64	1,033(c)	59,400	139.8	2.35	7,800
1964–65	n.a.	63,000(d)	152.8(d)	2.43	8,600(d)

n.a. - Not available.

(a) Gross value of recorded production at the principal markets in Australia.

(b) Figure refers to year 1938-39.

(c) 1,027 in N.S.W., 3 in W.A., 3 in the N.T.

(d) Revised estimate of the Bureau of Agricultural Economics, Canberra.

Sources: Commonwealth Bureau of Census and Statistics, Yearbook of the Commonwealth of Australia (published annually, Canberra); Rural Land Use and Crop Production (Statistical Bulletin No. 21, Season 1963–64, Canberra).
Deputy Commonwealth Statistician and Government Statistician of New South Wales, The Official Year Book of New South Wales (published annually, Sydney).
Commonwealth of Australia, Bureau of Agricultural Economics, Trends in Australian Rural Production and Exports, No. 32, (December 1964, Canberra).

the range of export markets. The expansion of long-grain rice production would allow greater scope for exports to Asian countries where long-grain rice is selling at prices well above those received for short-grain rice.[34]

As shown in Table 6.7.6 average yields increased substantially — especially since 1954—55. Another important development in recent years was the widespread adoption of bulk handling methods, which enable the crop to be harvested earlier with a higher moisture content, thus reducing the proportion of sun-cracked grain. The New South Wales Rice Marketing Board operates a central aeration plant which reduces the moisture content of grain from about 23 to 14 percent after aeration.

All rice produced in New South Wales is marketed through this Board. The Board's selling price for paddy to local millers is based on expected returns from the domestic and export market. Proceeds from all markets are collected and a pooled return for each crop is paid to growers. Of the total production, the greater part is exported, the quantity of exports in most years being more than twice, and in some years over three times, the quantity retained for domestic consumption (excluding seed). The largest single export market is Papua-New Guinea (and other Pacific Islands), followed by the United Kingdom. There is a considerable difference in the returns obtained from the various markets. The Board currently obtains about £115 or $A230 per ton for short-grained milled rice (at capital cities). This is almost twice the average price obtained from exports (for all grades and all markets). Returns obtained from exports also differ according to the market supplied, with the near-Pacific area providing the most attractive returns. Table 6.7.7 gives the prices received by growers in recent years and the Rice Marketing Board's deduction for various expenses.

34. Small quantities of long-grain rice are currently being grown on an experimental basis in the Ord River area.

As shown in Table 6.7.7, the average price received by growers declined sharply after 1953—54, reaching a low point of $49.52 per ton of paddy in 1959—60. Since then there has been a slight recovery. Average export prices also declined after 1953—54; but they have been relatively stable since 1958—59. Quantities exported (and average prices realised) are given in Table A6.7.3.

(d) Tallow

Tallow results from the boiling down ("rendering") of fat-bearing animal tissues, such as internal organs, meat scraps, bones, and in some instances, whole carcasses. The most important sources of tallow are cattle and sheep. The main classification distinguishes between beef and mutton tallow, and further between edible and inedible tallow.

In contrast to most overseas countries, tallow is a major ingredient of industrial and cooking margarine in Australia,[35] thus assuring an outlet for edible tallow on the domestic market. Both beef and mutton tallow may be used for margarine production, but the former is preferred. Caul or omental fat, being the hardest animal fat, is considered the best grade for this purpose. Occasionally mesenteric fats are also used, if suitably processed.

Inedible tallow can be produced from any fat-bearing part of the carcass. Mutton produces mainly inedible tallow. The best grade, known as "collar white", is derived from the omental fats. Mesenteric fats usually provide a lower grade. There is a wide range of grades of both edible and inedible tallow, according to colour and free fatty acid content. Rendering is best carried out immediately after slaughter. For this reason, processing works are usually situated at or near abattoirs.

35. State legislation in most States provides for a minimum of 75 to 90 percent of beef or mutton tallow in industrial and cooking margarine respectively (e.g., Victoria - Margarine Act, No. 6301 of 1958).

Table 6.7.7

N.S W. RICE MARKETING BOARD'S AVERAGE PRICE FROM MILLERS AND RETURN TO GROWERS

Crop Year	Average Price Received from Millers	Board's Deductions from Returns (a)	Return to Grower from Board
		per ton (paddy) $	
1944—45	23.52	0.71	22.82
1945—46	26.18	0.57	25.61
1946—47	31.42	0.51	30.81
1947—48	38.14	0.70	37.44
1948—49	38.21	0.86	37.34
1949—50	42.99	0.45	42.54
1950—51	52.02	0.37	51.65
1951—52	64.69	0.38	64.12
1952—53	80.00	0.07	79.83
1953—54	74.67	0.32	74.67
1954—55	63.81	0.08(b)	63.89
1955—56	63.09	0.88	62.21
1956—57	63.24	1.30	61.94
1957—58	62.76	1.14	61.62
1958—59	53.29	1.49	51.79
1959—60	51.34	1.72	49.52
1960—61	56.33	2.64	52.69
1961—62	59.28	2.82	54.46
1962—63	59.92	3.32	54.60

(a) Since 1953 includes deductions for the Equity Redemption Fund, and since 1961 an amount of $2.50 per ton to finance additional storage facilities.

(b) A credit; interest received in this period exceeded working costs.

Sources: G.N. Steele, "The Changing Outlook for Australian Rice", Quarterly Review of Agricultural Economics, Vol. 13, No. 3 (July 1960), pp. 101—111.
The Public Accounts Prepared by the Treasurer of New South Wales, Report of the Auditor-General: Accounts of Statutory Bodies—Rice Marketing Board for the State of New South Wales (Government Printer, Sydney; annually).

Table 6.7.8

NUMBER OF LIVESTOCK SLAUGHTERED, PRODUCTION OF MEAT AND TALLOW : AUSTRALIA

Year, ending 30 June	Number of Livestock Slaughtered		Production of Meat			Production of Tallow Edible (e):—				
	Cattle(a)	Sheep(b)	Beef(c)	Mutton(d)	Beef and Mutton (c), (d)	Edible (c) Beef	Edible (c) Mutton	Total Edible	Total Inedible	Total Edible and Inedible
	'000		'000 tons, carcass weight			'000 tons				
1953	2,832	12,354	642.4	249.0	891.4			37.2	56.0	93.2
1954	3,014	12,439	661.7	237.6	899.3			37.3	55.1	92.4
1955	3,154	12,306	679.1	240.5	919.6			43.8	56.3	100.1
1956	3,184	11,377	708.6	234.4	943.0			52.1	66.8	118.9
1957	3,393	11,128	765.5	223.9	989.0			51.4	81.7	133.1
1958	3,566	14,355	733.1	269.8	1,002.9			35.9	87.0	123.0
1959	4,191	15,757	849.3	310.4	1,159.7			51.0	112.8	163.8
1960	3,471	19,264	707.5	370.4	1,077.9	44.9	6.9	51.8	117.5	169.2
1961	2,938	18,927	593.0	367.6	960.6	38.3	13.5	51.8	98.8	150.6
1962	3,592	19,147	747.3	368.0	1,115.3	52.1	15.3	67.4	140.4	207.9
1963	4,236	19,034	864.8	365.6	1,230.4	60.5	13.7	74.2	164.4	238.6
1964	4,573	18,981	918.8	376.0	1,294.8	67.3	9.7	77.0	159.6	236.6

(a) Excludes calves; (b) Excludes lambs; (c) Excludes veal; (d) Excludes lamb; (e) Includes dripping, but excludes lard.

Sources: Commonwealth Bureau of Census and Statistics, Canberra, Year Book of the Commonwealth of Australia, Primary Industries Bulletin, Part I - Rural Industries; Secondary Industries Bulletin; Statistical Bulletin — The Meat Industry, Australia.

Data on total tallow production are available since 1952—53, but it is only since 1959—60 that statistics of the production of beef and mutton tallow have been collected separately, and only for the edible grades. The available data are given in Table 6.7.8. In recent years edible tallow (including dripping) represented, on average, about one-third of total production.

The quantity of tallow produced depends on the number of stock slaughtered, the condition of animals at slaughter, and, as will be discussed below, on the form in which meat is exported. The rate of increase in total tallow production has been considerably faster than the increase in the number of cattle and sheep slaughtered.[36] When total tallow production (edible and inedible) is expressed as a percentage of total beef and mutton output each year from 1952—53, there is an almost uninterrupted increase in the extraction rate from 10.5 percent in 1952—53 to a peak of 19.4 percent in 1962—63 and 18.3 percent in 1963—64. The increase in the rate of extraction has been particularly pronounced since 1958—59. The main reason for this is believed to be the change in the form in which meat is exported from Australia. Since that year, an increasing proportion of both beef and mutton has been exported in boned-out form, thus making more material available for boiling down. Compared to total meat export, the proportion of beef and veal exported in boned-out form increased from 1.7 percent in 1952—53 to 9.1 percent in 1957—58, 20.3 percent in 1958—59 and 39.5 percent in 1962—63. It was only in 1961—62 that the break up of mutton export into "bone-in" and "boneless" form was first published by the Commonwealth Statistician. In that year 76 percent of mutton export was in boneless form. In the following year, the corresponding figure was 87 percent. This change in the form of meat export is too recent to provide a sufficient number of observations for the estimation of a possible new relationship between meat and tallow production with any degree of reliability.

36. In the 12 years ending 1963-64, total tallow production rose by about 150 percent, whilst the number of adult sheep and cattle slaughtered increased by 54 and 62 percent, respectively.

It is difficult to assess the relationship between prices obtained for tallow and its production. Most tallow is sold in Australia under a variety of private treaty arrangements, and prices are not disclosed. A small proportion of total production is sold by auctions held in Sydney. These prices cannot be regarded as representative of the prices generally received for all tallow sold in Australia. Top prices received for prime grade tallow at Sydney auctions indicate some fall in prices since 1960—61. Similar changes occurred in export prices in recent years. Since the raw material for tallow is a by-product at meat works, tallow production can be expected to be relatively unresponsive to price changes and to continue as long as returns remain above the costs of processing and marketing. The returns include those received for other marketable by-products, such as meat-meal, fertilisers, and the saving in the cost of disposal of waste otherwise incurred. Being a by-product, the output of tallow is largely influenced by factors that govern the output of meat.

The practice of bulk-handling has recently been introduced. It is reported to reduce costs by some $20 per ton, mainly through saving in time and labour.[37] In addition, bulk tallow commands a premium in some exporting countries. Facilities for bulk-handling are now available in all Australian mainland ports, and the provision of road and rail tankers has extended bulk-handling to inland areas.

37. The Meat Industry Bulletin, November 1963.

(e) Hides and Skins

Production of hides and skins is recorded in three components: cattle hides, calf skins, and sheep and lamb skins. Their production is directly related to the number of animals slaughtered. Statistics exist for the number of hides and skins used by Australian tanneries and for the number exported. In the case of cattle hides, local use and exports account for 98.5 percent of the number of cattle slaughtered.[38] A similar check could not be carried out for calves (the export of calf skins is only available by weight), but it is assumed there is a total clearance through these two outlets. Making the same comparison for sheep and lambs accounts for only about 90 percent of the animals slaughtered. Of the remainder, some are used by local fellmongers, others are exported as skin pieces, and a small quantity is probably lost on farms and during processing.

Two significant features of the hides and skins industry in recent years have been the marked increase in export trade and the improvement in the quality of the product. Up to 35 percent of cattle hides and between 50 and 60 percent of calf skins are now exported. Export has long been the main outlet for sheep and lamb skins and at present over 80 percent are sold on this market. The exported skins are sold principally to fellmongers in France, but other European countries are increasing their purchases of Australian sheep and lamb skins. The quality of Australian hides was often criticised because of careless removal from the beast and external markings caused by ticks, horns, brands, and stockwhips. A major improvement has been achieved in the past 2 or 3 years by the introduction of mechanical equipment for removing the hide or skin.

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38. Summed over the 10-year period ending in 1963-64, to allow for marked annual changes in stocks (Table 4.7.5).

CHAPTER VII

THE PROJECTION OF AUSTRALIAN SUPPLY OF FARM PRODUCTS

1. INTRODUCTION

The projection of agricultural supply poses great theoretical and practical difficulties. As far as we are aware, no one has managed to solve these entirely satisfactorily. The usual procedure has been to extrapolate past trends in yields, livestock numbers and crop acreages, subject to some arbitrary, subjective adjustments made in the light of what are believed to be the technical "possibilities" in any given situation. Sometimes, where the past changes in production and prices allow the determination of supply schedules, projections allowed for the effect of changes in expected prices on the quantity produced. However, even in these situations it was usually necessary to allow for changes in technology to shift the supply schedule to the right. One major difficulty involves the quantitative estimation of the shifts which can be expected to prevail in the future. Some shifts occur autonomously — they rerequire little, if any, developmental expenditure or capital investment;[39] others demand substantial capital outlays. In the case of "embodied" technical progress (where capital investment is required to move on to a new and higher production frontier), the rate of advance is likely to depend on: The funds available to the farming community for such investment, and the profitability of the new techniques.

High prices for farm products enable farmers to accumulate the funds which they tend to use for investment; they also raise the profitability of such investment. Hence, we can expect that periods of favourable farm product prices will be associated with high levels of investment. This in turn will induce a more rapid increase in aggregate agricultural output. Past trends conform to this pattern; Gutman's study of Australian agriculture over the period 1920 to 1947 showed a close relationship between, on the one hand, the relative level of farm prices and net farm investment; and on the other hand, between changes in investment and output (the latter lagged by one or two years).[40] However, trends in the post-war period are not quite as clear cut. In spite of a 20 percent decline in the relative prices received by farmers between 1952—53 and 1962—63, there has been little reduction in the volume of purchases of fixed assets over this period.[41] Other forms of investment, such as pasture improvement have also been maintained at a high level in recent years. It seems possible then, that developmental expenditure at present is not as closely related to relative prices as in the past — or

39. Examples are: the use of new crop varieties and technical advances financed and undertaken by Governments such as rainmaking, and biological methods of pest control including myxomatosis and cactoblastis.

40. G.O. Gutman, "Investment and Production in Australian Agriculture", Review of Marketing and Agricultural Economics, Vol. 23, No. 4 (December 1955), pp. 237-310.

41. Table 6.2.2.

alternatively, that there has been an upward shift in the propensity to invest in recent years. However, these are necessarily speculative conclusions at this stage.

In view of our inability to estimate an aggregate production function for Australian agriculture in Chapter VI, no attempt was made to project total agricultural output; instead we made our projections for individual products or groups of products. Our methods of projection varied for the different commodities and are discussed in detail in the succeeding sections of this chapter. Here it is desirable to make a few comments about some issues which relate to more than one of the succeeding sections.

1. As in Chapter V we have specified "low" and "high" projections. Our "most likely" estimate of future output is given by the arithmetic mean of the "low" and "high" projections — unless a different "most likely" projection is specifically mentioned.
2. Many of the projections in this chapter are first-round, constant-price projections. The constant prices are normally those of the base period (the average of 1958—59 to 1961—62). Where, for some specific reason, we felt that constant base-period prices were unrealistic, the other prices used are specified.
3. In the case of three products — mutton, tallow, and hides and skins — the level of production was regarded as dependent on the output of other products. Projections of output for these products is deferred to Chapter X when final projections for wool and beef production will be formulated[42]
4. At the time of writing this chapter (July 1966) the drought conditions prevailing over a large part of New South Wales and Queensland during the last 12 to 18 months were likely to have a severe effect, for some years, on Australian output of meat and, to a lesser extent, wool. The likely quantitative effect of this drought is extremely difficult to estimate partly because we do not as yet know the full extent of the livestock losses resulting from the drought;[43] and partly because we know little about the speed of the build-up in stock numbers after such a drought.

42. There seemed no point in formulating projections for mutton, tallow and hides and skins when it was known that the projections for wool and beef production were first-round projections which were likely to be revised.

2. FRAMEWORK FOR PROJECTION FROM 6-SECTOR SUPPLY MODEL: PASTORAL, CEREALS, DAIRYING

The products involved here are those of section 3, Chapter VI: wool, lamb, wheat, coarse grains, beef and veal, and dairy products. As elsewhere within the present chapter, our projections are, in the main, based on the mean commodity prices prevailing over the 4 year base period 1958—59 through 1961—62. However, here we rely on a somewhat different strategy to that adopted in the rest of this chapter. The principles underlying our simultaneous projections are described below.

A Methodology for Projection

A set of six simultaneous supply equations are our basic tool for projection.[44]

43. Preliminary information released in June 1966 indicates that sheep and lamb numbers at March 31, 1966 were some 13½ million lower than in March 1965; however further losses are possible in the succeeding 12 months period. In addition, no information on cattle losses has yet been released.

44. The supply projections of this chapter constitute the first round of a step-wise approach to the equilibrium projections of Ch. X. At the time at which the present projections were made, the system finally adopted in Ch. VI had not been fully developed. However the set of simultaneous equations used here resembles that reported in Ch. VI very closely, except in the case of the supply equation for lamb; details of discrepancies will be found below. In all subsequent rounds of the step-wise approach to equilibrium projections, the results of Ch. VI. 3 have been used.

It will be recalled that our equations are linear in expected prices, and hence also in actual prices, since the former are linear in the latter. Under our treatment, actual prices prevailing 7 or fewer years previously affect the price expected to hold for the current production period. Suppose, then, that one wished to project further than 7 years beyond the point at which the extant data run out. In line with equation (6.3.2), we can partition our projection from the i^{th} product during that year — say year t — into a component $\psi_{it} = \{\sum_{j=1}^{6} a_{ij} \pi_{jt}\}$ which depends on price expectations then current, plus a component $\hat{\Gamma}_{it}$ which is independent of such considerations.[45] Since we have projected sufficiently far beyond our current price history, and since we wish to project under constant price assumptions, we may write $\pi_{jt} \equiv \bar{p}_j$, where the $\{\bar{p}_j\}$ are the constant set of prices under which the projections are to be made. As far as ψ_{it} (the component of the projection responsive to current price expectations) is concerned, some minor difficulties would arise should we wish to project fewer than 7 years[46] ahead: in that case, we would have to compute the set of expected prices $\{\hat{\pi}_{jt}\}$, making due allowance for what has already occurred — constant price projections cannot assume away observed history. For some products — those in which there exist significant autonomous trends in physical productivity per decision unit [47] — there exists the further complication that the assumption of constant commodity prices involves assuming an upward trend in revenues per decision unit; i.e., in 'prices' as they have entered into our supply analysis of Chapter VI.1. Again, one could cope with this fairly readily, but the computational simplicity of the method is lost.

These thoughts in themselves suggest that it might be worthwhile to automate the projection procedure; i.e., to programme it for a digital computer. But of course, the problems involved with the component ψ_{it} of the projection for year t pale into ghostliest insignificance by comparison with what projecting Γ_{it} involves. For whilst Γ_{it} does not depend on current price expectations, it depends critically on almost all of previous price history: the only set of actual prices not contributing to the cumulative impact of prices on Γ_{it} being the set $\{p_{it-1}\}$; i.e., the set of actual prices prevailing last year from the point of view of year t for which projections are to be made. All of this is simply a consequence of last year's output appearing in every equation as an argument of the shift functions Γ_{it}.[48]

The inclusion of lagged output complicates the issue in yet other ways. Drought indexes appear as shift variables included in Γ_{it} in three of our estimated supply equations (wool, lamb, beef and veal). Since the impact of a single drought is cumulative over a number of years in the case of animal products, one would be led to question the realism of projections assuming 'constant neutral weather' in addition to constant commodity prices. A stochastic approach to projection was clearly called for; this need, plus the alternative prospect of tedious and extensive desk computations, figured largely in our adoption of Monte-Carlo techniques. The other major element contributing to this decision was our hope that we might be able to estimate the sampling variability of our projections in so far

45. Circumflexes indicate estimates.

46. We realize that the figure 7 here is a child of our own begetting. The crucial point, in a more general operational context, is that there will exist some integral number of years beyond which price history will have an arbitrarily low relevance for future expectations.

47. For example, wheat, where the 'decision units' used to measure planned output are acres.

48. In the case of beef, lagged output is not an explicit argument of the shift function; that it is an implicit argument, however, is established by equation (6.3.9).

as such arose from 'random'[49] behaviour of the 'exogenous'[49] variables in our system.

Terminology of Simulation Model

Units of Measurement: A number of distinctions become not only useful, but indeed essential, in what follows. We have already distinguished between a 'decision' unit and a natural, or commodity, unit. For two of the products studied here, the natural unit has been taken as proxy for the decision unit; thus in the case of the meats ('lamb' and 'beef and veal') only one unit of measurement is involved — namely, the ton of carcass weight. For wool, a convenient natural unit would be weight of greasy wool in millions of lbs; however, the decision unit consisted here of millions of adult sheep shorn. Again, dairy cow numbers were taken as the decision units for dairy products, whereas gallons would be a convenient natural unit. For grains, the decision units are acres; the natural units, bushels. We will discuss the basis for conversion from one system of measurement to the other below.

Simple Exogenous Variables: By this term we designate those explanatory variables in the supply system whose explanation (if such there be) lies outside not only the supply system, but indeed, outside the entire supply/demand complex within the framework of which projections are to be made. In the current context, drought indexes clearly belong to this category, whilst commodity prices obviously do not. (In fact, drought indexes constitute the only simple exogenous variables in this system.)

Quasi-Exogenous Variables: The values of these variables may be taken as given from the viewpoint of the supply analysis, but their explanation is imbedded within the supply/demand complex. Specifically, prices are quasi-exogenous, being generated by a time series of Marshallian crosses. The only quasi-exogenous variables involved here are prices.

Lagged Endogenous: This category is self explanatory, consisting of lagged values of quantities supplied (decision unit basis).

Special: This category is reserved for the role of the opening inventory of non-breeding beef cattle in the supply equation for beef and veal. This variable combines lagged endogenous, lagged special, and lagged simple exogenous influences [equation (6.3.9)].

Stochastic Approach

It is assumed that the exogenous variables (both sub-categories) are subject to a potential (joint) probability distribution. Moreover, the distribution of each such variable is assumed to be independent of every other exogenous variable.[50] Further, it is assumed that past experience over the 18-year sample period (1947—48 to 1964—65) provides a reasonable base to estimate the probability distributions of these variables.

In the case of the quasi-exogenous variables (prices), the philosophy underlying our projections runs something like this. Suppose that at the beginning of the sample period (1947—48 through 1964—65) we had been confronted with the task of projecting the time-paths of prices and outputs for each of the six commodities considered here. Further suppose that we had been able, ex ante, to correctly forecast the trends (assumed linear)

49. Some care is needed with these adjectives if terminological confusion is to be avoided. We attempt a more precise statement below.

50. Of the entire set of exogenous variables, the drought indexes for sheep products and for cattle products seemed the most likely pair to exhibit correlation. Over the sample period (1947-48 to 1964-65), the simple correlation between these two indexes was only 0.34 (not significantly different from zero at the 5 percent level). It was expected, however, that the Korean War would have caused 'shocks' of the same direction in the case of all commodity prices. As is outlined below, however, our projections abstract from cataclysms of this magnitude.

in prices. [We make this last supposition because this is what we hope to accomplish in our equilibrium (as distinct from the present constant price) projections. (See Chapter X.) Thus we are in a system where knowledge of trends in prices is assumed given, but the sizes of the 'shocks' by which actual prices depart from their trends in any given future year are unknown, and are to be treated as stochastic. We assume that the probability distribution of such shocks for future projective work may be estimated from the sample period data by the method now described.

Simulation of 'Shocks' in Prices

Each time series on prices (decision unit basis) was fed into the computer (subject in certain instances to the deletion of the Korean War period). This series was then regressed linearly on time by the standard method of least squares, obtaining trend estimates $\hat{p}_{it}$ for product i at time t. The proportional deviation of the actual price p_{it} from this trend value was computed; i.e., the variables ζ_{it} were computed from the formula

(7.2.1) $$\zeta_{it} = (p_{it} - \hat{p}_{it})/\hat{p}_{it}$$

These proportional deviations from trend formed an individual time series for each product. Make the twin assumptions (i) that the trends in future prices are accurately known; and (ii) that the proportional shocks about these trends will follow the same probability distribution as in the past. Suppose that $\hat{p}_{it'}$ is the trend estimate made (under assumed perfect foresight of trends) for the price of product i in some future period t'. Then the stochastic component of price can be superimposed on this by writing

(7.2.2) $$p_{it'} = \hat{p}_{it'} (1 + \zeta_{iT})$$

where $p_{it'}$ is the 'simulated' price of product i for time t', and ζ_{iT} is drawn at random from the series $\{\zeta_{it}\}$ as compiled for the historical sample period.

In point of fact, provision was made for sampling in blocks of lengths ranging from 1 to 3 years (the actual block length used to be selected ex ante, parametrically). Thus the starting point T would be generated at random, and a block of ζ_{it}'s taken in sequence from this starting point. Successive substitution of these ζ_{it}'s into (7.2.2) was used to generate a 'random block' in the simulated time series on prices. This provision for sampling in blocks was made in order to take some account of the potential impact of the autocorrelation undoubtedly present in some of the historical series. However, independence between products was assumed; thus the starting points for blocks were selected independently across products. This then has been our approach to simulating the time paths of quasi-exogenous variables on the basis of known future trends.[51]

Simulation of 'Shocks' in Drought Indexes

The simple exogenous variables — the sheep and cattle drought indexes — have sample means near zero. They are already quoted on a proportionality basis, being deviations of percentage mortality rates. Our Monte Carlo simulation procedure for drawing from the probability distributions of these variables consisted of feeding the data into the computer in sequence, and then generating a random starting point (as in

51. In fact, (7.2.2) is not fully operational in the sense that its use could (and did) lead to time-paths not fully consistent with the trends assumed ex ante. This result was to be expected, since the method of least-squares trend fitting ensures that the deviations from fitted trend (when expressed in absolute units) add identically to zero; no such guarantee exists for proportional deviations. However, the matter was easily corrected by use of a two-stage generation process. In the first stage, equation (7.2.2) was used as it stands to generate simulated prices for a very large number of replicates of potential time-paths of prices. The ex post biases between the theoretical means of these series, and those actually generated, were noted. These bias corrections were used in the second stage generation process to ensure that the generated price series did, in fact, have the means required by the trend assumptions upon which they were generated.

the case of prices). Again, the sampling procedure was based on the assumption of independence between the two series.[52]

Simulated Time-Paths of Endogenous Variations

It will be recalled [equation (6.3.5)] that lagged output enters explicitly into all but one of our six estimated supply equations, and in the one exceptional case (beef), lagged output remained an implicit argument of the supply function [equation (6.3.9)]. From the viewpoint of these projections, 1965—66 served as origin on the time scale. Thus in projecting the time paths of quantities supplied we began with starting data on prices and quantities for 1965—66, and then computed estimates of supplies in 1966—67. In the latter and in subsequent years, prices and drought indexes were generated in the manner described above, and the time paths of all variables traced out over the period 1966—67 to 1980—81. The whole procedure was then replicated 100 times, and the means and standard deviations of each variable in the system computed for every year in the projection period. This procedure, of course, could not be carried out unless the trends in prices had been specified ex ante. In the present chapter we are concerned with projections at constant commodity prices; i.e., of prices which, in terms of natural units, exhibit no trends. In the case of the meats — lamb, and beef and veal — there was no difference between natural and decision units. Thus, for projecting at constant prices, the ex ante slopes of the trend lines in prices were taken as zero, whilst the intercepts on the price axes — i.e., the average values, roughly speaking, which the simulator would have generated for prices in 1965—66[53] — were taken as the base period average prices.[54]

In all other cases, the decision units in which supplies were measured differed from the natural commodity units: this was a consequence of 'autonomous' trends in productivity per decision unit. The equations for conversion from one basis to the other are given below:

Equations for Conversion from Natural Unit Basis to Decision Unit Basis[55]

(7.2.3) Wool:
(adult sheep fleece weight in lbs, year t)
$= 5.97 + 0.0704\,t \quad (R^2 = 0.65),$
$\quad (0.63) \quad (0.0124)$
based on least-squares regression using annual data, fitted to the period 1938—39 to 1963—64 (t = 39 for 1938—39).

(7.2.4) Wheat:
(yield, bushels per acre, in year t)
$= 14.524 + 0.242\,t \quad (R^2 = 0.42),$
$\quad (0.4941)(0.0504)$
based on least-squares regression using annual data, fitted to the period 1930—31 to 1963—64 (t = 0 in 1946—47).

(7.2.5) Coarse Grains:
(a) Barley
(yield, bushels per acre, in year t)
$= 6.5395 + 0.2396\,t \quad (R^2 = 0.114);$
$\quad (5.8094) \quad (0.1108)$

52. As for prices, provision was made for sampling in blocks of variable length; the block length for any given simulation experiment was invariant between all exogenous variables.

53. As already explained above, estimates of actual prices for 1965-66 were available. The first year for which simulated prices were used was in fact 1966-67.

54. For all products other than lamb and beef and veal, the constant commodity prices used for projection in this chapter are the average levels prevailing over the 4 year period 1958-59 through 1961-62. For the meat products, these average figures have been further averaged with commodity prices prevailing in 1963-64: the rationale for this procedure will be found in the text below.

55. These equations have been extracted from Powell and Gruen, "Problems in Aggregate Agricultural Supply Analysis: I", op. cit.; they do not appear there in a convenient summary form.

(b) Oats
(yield, bushels per acre, in year t)
$= 5.6573 + 0.3881\,t \quad (R^2 = .369);$
$\quad (7.6375) \quad (0.1457)$

(c) Maize[56]
(yield, bushels per acre, in year t)
$= 0.8870 + 0.5391 \quad (R^2 = 0.721);$
$\quad (3.8392) \quad (0.0732)$
based (in each case) on least-squares regressions using annual data, fitted to the period 1940—41 to 1962—63 (t = 41 in 1941).

(7.2.6) Dairy:
(a) $\log_{10}$ (milk yield in gallons per cow per annum)
$= 2.268 + .00598\,t \quad (R^2 = 0.779);$
$\quad (0.047) \quad (.00084)$
based on a least-squares regression using annual data, fitted to the period 1946—47 to 1963—64 (t = 47 in 1946—47)

(b) (milk yield in gallons per cow per annum)
$= 460 + 6.2\,t$
which is a linearisation of (a), with t = 0 in 1965—66, and which assumes that the arithmetic rate of productivity increase predicted by (a) for 1965—66 will persist in subsequent years.

Establishing *Ex Ante* Parameters for Price Trends (Decision Unit Basis)

We have made detailed tabulations on commodity prices elsewhere:[57] the average wool price for the base period (1958—59 through 1961—62) was, on a natural unit basis, 53.135 pence (44.3 cents A.) per lb. According to equation (7.2.3), the expected 'normal' fleece weight in 1965—66 would be 10.6868 lbs. Thus the 'normal' price for 1965—66 which corresponds to the base year commodity price, in terms of value per decision unit, may be calculated as (53.135 × 10.6868) pence per fleece. This works out at £A2.366 per fleece ($A4.73). Hence we have established the intercept for the trend line in wool prices when the latter are reckoned on a decision unit basis.

What of the slope of the trend in value per fleece? We first of all note that
(value per fleece) = (value per lb of wool) × (lbs wool cut per sheep),
abbreviating this to

(7.2.7) $$v = p\,q,$$

Under constant commodity prices, p is a constant, so that

(7.2.8) $$\partial v/\partial t = p\,(\partial q/\partial t).$$

Equation (7.2.3) gives the value of $(\partial q/\partial t)$; namely, 0.0704 lbs per fleece per annum. When multiplied by p = 53.135 (pence per fleece), the resultant trend in wool prices per fleece is £A0.015586 ($A0.03117) per fleece per year. This amount is the estimated annual increment in the value of a fleece due to autonomous productivity improvement when the price of wool is 'frozen' at the base period level.

In fact, equations of the form (7.2.7) and (7.2.8) are relevant not only to wool, but also to wheat, dairy products, and — in a slightly more general form — to coarse grains.

The computations of *ex ante* slopes and intercepts for wheat and dairy products do not differ in any important way from the method outlined above for wool. These computations are shown in Table 7.2.1.

The calculation of the appropriate trend parameters for coarse grains is more complicated than for any other product considered. The additional difficulty springs from the

56. Although maize is not included within the terms of reference of this study, it contributed a minor component of the aggregate coarse grains series used in our analysis and the tabulated equation is necessary for projecting the barley and oats components of this acreage.

57. Powell and Gruen, *op. cit.* See also the tabular appendices to this report.

fact that an aggregate of three grains — barley, oats, maize — is involved. The output indicator used in the supply analysis of Ch. VI was simply the total (intended) acreage under such grains. Yields per acre have been rising in all three cases [equations (7.2.5), (a), (b), and (c)].

As an initial step towards computing the intercept for the trend in the value per acre of coarse grains consonant with base period commodity prices, it was assumed that the composition of the total coarse grains acreage in 1965 — 66 could be approximated by the average composition for the preceding two years. This led to acreage weights of 0.3575, 0.6050, and 0.0375, respectively, for barley, oats, and maize. The second step in our procedure was to compute from equations (7.2.5) the 'normal' yield of each grain expected for 1965 — 66. The values obtained, in bushels per acre, were 22.35, 19.96, and 36.47, for barley, oats and maize respectively. The corresponding average commodity prices in the base period (1958 — 59 through 1961 — 62) were: barley, £A0.5100 ($A1.02) per bushel; oats, £A0.4653 ($A0.9306) per bushel; maize, £A0.5424 ($A1.092) per bushel. Using the normal yield figures for 1965 — 66, these prices correspond to the following valuations per acre:

barley: £A11.3985 ($A22.797)
oats: £A 9.2874 ($A18.5748)
maize: £A19.7813 ($A39.5626)

The final operation consisted of aggregating the three figures above using the acreage weights found in the initial step. The resultant intercept value for coarse grains was £A10.436 ($A20.872) per acre.

The computation of the appropriate slope coefficient for coarse grains hinges on the postulate that, at given commodity prices, the relative acreage weights for each of the three grains may be taken as constant without introducing serious error. Thus we have

$\tilde{v}$ = Average value of coarse grains output per acre

$$(7.2.9) \quad = \sum_{i=1}^{3} w_i v_i$$

where the (w_i) are the acreage weights (assumed constant) and v_i is the valuation per acre of the i^{th} coarse grain (i = 1, barley; i = 2, oats; 1 = 3, maize). As in the case of wheat, these individual valuations per acre can be split into the product of commodity price (natural unit basis) and yield per acre. Suppose we write, analogously with (7.2.7), that $v_i = p_i q_i$. Then, from the point of view of our projections, we want the slope

$$(7.2.10) \quad \partial\tilde{v}/\partial t = \frac{\partial}{\partial t}\{\sum_{i=1}^{3} w_i p_i q_i\}.$$

By assumption, each w_i and p_i is constant, so that

$$(7.2.11) \quad \partial\tilde{v}/\partial t = \sum_{i=1}^{3} w_i p_i \frac{\partial q_i}{\partial t}$$

The 'autonomous' rates of improvement in productivity $\{\partial q_i/\partial t\}$ were found from equations (7.2.5); the constant commodity $\{p_i\}$ of the base period (1958 — 59 through 1961 — 62) have already been discussed above; finally, the constant weights used were also those computed for 1965 — 66 as outlined above. Our resultant slope estimate for $\partial\tilde{v}/\partial t$ was £A0.1639 ($A0.3278) per acre per year.[58]

For the two meat products, their natural units of measurement (tons, carcass weight) were used in raw form for the supply analysis of Ch. VI. With no distinction necessary between decision and natural units, the assumption of constant prices quite unambiguously implies that there is no trend in

58. The relatively slight differences between the set of acreage weights for 1965-66 and the averages of those prevailing over the base period (1958-59 through 1961-62) would cause our estimate of $\partial\tilde{v}/\partial t$ to differ in the third significant digit; as this discrepancy was discovered late in our work, and since its potential impact on our projections was very slight, we did not attempt a revision. On the basis of average acreage weights for the base period, our estimate of $\partial\tilde{v}/\partial t$ would have come out at £A0.1607 per acre per year (versus £A0.1639 actually used).

Table 7.2.1

SLOPES AND INTERCEPTS OF TRENDS IN VALUES PER DECISION UNIT CORRESPONDING TO CONSTANT COMMODITY PRICES FOR WHEAT AND DAIRY PRODUCTS*

Product	Intercept			Slope	
	'Normal' Output per Decision Unit, 1965—66 (1)	Constant Commodity Price Assumed (2)	Trend Line Intercept = (1) × (2) (3)	Rate of 'Autonomous' Productivity Increase (4)	Trend Line Slope = (2) × (4) (5)
Wheat	19.122 bushels per acre (a)	£A0.66375 per bushel ($A1.3275)	£A12.692 per acre ($A25.384)"	0.242 bushels per acre per annum (a)	£A0.16063 per acre per annum ($A0.32126) "
Dairy Products	459.8 gallons per cow (b)	£A0.11889 per gallon ($A0.23778)"	£A54.665 per cow ($A109.33)"	6.2 gallons per cow per annum (c)	£A0.737 per cow per annum ($A1.474) "

* Constant commodity prices are those of the base period: the average of the 4 years 1958-59 through 1961-62.

(a) Based on equation (7.2.4).

(b) Based on equation (7.2.6) (a).

(c) Based on equation (7.2.6) (b).

price, however measured. Since their slopes are by assumption zero, this leaves to be estimated only the appropriate intercepts for the prices of lamb, and of beef and veal.

The standard base period (average of 1958—59 through 1961—62) is not a 'realistic' one for projections in the cases of sheep and cattle meats. By this we mean that there was strong prior evidence that the equilibrium projections of Ch. X must involve meat prices considerably above the standard base period values. Even though the purpose of the present chapter is only to establish a first pass of constant price supply projections (the compatability of which with the corresponding demand projections would only, by a statistical miracle, be perfect), there seemed little point — even at the first round — in beginning with price assumptions whose likelihood of fulfillment was extremely remote. As a step in the direction of realism, the constant prices upon which the supplies of beef and veal and lamb have been here projected, are somewhat higher than those of the base period figures used for the remaining four products. The (arbitrary) upward adjustment was effected by taking the simple average of the standard base period average commodity prices and those pertaining in 1964—65. These values — conceptually, the intercepts of the trends in meat prices — were found to be £A279 ($A558) per ton for lamb, and £A204.5 ($A409) per ton for beef and veal.

For convenience, all values of intercepts and slopes in ex ante trend lines for prices are summarized in Table 7.2.2.

Final Operational Specification of Simulation Model

Two further decisions remained to be taken before the simulated time paths of the endogenous variables could be generated by our Monte-Carlo procedure. The first related to the length of block to be used for sampling from the historical time series on 'shocks' in prices and in drought indexes. Largely on pragmatic grounds we chose to sample in blocks of two years: one could scarcely sample in larger units from a total which, in many cases, did not exceed 18 annual observations; whilst to ignore autocorrelation altogether was also unpalatable. The mean time paths of the endogenous variables, at all events, proved to be insensitive to the choice of block length over the range considered — from 1 to 3 years. The estimated sampling standard deviations of the endogenous variables were modestly larger for samples drawn on the basis of two year blocks when compared with the results obtained by sampling in units of a single year.[59]

The final problem confronting us was occasioned by the exceptionally severe drought in eastern Australia during the crop years 1964—65/1965—66. Our system of structural supply equations was estimated from data which did not include any drought experience of this magnitude: thus it was expected to prove an unreliable guide to movements in output during the 3—4 year recovery period following this latest major drought. It has been observed that in the wake of severe droughts, production indexes increase at rates which would rarely be observed during less exceptional periods. Since our estimated supply structure could not be expected to cope with such a situation, we have used as starting values of the output indicators, not the values officially estimated to obtain during 1965—66 (the latest available estimates), but values somewhat higher. These upward adjustments were carried out in ad hoc fashion on the basis of our subjective judgements.

59. We stress that the sampling standard deviations in endogenous variables here estimated are generated by stochastic shocks in the quasi-exogenous and in the exogenous variables; no allowance was made for supply equation residual errors which would introduce further variability. To the extent that they reflect equation errors on the demand side, the simulated 'shocks' in prices do, however, allow for some stochastic equation errors in the market structure.

Table 7.2.2

SUMMARY OF SLOPES AND INTERCEPTS FOR EX ANTE TRENDS IN VALUES PER DECISION UNIT WHICH CORRESPOND TO CONSTANT COMMODITY PRICES UNDERLYING PROJECTIONS

Product	Intercept (d)	Slope
Wool (b)	£A2.366 per fleece ($A4.73) " "	£A0.015586 per fleece per ($A0.03117) annum
Lamb (a) (c)	£A279 per ton carcass ($A558) weight	0
Wheat (b)	£A12.692 per acre ($A25.384) " "	£A0.16063 per acre per ($A0.32126) annum
Coarse Grains (b)	£A10.436 per acre ($A20.872) " "	£A0.1639 per acre per ($A0.3278) annum
Beef and Veal (a) (c)	£A204.5 per ton carcass ($A409) weight	0
Dairy Products (b)	£A54.665 per cow ($A109.33) " "	£A0.737 per cow per annum ($A1.474) " " " "

(a) Decision units identical with natural commodity units.

(b) Standard base period prices; i.e., average of commodity prices prevailing over 1958-59 through 1961-62.

(c) Special constant price assumptions: simple average of figure obtained above in (b) with commodity prices prevailing in 1964-65 has been used.

(d) This may loosely be interpreted as the average over replicates which 'value per decision unit' would have assumed in 1965-66 if such had been generated from Monte-Carlo model. (Actual estimates were available for 1965-66, and these have been used: the first year in which prices were projected by Monte-Carlo techniques was 1966-67.)

Results of Monte Carlo Experiment

The net result of this analysis is recorded in Table 7.2.3,[59a] in which the mean time paths of each endogenous variable are traced out subject to the stated assumptions. One striking feature immediately emerges; namely, that at the postulated relative prices, our system predicts an alarming decline in lamb output. This to some extent may be due to the fact that the constant prices under which lamb output has been projected ($558 per ton) seems implausibly low by comparison with the actual prices currently being obtained ($734 per ton for the 1965—66 season, on our estimate). Second, our estimated supply structure failed to detect any cross price responsiveness (of plausible sign) linking wool and lamb production.[60] Whilst we accept that the tools at our disposal were not adequate for the detection of such a response from our sample period data, our prior beliefs are by no means confounded by this apparent lack of success.[61] Clearly, substantial opportunities do exist for movement out of wool into lamb production, even though such movements may not have been dominant over the sample period (1947—48 through 1964—65) upon which our estimated structure depends. However, if in fact the time paths of wool and lamb were to follow those suggested by Table 7.2.3, there is no doubt that the very sizeable potential excess demand for lamb would so drastically alter the lamb/wool price ratio as to elicit an important cross response. As a final caveat in connection with these lamb projections, we point out that the problem is aggravated by the fact that autonomous productivity increases have been assumed to occur in dairying, whilst no such favorable trends exist for lamb. This whole issue is one to which we shall have to return in Chapter X. But in order to avoid exaggerating the gravity of the situation, we record here that in further simulation experiments in which the relative prices of lamb was held constant at the level actually observed during 1965—66, the output of lamb was maintained throughout the projection period at about the base period level.

Sampling Standard Errors

For the purposes of obtaining high and low commodity projections in the next section of this chapter, we have tabulated the estimated sampling standard deviations of the endogenous variables for the years 1970, 1975, and 1980 in Table 7.2.4. We again stress that these indicators of variability abstract from:

(i) Cataclysms of the order of the Korean War commodity price boom.
(ii) Extreme droughts of the order experienced during the early 1900's, in 1944—45/1945—46, and, more recently, during 1964—65/1965—66.
(iii) Stochastic errors in estimated structural equations.

In the interests of realism, some allowance for (iii) had to be made. Our computational resources precluded our giving estimates of what, in classical linear regression theory, is termed the 'standard error of forecast';[62] however, we were readily able to use classical tools to obtain estimates of the 'standard error of estimate' for each of our supply equations. The latter measure necessarily underestimates the more appropriate concept of the standard error of forecast because it treats the estimated re-

59a. The early estimate used in Table 7.2.3 for beef and veal production in 1965-66 was 0.890 million tons. The projections of Chapter X, Table 10.2.1, use a revised estimate, 0.949 million tons (also shown in Table 7.3.3). Discrepancies in estimates of lamb output for 1965-66 are also revealed by comparing Table 7.2.3 with later tables; again, the difference is due to production statistics for 1965-66 becoming available.

60. This major weakness was eliminated in the final supply structure adopted in Ch. VI.3; our equilibrium projections of Ch. X do, in fact, allow for cross responsiveness between wool and lamb.

61. This early view proved overly pessimistic. See footnote 60.

62. A.S. Goldberger, Econometric Theory (New York: John Wiley and Sons, 1964), pp. 169-170.

Table 7.2.3

PROJECTIONS OF SUPPLY AT CONSTANT PRICES :
DECISION UNIT BASIS*

Year	Beef and Veal (million tons carcass weight)	Wool (million adult sheep shorn)	Wheat (million acres)	Coarse Grains (million acres)	Lamb (million tons carcass weight)	Dairying (million dairy cows)
Base Period Values: Average 1958—59 through 1961—62	.770	138.1	12.4	5.9	.203	3.230
1965—66 (estimate)**	.890	141.7	17.5	5.9	.195	3.230
1965—66 (starting value)†	.880	145.0	17.5	5.9	.190	3.230
Projections						
1966—67 ††	.704	146.2	17.9	5.8	.181	3.259
1967—68 ††	.753	147.4	18.5	5.6	.181	3.265
1968—69 ††	.796	148.6	18.8	5.6	.173	3.318
1969—70 ††	.833	149.7	19.3	5.5	.171	3.336
1970—71	.878	151.0	19.5	5.5	.162	3.372
1971—72	.905	152.0	20.0	5.4	.159	3.360
1972—73	.933	153.0	20.2	5.4	.149	3.404
1973—74	.948	154.0	20.6	5.3	.147	3.403
1974—75	.958	154.4	21.0	5.3	.135	3.449
1975—76	.963	154.8	21.5	5.2	.131	3.462
1976—77	.983	155.5	21.8	5.3	.122	3.496
1977—78	.995	155.9	22.3	5.1	.120	3.497
1978—79	1.012	156.3	22.5	5.2	.109	3.532
1979—80	1.019	156.6	23.0	5.1	.106	3.538

* Based on sample means of Monte-Carlo experiment over 100 replicates. Constant commodity prices assumed are arithmetic averages of prices prevailing over 4 year period 1958-59 to 1961-62 inclusive (meats excepted). In the cases of lamb, and of beef and veal, the constant commodity prices are the simple averages of the base period figure (average 1958-59 to 1961-62) and the price prevailing in 1964-65.

** Latest estimate available of actual value achieved in 1965-66.

† In the case of wool, figures used as starting values for simulation procedure were purposely set at higher values than recorded statistics in order to allow for abnormal recovery rate expected to follow the severe drought of 1964-65/1965-66.

†† Short term projections for wool and lamb are probably unreliable due to artificial starting values. Short term projections for wheat are likely to understate actual outcomes.

Table 7.2.4

ESTIMATES OF POTENTIAL SAMPLING VARIABILITY IN PROJECTIONS INDUCED BY SHOCKS IN EXOGENOUS VARIABLES: MONTE-CARLO ESTIMATES OF STANDARD DEVIATIONS FOR WOOL, BEEF AND VEAL, LAMB, CEREALS AND DAIRY PRODUCTS*

Years	Wool	Beef and Veal	Lamb	Wheat	Coarse Grains	Dairy Products
	(million adult sheep shorn)	(million tons carcass weight)		(million acres)		(million dairy cows)
(a) 1969—70	2.894	.061	.024	.825	.298	.081
(b) 1970—71	2.887	.052	.025	.818	.304	.074
1970 [average of (a) and (b)]	2.891	.057	.025	.822	.301	.078
(c) 1974—75	3.649	.063	.030	.939	.346	.088
(d) 1975—76	4.073	.073	.031	1.035	.358	.116
1975 [average of (c) and (d)]	3.861	.068	.031	.987	.352	.102
1980 (e)	4.345	.061	.038	1.142	.387	.105

* Supplies measured on decision unit basis; estimates based on 100 replicates.

(e) Average of values for 1978-79 and 1979-80 is shown: projections were not made for 1980-81.

Table 7.2.5

APPROXIMATE SAMPLING STANDARD ERRORS OF PROJECTIONS* FOR SUPPLIES OF WOOL, BEEF AND VEAL, LAMB, CEREALS AND DAIRY PRODUCTS: DECISION UNIT BASIS

Year	Wool			Beef and Veal			Lamb			Wheat			Coarse Grains			Dairying		
	Due to		Total (c)	Due to		Total (c)	Due to		Total (c)	Due to		Total (c)	Due to		Total (c)	Due to		Total (c)
	SEE [a]	EX [b]		SEE [a]	EX [b]		SEE [a]	EX [b]		SEE [a]	EX [b]		SEE [a]	EX [b]		SEE [a]	EX [b]	
	(million adult sheep shorn)			(million tons carcass weight)						(million acres)						(million cows)		
1970	3.265	2.891	4.361	.057	.057	.080	.016	.025	.030	.925	.822	1.237	.485	.301	.571	.046	.078	.091
1975	3.265	3.861	5.057	.057	.068	.088	.016	.031	.035	.925	.987	1.352	.485	.352	.599	.046	.102	.112
1980	3.265	4.345	5.435	.057	.061	.083	.016	.038	.041	.925	1.142	1.470	.485	.387	.620	.046	.105	.114

* Include allowance for sampling deviation of projected supplies about fitted regression hyperplanes, and for random shocks in 'exogenous' variables; make no allowance for sampling divergence of fitted hyperplanes about their population counterparts.

(a) Standard error of estimate of fitted supply equation.

(b) Monte-Carlo estimate of sampling standard deviation in endogenous variable due to shocks in exogenous variables (Source: Table 7.2.4).

(c) Square root of the sum of the squares of (SEE) and (EX). Apparent discrepancies due to rounding.

Table 7.2.6

CONSTANT PRICE PROJECTIONS OF SUPPLIES OF WOOL, BEEF AND VEAL, LAMB, CEREALS AND DAIRY PRODUCTS: DECISION UNIT BASIS[a]

Year		Wool (million adult sheep shorn)	Beef and Veal (million tons carcass weight)	Lamb	Wheat (million acres)	Coarse Grains	Dairy Products (million dairy cows)
1970	High	154.7	.936	.197	20.6	6.1	3.445
	"Most Likely"	150.3	.856	.167	19.4	5.5	3.354
	Low	145.9	.776	.137	18.2	4.9	3.263
1975	High	159.7	1.049	.168	22.6	5.9	3.568
	"Most Likely"	154.6	.961	.133	21.3	5.3	3.456
	Low	149.5	.873	.098	19.9	4.7	3.344
1980	High	162.0	1.102	.147	24.5	5.7	3.652
	"Most Likely"	156.6	1.019	.106	23.0	5.1	3.538
	Low	151.2	.936	.065	21.5	4.5	3.424

Sources: Tables 7.2.3 and 7.2.5. "Most likely" value for 1970 and 1975 are averages of projections for 1969—70 and 1970—71, and for 1974—75 and 1975—76, respectively. "Most likely" value for 1980 has been taken as projected value for 1979—80 (1980—81 was not projected). Limits were established by adding and subtracting one estimated sampling standard deviation (Table 7.2.5).

(a) For base period values, and estimates for 1965-66, see Table 7.2.3.

gression hyperplane as if it were the 'true', underlying, structural hyperplane.

In what follows we assume independence between shocks in simple exogenous and quasi-exogenous variables on the one hand, and deviations of predictions generated by the supply equations from values actually realised, on the other. Under these circumstances the sampling standard deviations of the endogenous variables due to shocks in exogenous variables may be added to the standard errors of estimate obtained from the estimated supply equations by use of Pythagorean addition: one squares the individual aggregands, adds up their squares, and finally takes the square root of the sum. These operations have been carried through in Table 7.2.5, in which are given our final estimates of the conditional standard error of our projections under the assumed price regime.

As will be explained in the next section, 'high' and 'low' bounds have been placed on our projections by the simple device of adding and subtracting one sampling standard deviation from estimated central values. On this basis, our projections in terms of decision units for 1970, 1975, and 1980 have the limits indicated in Table 7.2.6.

3. PROJECTIONS OF PASTORAL, CEREAL AND DAIRY PRODUCTS AT CONSTANT PRICES

In the previous section we have outlined our approach to these constant price projections, and indeed, have generated the time-paths of supplies in terms of decision units. We have also attempted to derive some indicators (Table 7.2.5) of the statistical reliability of our projections (on a decision unit basis) for 1970, 1975 and 1980. The role of the present section is to convert our projections for each product into natural commodity units, and to make some statements about the statistical reliability of these projections. Our task includes disaggregating coarse grains and dairy products into finer components.

Approaches to establishing "high" and "low" limits in this study have necessarily been dictated by the kind and quality of the data available; by the type of model within whose framework these data have been analysed; and last (but not least) by the amount of confidence which the individual researcher felt could be attached to his projections in the light of his intimate knowledge of their underpinning assumptions and of the inherent power, or lack of power, of the statistical tools at his disposal. It is not our intention here to reiterate all of what was said in part 1 of this chapter; however, we do wish to stress that the method of arriving at 'high' and 'low' projections described below is quite specific to the present section of this chapter.

It is well known that normally distributed random variables are such that roughly two thirds of all observations will lie within plus or minus one standard deviation of the mean.[63] Even if it were known, *ex ante*, that one were sampling from the *normal* distribution, placing bounds on one's projections which covered rather less than 70 percent of the potentially reliable observations would seem a limited enough objective. However, the assumption of normality is completely arbitrary and untested: distribution-free methods have *nothing* to say about bands so narrow as one standard deviation about the mean.[64] Given our ignorance of the relevant underlying distributions, one standard deviation above and below the mean, we repeat, would seem to establish 'high' and 'low' bounds of *minimal* width.

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63. See, e.g., D. A. S. Fraser, *Statistics: An Introduction* (New York: John Wiley and Sons, 1958), p. 71. A more exact figure than 'two-thirds' is 68.24 percent.

64. Tchebycheff's inequality holds irrespective of the distribution from which one is sampling; this inequality states that the probability that an observation will diverge by an amount so great (or greater) than k standard deviations from the mean is less than (1 k^2) [See Fraser, *ibid.*, p. 99]. With k=1, the information content of this statement is nil.

This process of taking one standard deviation above and below the mean was carried out as single stage process only in the cases of lamb, and beef and veal. This was because these are the only two products for which decision and natural units coincide. The 'high' and 'low' values, in these cases, reflect only deviations about regression hyperplanes compounded with the influence of 'shocks' in exogenous variables. Thus the 'high' and 'low' projections for meats in Table 7.2.6 establish our final projection band widths.[66]

For the other four products, the picture is further complicated by potential variation in yields per decision unit. Allowance is made for this variability factor in a similar spirit to the above by taking bounds which are obtained by adding and subtracting one standard error of forecast[67] to the 'normal' values predicted by equations (7.2.3) through (7.2.6).[68] The resultant 'high' and 'low' yield estimates are given in Table 7.3.1.

It will be noted that whilst our previous projections gave an aggregate acreage for coarse grains, the yield figures are quoted separately for barley and oats. Thus before the decision unit projections could be converted into natural commodity units, the coarse grains acreages given in Table 7.2.6 had to be split into their components.

66. For convenient reference, these projections are repeated below in Table 7.3.3.

67. For a rigorous discussion of the standard error of forecast, see Goldberger, op. cit., pp. 168-170.

68. The linearization (7. 2. 6) (b) used for projecting dairy yields caused some computational and interpretive problems which were solved in ad hoc fashion by using the antilog of the standard error of forecast of (7. 2. 5) (a) as an estimate of the standard error of forecast applicable to (7. 2. 6) (b).

Disaggregation of Coarse Grains

For the purpose of disaggregating coarse grains acreage, the following set of two simultaneous equations was fitted to the historical series (1947 — 48 through 1964 — 65) using basically the same techniques as were employed to fit the six-sector supply model reported in Chapter VI:

(7.3.1) barley: (proportion of coarse grains acreage sown to barley, year t)
= 0.2142 + .0347 [total coarse grains acreage, year (t-1)]
+ .003845 (price expected for barley in year t)
= .005636 (price expected for oats in year t);
(R^2 = .547).

(7.3.2) oats: (proportion of coarse grains acreage sown to oats, year t)
= 0.7119 - 0.0272 [total coarse grains acreage, year (t-1)]
- .005636 (price expected for barley in year t)
+ .008260 (price expected for oats in year t);
(R^2 = .407)

All estimated coefficients, other than the price coefficients, differed from zero with high statistical significance under the usual tests. The price coefficients are based on an estimated partial transformation elasticity of -0.23; the associated Student's |t| -value, at 1.5, failed to reveal significant price effects. Of more interest are the estimated standard errors of estimates: .0113 and .0107 respectively for barley and oats. However, rather than attempt to compound this source of variability with the variability observed in the coarse grains aggregate itself — and here the possibility of double counting certainly arises — we have followed a simpler approach which partitions the variance in the aggregate acreages series

Table 7.3.1

PROJECTED YIELDS PER DECISION UNIT:
WOOL, WHEAT, BARLEY, OATS AND DAIRY PRODUCTS*

Year		Wool	Wheat	Barley	Oats	Dairy (a) Products
		(lbs greasy per adult fleece)	(bushels per acre)			(gallons whole milk per cow)
1970	high	12.0361	23.015	35.6559	31.0041	489.1
	"most likely"	11.0036	20.211	23.4329	21.7067	487.9
	low	9.9711	17.407	11.2099	12.4093	486.7
1975	high	12.4322	24.264	37.3809	33.3290	520.1
	"most likely"	11.3556	21.421	24.6309	23.6472	518.9
	low	10.2790	18.578	11.8809	13.9654	517.7
1980	high	12.8296	25.414	38.9021	35.4216	551.1
	"most likely"	11.7076	22.510	25.7091	25.3936	549.9
	low	10.5856	19.606	12.5161	15.3656	548.7

* "Most likely" figure is based on equations (7.2.3) through (7.2.5), and on equation (7.2.6) (b). Upper and lower bounds are obtained by adding and subtracting respectively one standard error of forecast.

(a) Standard error of forecast used to establish limits is approximate only.

into components due to barley and oats.[69] Thus the "most likely" acreages for barley and oats have been estimated by use of (7.3.1) and (7.3.2) in conjunction with the tabulated mean time path of total coarse grain acreages given in Table 7.2.3.[70] To the resulting "most likely" values have been added and subtracted an allowance based on the sampling standard deviation of total coarse grains acreage: the allowance is intended, in each case, to approximate one standard deviation for the individual grain.

69. This approach has necessarily been very rough and has involved the use of several arbitrary simplifying assumptions, none of which could withstand close scrutiny. The bias introduced is toward understating the likely extent of sampling error. As will be seen, the bounds placed on barley and oats production turn out to be extremely wide even under these simplifying assumptions.

70. For brevity, we have not tabulated mean time paths of expected prices; the dissection into barley and oats required these data also.

These acreage projections for barley and oats are given in Table 7.3.2.

Projections on Natural Commodity Unit Basis

(a) **Non-Dairy Products:** We now have assembled all the information necessary to bring these projections into near final form. Tables 7.2.6, 7.3.1 and 7.3.2 enable us to give high, most likely and low projections for wool, lamb, beef and veal, barley, oats, and whole milk. We have already remarked that in the case of the meats, the projections of Table 7.2.6 need no further adjustment. For the remaining products, 'high' yield projections have been multiplied by 'high' decision unit projections in order to obtain 'high' final commodity projections; analagous procedures applied for 'most likely' and 'low' projections. In the case of wool, one further complication arose from the fact that a proportion (somewhat less than

Table 7.3.2

PROJECTED ACREAGES OF BARLEY AND OATS*

Year		Barley	Oats
		million acres	
1970	high	2.651	3.472
	"most likely"	2.168	3.167
	low	1.686	2.862
1975	high	2.536	3.414
	"most likely"	2.030	3.094
	low	1.524	2.774
1980	high	2.476	3.383
	"most likely"	1.952	3.051
	low	1.428	2.720

* Projections assume constant commodity prices at average 1958-59 through 1961-62 levels.

15 percent) of wool production comes in the form of lambs wool and fellmongered wool plus wool exported on skins.[71] Production of lambs wool has been estimated by making use of the average ratio over 1947—48 through 1962—63 of lambs wool production to tonnage carcass weight of lamb production; a similar ratio estimating technique has been used for wool exported on skins and fellmongered wool, with output of these two categories in aggregate linked to the number of adult sheep shorn. No attempt has been made to allow for estimating error in the case of these final adjustments.[72] Short of disaggregating whole milk into various dairy products, Table 7.3.3 gives our final constant price supply projections.

(b) **Dairy Products**: Projections of domestic liquid milk consumption have been given in Chapter V; because of the very low (and statistically tenuous) price responsiveness of liquid milk consumption, one may legitimately assume that this sector of the whole milk market will clear with consumption running at about the levels indicated in Table 5.3.4, irrespective of one's particular assumptions about the retail and wholesale prices of liquid milk. Consequently, one may regard the surplus between the total supply for whole milk projected in Table 7.3.3, and domestic demand for liquid milk as projected in Table 5.3.4, as projections of the supply of whole milk available for processing.

The task of splitting up this whole milk surplus was one which did not lend itself to refined statistical analysis: this, no doubt, largely reflecting the complex nature of this highly administered market. Even the use of a constant ratio allocation of whole milk surplus between its principal uses—butter, cheese, and condensery products—was hampered by the recent introduction of a new Bill (the Processed Milk Products Bounty Act, 1962—64) which tended to increase the relative profitability of

71. Local consumption of wool on skins is negligible.

72. The relevant ratios used were: (a) lambs wool— 491 lbs greasy per ton carcass weight; (b) other—1.0045 lbs greasy per adult sheep shorn.

Table 7.3.3

CONSTANT-PRICE PROJECTIONS FOR SUPPLIES OF WOOL, BEEF AND VEAL, LAMB, CEREALS AND WHOLE MILK: NATURAL COMMODITY UNIT BASIS*

Year		Wool	Beef and Veal	Lamb	Wheat	Barley	Oats	Whole Milk
		(million lbs greasy)	(million tons carcass weight)		(million bushels)			(million gallons)
Base Period Values:								
Average 1958—59 through 1961—62		1648.7	.770	.203	233.6	51.7	66.2	1390
Average of 2 Fiscal years centred on: 1965 (estimate)**		1706.0	.949	.210	313.4	44.6	64.0	1512
Projections:								
1970	High	2094.8	.936	.197	474.1	94.5	107.7	1685.0
	"Most likely"	1886.6	.856	.167	392.1	50.8	68.8	1636.4
	Low	1687.6	.776	.137	316.8	18.9	35.5	1588.1
1975	High	2206.0	1.049	.168	548.4	94.8	113.8	1855.7
	"Most likely"	1976.2	.961	.133	456.3	50.0	73.2	1793.3
	Low	1757.3	.873	.098	369.7	18.1	38.7	1731.2
1980	High	2287.4	1.102	.147	622.6	96.3	119.8	2012.6
	"Most likely"	2042.8	1.019	.106	517.7	50.2	77.5	1945.6
	Low	1809.9	.936	.065	421.5	17.9	41.8	1878.8

* Constant prices are, meats excepted, average commodity prices over the 4 year base period 1958-59 through 1961-62. In the case of meats, this average has been further averaged with commodity prices prevailing in 1964-65.

** Based on Bureau of Agricultural Economics, Trends of Australian Rural Production and Exports, No. 38 (Canberra, June 1966) [mimeo].

Table 7.3.4

CONSTANT PRICE PROJECTIONS OF SUPPLIES OF LIQUID MILK, BUTTER, CHEESE AND CONDENSERY PRODUCTS*

Year		Whole Milk (a) Equivalent (Total) 1	Domestic Liquid (b) Milk Consumption 2	Supplies Available for Processing (c) 3	Projected Supply of: Butter (d) 4	Projected Supply of: Cheese (e) 5	Projected Supply of: Condensery Products (f) 6
		(million gallons)			(thousand tons)		(million gallons whole milk equivalent)
Base Period Values:							
Average 1958—59(g) through 1961—62		1390	292	1098	187.7	57.9	87
Average of 2 Fiscal Years Centred on:							
1965 (estimate) (h)		1512	341	1171	202.0	52.0	94
Projections:							
1970	High	1685	377	1340	231.2	70.6	107
	"Most likely"	1636	360	1276	220.1	67.4	102
	Low	1588	345	1211	208.9	63.8	97
1975	High	1856	428	1477	254.8	78.0	118
	"Most likely"	1793	400	1393	240.2	73.4	111
	Low	1731	379	1303	224.8	68.8	104
1980	High	2013	485	1597	275.6	83.9	128
	"Most likely"	1946	450	1496	258.0	78.9	120
	Low	1879	417	1394	240.4	73.4	112

* For price assumptions, see Table 7.3.3.

Sources and Notes

(a) Table 7.3.3, supra.
(b) Projections from Table 5.3.4, supra.
(c) Difference between preceding two columns: High = high of column (1) minus low of column (2); low = low of column (1) minus high of column (2); Most likely = "most likely" of column (1) minus "most likely" of column (2).
(d) 80.5 percent of column (3), with (1 ton butter = 4,666.6 gals. whole milk) as conversion factor.
(e) 11.5 percent of column (3) with (1 ton cheese = 2,180.3 gals. whole milk) as conversion factor.
(f) 8.0 percent of column (3).
(g) Commonwealth Bureau of Census and Statistics, Rural Industries, Bulletin No. 1, 1962—63 (Canberra, 1965).
(h) Based on Bureau of Agricultural Economics, Trends in Australian Rural Production and Exports, No. 38 (Canberra, June 1966) [mimeo].

condensery products in later years. Under the circumstances, we could do no more than allocate the whole milk surplus between its three competing end-uses in the average ratio actually observed for 1963 — 64 and 1964 – 65 for which data were available.[73] This involved our allocating 80.5 percent of the whole milk gallonage to butter, 11.5 percent to cheese, and 8.0 percent to condensery products. These ratios are undoubtedly liable to potential sampling variability, but we have been unable to take this factor into account in our analysis of Table 7.3.4. However, the limits on projected supply in this table were devised by subtracting "low" projections of demand for liquid milk from "high" projections of supply of whole milk (and the corresponding reverse procedure used to obtain "low" projections of the surplus) This somewhat stringent approach to establishing limits may compensate adequately for potential errors in the proportional allocation of the whole milk surplus.[73a]

4. OTHER MEATS

(a) Mutton

Projections of mutton production will be made using equation 6.4.1 which gives mutton production as a function of sheep numbers, changes in sheep numbers, and a drought index. Since our constant price projections of sheep numbers may be revised in Chapter X, the projections of mutton production will be delayed until final sheep number projections are decided on.

(b) Pigmeat

Australian pigmeat production is now almost entirely disposed of on the local market. There seems little prospect of any significant increase in overseas sales. Projections of pigmeat production were therefore based principally on the estimates of future consumption of pigmeat in Australia given in Table 5.4.2. Slight upward adjustments to these consumption estimates were made to allow for canned pigmeats (6,000 to 10,000 tons in 1970 and 8,000 to 11,000 tons in 1980) and for very small tonnages of exports, such as ship's stores, etc. (Table 7.4.1). The output of bacon, ham and canned pigmeats has been estimated as the difference between total pigmeats and pork.

The number of pigs likely to be slaughtered to produce this quantity of meat has been estimated by assuming an average slaughter weight (for all pigs) of 105 to 110 lb carcass weight respectively. This assumption is largely based on the experience of recent years. Future slaughterings are expected to include roughly the same proportion of the heavier bacon type pigs and there is little reason to anticipate a general increase in slaughter weight within the respective classes. The "low" estimates of number slaughtered were obtained by dividing the lower pigmeat projections by 110 lb and the "high" by 105 lb.

The number of sows necessary to produce this quantity of pigmeat is calculated from equation (6.4.6) in which the number of pigs slaughtered is estimated as a function of the mean of the number of sows in the current and previous years. As the coefficient of 1.13 of this equation implies an increase of 11.3 percent in the number of pigs slaughtered for every 10 percent increase in the number of sows, the equation implies an expected increase in productivity from the breeding herds. In view of the continued trend towards specialisation in the pig industry there is a good possibility that the higher productivity postulated can be achieved — by increasing the average of both the litter size and the number of litters per year.

73. Source data were obtained from Australian Dairy Produce Board, Fortieth Annual Report (Preliminary) (Canberra, 1965).

73a. A different technique of allocation based on current dairy stabilisation machinery is used in final projections in Chapter X.

Table 7.4.1

PROJECTED SOW NUMBERS, PIGS SLAUGHTERED AND PIGMEAT PRODUCTION, AUSTRALIA, 1965, 1970, 1975 AND 1980

Item Projected	Units	Base (a) Period	1965 (c)	1970		1975		1980	
				Low	High	Low	High	Low	High
Number of Sows	'000's	215.6	252.0	246.8	294.5	274.5	350.1	307.7	416.8
Number of Pigs Slaughtered (b)	'000's	2231	2489	2668	3221	3014	3925	3441	4800
Production of Pigmeat for:									
Pork, etc.	'000 tons	53.2	63.0	71.0	81.0	82.0	104.0	96.0	134.0
Bacon, Ham and Canning	'000 tons	54.4	59.0	60.0	70.0	66.0	80.0	73.0	91.0
Total	'000 tons	107.6	122.0	131.0	151.0	148.0	184.0	169.0	225.0

(a) Base period is average of years 1958-59 to 1961-62. Actual data obtained from Table 6.4.2.

(b) The number of pigs slaughtered is a function of the number of sows in the current year and previous year. In particular it can be noted that the number of sows estimated for 1963-64 was only 224 thousand. Hence the relatively low number slaughtered in 1964-65.

(c) Carcass equivalent weight.

5. FRUITS

(a) Canned Fruits

Estimates of future canned production of each fruit are derived from the projections of bearing acreage, yield per bearing acre, and the likely proportion of the total fresh fruit crop to be canned. The F.I.S.C.C. minimum price is assumed to remain constant at the average during the base period, 1958—59 to 1961—62.

Apricots: Australia's total area of bearing apricots in 1965 was estimated to be 9364 acres compared to the base period average of 9326 acres, and the area is not expected to increase by more than about 10 percent in the next 15 years. Present trends indicate a fairly stable acreage in New South Wales, but some decline should occur in Victoria where irregular bearing of canning apricots in the Goulburn Valley has brought faster tree removal and a lower planting rate. This has caused a fall in the total area of apricots in that region from about 2850 acres in 1962 to below 2700 acres in 1964.[74] In South Australia, however, slow expansion of apricot acreage is continuing due to increased plantings in the irrigation districts — the area of non-irrigated apricots is stationary or slowly declining.[75]

The bearing acreage in Australia will probably rise to between 9500 and 9800 acres by 1970, depending mainly on the rate of removal from Victorian orchards. A continued slow rise to 1975 would place the area between 9700 and 10,000 acres. An improvement in returns to apricot growers in the early 1970's may result from moves currently underway to improve the quality of the canned apricots which reach the Australian public.

A faster planting rate in this period and subsequently a slower removal rate — particularly in Victoria — could raise the total bearing acreage to between 10,000 and 10,500 acres by 1980.

Average yield per acre of apricots has only risen slowly since 1950. Projection of yield on the basis of past trends[76] (equation 6.5.6) is likely to be too conservative for the following reasons. A contraction of unsuitable areas in Victoria and expansion of acreage on the higher yielding South Australian orchards should contribute to a more rapid rise in the future. Further, as in the case of peaches and pears, a large proportion of the trees have yet to reach peak bearing age (10 to 15 years). The average yield of 210 bushels per acre in 1964—65 is high compared to the base period average of 165 bushels. In 1970 the yield is likely to be between 200 and 240 bushels, in 1975 between 230 and 280 bushels and in 1980 between 250 and 300 bushels.[77]

Two important factors have contributed to the large variation in output of canned apricots in recent years. First, Australia's major producing region, the Goulburn Valley, has experienced a number of below-average apricot crops which have, in certain years (1960—61 and 1963—64), greatly reduced the total quantity of apricots available for canning. Second, as the quantity of fresh apricots available falls, the proportion canned also declines. This is particularly true in South Australia where growers prefer

74. Goulburn Valley Orchard Census Committee, Goulburn Valley Orchard Census, 1964 (to be published).

75. South Australia's total bearing area of apricots rose from 3640 acres in 1962 to 3880 acres in 1964. of. South Australian Department of Agriculture, Trends in Stone Fruit, (Adelaide 1965), p. 8.

76. Apart from a series of low-yielding years in Victoria, recent average yields have also been depressed due to over-estimation of the bearing acreage contributing to total production (e.g. 1962-63 and 1963-64).

77. The problem of aging trees (in 1980) will not be as great in apricots as in the case of peaches because of the more evenly distributed age pattern and the longer bearing life of apricot trees.

Table 7.5.1

PROJECTED OUTPUT OF CANNED APRICOTS, AUSTRALIA, 1965, 1970, 1975 AND 1980

Factors Estimated	Units	Base Period	1965	1970		1975		1980	
	(a)	Actual (b)	Actual (b)	Low	High	Low	High	Low	High
Bearing acreage	acres	9,351	9,364	9,500	9,800	9,700	10,000	10,000	10,500
Yield per bearing acre	bus.	165	210	200	240	230	280	250	300
Fresh apricot production	'000 bus.	1,542	1,968	1,900	2,352	2,231	2,800	2,500	3,150
Proportion of crop canned	%	25.5	28.0	21.8	29.8	21.6	30.8	20.7	30.6
Likely canned output	'000 std. cases	569	798	600	1,000	700	1,250	750	1,400

(a) For comparison of fresh apricot production and canned output the following conversion factors were used: 47 bushels ≡ 1 ton (long) of fresh apricots ≡ 68 standard cases of canned apricots.

(b) Source for actual data: Table A6.5.3.

to meet the demands of the dried fruit market before forwarding fruit to canneries. Thus, canned output fluctuates to a greater degree than the total apricot crop. The influence of both these factors should continue and therefore future output of canned apricots can be expected to fluctuate widely from year to year.

The best "explanations" of past trends in output of canned apricoats (Table 6.5.5) involve the use of a trend variable which has a high negative coefficient. This resulted mainly from the decline in the proportion of the apricot crop used by canneries — in fact the average level has remained about the same since 1958 — 59.

It has therefore been assumed that the proportion of the total crop canned would fall roughly within the present range — that is, about 20 percent for a light crop to 30 percent for a heavy crop. By this method, canned apricot production in 1970 is forecast to range between 0.6 million standard cases (in a "light crop" year) and 1.0 million cases (in a "heavy crop" year); with the most likely estimate being 0.8 million cases in an "average crop" year.

By comparison, output in 1965 (a heavy year) was 0.8 million cases and the average for the base period was 0.57 million. In 1975, "most likely" output is expected to be about 1.0 million cases and in 1980, about 1.15 million cases.

Peaches: The analysis of canned peach production in Chapter VI was largely confined to New South Wales and Victoria (including the output from Queensland canneries, the fruit for which is mostly grown in New South Wales). The bulk of Australia's canned peaches should continue to come from these States. However, in estimating the future total supply of canned peaches, separate projections must also be made for South Australia.

In Victoria and New South Wales, canned peach production is mainly from the Goulburn Valley and the M. I. A. However, time series of acreages are only available for the area of cling peaches grown in the two States (Table A6.5.4). Bearing acreage began to rise quickly after 1960 — 61 due to the large number of trees planted in 1958 — 59 and the following two or three years. New plantings since 1962 have only been sufficient to replace normal losses and removals; therefore bearing acreage should reach a nearly stable level by about 1967. The wet winter of 1963 led to the loss of many young trees but this has not yet led to any subsequent increase in the planting rate. The uncertainty of the future canned fruits market and the difficulty many orchardists are experiencing in deriving sufficient return from their enterprise, suggest that no new resurgence in peach tree planting will occur in the next few years. On these assumptions the bearing acreage in 1970 should be slightly above the area in 1965 which was estimated to be about 13,300 acres.[78] An upper estimate for 1970 is 14,000 acres which may be reached if there is some increase in the planting rate in 1966. Conversely, the bearing acreage could be as low as 13,500 acres in 1970 if there has been no replacement of the trees lost in 1963.

The bearing acreage in 1975 will be influenced by plantings in the late 1960's and removals in the early 1970's. Apart from the need to replace the losses of 1963, it has been indicated that no economic incentive to increase planting is likely to occur before 1970. In 1975 as many as 50 percent of the bearing trees could be between 13 and 18 years old. This may lead to a slightly increased removal rate by 1975 and subsequent increase in the non-bearing acreage as these

78. Commonwealth Bureau of Census and Statistics, private communication.

trees are being replaced.[79] The bearing area of cling peaches in 1975 is therefore estimated to range between 13,250 and 13,750 acres.

By 1980 the greater part of the trees planted up to 1961 will have been removed and the trees planted in their place will be of young bearing age or, more likely, still of non-bearing age. Assuming present economic conditions in the industry continue into the 1970's it is possible that the bearing area of 1980 will be as much as 1,000 acres less than in 1975.

Yields fluctuate randomly due to conditions of weather, pests, and diseases, etc. However a general upward trend can be expected to continue from the adoption of improved cultural and management techniques. Many properties are already producing at a high yield level, but there is considerable scope for improvement on many poorer properties — particularly through better management. Other factors likely to contribute to a general improvement of yields include improved control of preharvest drop and brown-rot of peaches, faster maturing trees, development of water-resistant stock, and removal of poorly bearing orchards. Future yields will also be a function of the age distribution of the peach tree population.

The estimation of future yield levels is not an easy task. On a State basis, yields are much lower than those recorded by regional surveys. Present yields from the Goulburn Valley and M.I.A. are supposed to average 8 tons or about 320 bushels per acre. However, from Table A6.5.4, the highest average yield recorded is 268 bus./acre (in 1959—60) and the average for the last four years (including 227 bus. in 1964—65) is only 214 bushels. Recent yields have been depressed due to the high proportion of young trees among those of bearing age. Yields should rise rapidly to 1970 as these young trees approach their peak bearing age (9—12 years) and may average between 270 and 300 bushels per acre. The age pattern will be only slightly less favorable in 1975 and therefore another fairly significant increase should occur (as a result of the improvements in management and technology mentioned earlier) to between 300 and 330 bushels per acre. In 1980, however, the bearing area will comprise largely old trees with declining yields and young trees below peak production. Allowing for this adverse effect, it can be expected that yields in 1980 will approximate those in 1975 —adding however, a wider margin for error (300 to 350 bushels per acre).

In Table 7.5.2, estimates are shown for production of fresh canning peaches and the likely total output of peaches in cans. The canned output was predicted from equation (6.5.8) in which output is a simple function of the quantity of fresh cling peaches available. Projection of canned peach output, exclusive of mixed fruits, is obtained by substracting from the total the estimated peach content of future canned mixed fruits produced in New South Wales, Victoria and Queensland.[80] No separate estimates have been derived for canned freestone peaches in these States because production has declined to only a few thousand cases annually.

Future output of canned peaches in South Australia is also likely to show a rapid rate of expansion. Production in 1965 reached 887,000 standard cases, rising from a base period output of 410,000 cases. Except for a small quantity, the entire output acreage originates from the Murray Valley Irrigation areas. The 1964 bearing acreage of cling peaches in this region was about 3,160[81] and

79. Under the enforced growing conditions of irrigated orchards, the economic life span is likely to average 18 to 20 years, with many trees requiring replacement prior to this age.

80. Peaches and pears constitute the bulk of the mixed fruits and for statistical purposes each are assumed to constitute 50 percent of the output of canned mixed fruits.

81. South Australian Department of Agriculture, Survey and Review of Canning Apricot, Peach and Pear Tree Plantings in South Australia (Period 1963—64) (roneod, Adelaide 1964) p. 4.

Table 7.5.2

PROJECTED OUTPUT OF CANNED PEACHES, NEW SOUTH WALES AND VICTORIA,[(a)] SOUTH AUSTRALIA, AND AUSTRALIA; AND MIXED FRUITS, AUSTRALIA, 1965, 1970, 1975, 1980

Factors Estimated	Units	Base Period	1965	1970		1975		1980	
		Actual (b)	Actual (b)	Low	High	Low	High	Low	High
N. S. W. and Victoria:									
Cling peach bearing acreage	acres	6,928	13,333	13,500	14,000	13,250	13,750	12,250	12,750
Yield/bearing acre	bus.	230	227	270	300	300	330	300	350
Fresh cling peach production	'000 bus.	1,593	3,027	3,645	4,200	3,975	4,538	3,675	4,463
Peaches in cans predicted from equation (6.5.8)	'000 std. cases	1,722 (1,858)(c)	3,494 (3,648)(c)	4,306	5,032	4,735	5,480	4,395	5,379
Peach content of mixed fruits	"	96	320	400	450	460	500	500	550
Net output of canned peaches	"	1,762	3,328	3,906	4,582	4,275	4,980	3,895	4,829
South Australia:									
Cling peach bearing acreage	acres	n. a.	3,250	3,500		3,700		3,500	
Yield/bearing acre	bus.	n. a.	305	300		325		340	
Fresh cling peach production	'000 bus.	n. a.	900	1,050		1,200		1,190	
Canned cling peaches	'000 std. cases	232	887	930		1,100		1,150	
Canned freestone peaches	"	178	100	75		50		50	
Australia:[(d)]									
Fresh cling peach production	'000 bus.	n. a.	4,000	4,800	5,300	5,200	5,800	4,885	5,453
Canned peach output (clingstone and freestone)	'000 std. cases	2,172	4,330	5,000	5,600	5,500	6,200	5,100	6,100
Production of canned mixed fruits	"	253	894	1,100	1,250	1,300	1,400	1,400	1,500

(a) Includes canned output from Queensland.

(b) Source of actual data: Table A6.5.4. Base period is average of years 1958-59 to 1961-62. Average base price = £43.5 per ton.

(c) Recorded production.

(d) Values are greater than the sum of the States shown because of a small output by Western Australia.

n. a. Not available. Estimates are based on current data for the Murray River area.

the figure for 1965 is estimated at about 3,250 acres. The rate of planting was high until 1963, but in the past 2 or 3 years it has declined to a level a little more than sufficient to replace removals.[82] New areas being developed near Waikerie are being largely planted to cling peaches and indicate that the bearing area may continue to rise slowly into the 1970's. On this basis bearing cling peaches along the Murray River should cover around 3,500 acres by 1970 and 3,700 acres by 1975, falling to 3,500 acres by 1980 — by which time the removal rate of declining trees will be high.

Present average yields of 270 bushels per acre from the Murray River region of South Australia should rise to near 300 bushels per acre by 1970, 325 bushels in 1975 and about 340 bushels in 1980. In Table 7.5.2, canned output of cling peaches is estimated from the rate of out-turn experienced in the past few years, with some allowance for a small increase in the proportion of the crop canned. Mixed fruits are not included in the estimation.

Canning of freestone peaches in South Australia will probably decline further although total disappearance of the product is not expected. Acreages of freestone peaches are not increasing and dried peaches should continue to offer a satisfactory alternative outlet. The demand by canneries for canned freestone peaches may increase in the late 1970's when the rise in cling peach production slows down or is reversed.

Projections of total canned peach output are obtained from the sum of canned cling and freestone peaches in South Australia and canned cling peaches in the other States. Final low and high estimates have been rounded to the next 100,000 cases to account for, in an arbitrary manner, the uncertain trend in canned peach production in Western Australia.[83]

From an average base period output of 2.17 million standard cases and a 1965 production figure of 4.33 million cases, total production in Australia by 1970 should reach around 5.35 million standard cases — assuming an average crop and normal conditions for tree development.[84] By 1975 production should be near 5.85 million cases with a slightly lower output of about 5.6 million cases in 1980.

Pears: In Chapter VI post-war production of canned pears was analyzed in aggregate terms for the whole of Australia, including all pear varieties. However, the future of the industry will be largely determined by trends in the Goulburn Valley which accounted for nearly 90 percent of Australia's canned pear output in 1964—65. Of the remaining centres of production in Australia, the M.I.A. shows little tendency to increase the area growing pears, but the bearing acreage in South Australia is continuing to rise slowly — primarily in the Murray Valley region. Pears in Tasmania and Western Australia will continue to be grown mainly for fresh fruit sales.[85]

The total bearing area of pears growing in Australia in 1965 was estimated to be just under 19,500 acres compared to a base period average of nearly 18,000 acres. The rapid increase in bearing acreage in the Goulburn Valley is being partially offset by a declining area in the outer Metropolitan area of Melbourne and other non-irrigated regions. By 1970 an additional two and a half thousand acres of pears will be classified statistically as having reached bearing age in the Goulburn Valley. Most of this

82. Including a number of citrus interplants. Quick growing peach trees are planted between citrus trees and then removed when the citrus begin to bear adequate crops — 8 to 10 years.

83. Output is at present rising in Western Australia following the establishment of a permanent industry in that State. The likely rate of expansion of the industry is not known, but production is not expected to reach significant proportions.

84. A recurrence of minor losses due to excess waterlogging during wet winters are anticipated, but conditions even approaching those of 1956 will cause ultimate production to be well below the above estimates.

85. Although in 1963-64 and 1964-65, canned pear output in Tasmania was about 50,000 standard cases or roughly 2 percent of the Australian total.

will be grown for canning purposes.[86] An increase of around 400 acres in South Australia and minor increases elsewhere should almost compensate the area removed due to urban expansion, unsuitable location, or natural decline.[87] Based on this premise, bearing acreage of pears in Australia in 1970 is expected to lie between 21,750 and 22,000 acres.

Although the present planting rate is lower than 5 years ago, current indications are that it will remain high enough to ensure yearly expansion of about 150 acres. This would give a bearing acreage of between 22,500 and 22,800 acres by 1975. The three main reasons for forecasting continued expansion are (1) the greater profitability of pears, compared with peaches and other fruits in the Goulburn Valley, (2) the greater flexibility that can be exercised in disposing of a crop which exceeds apparent canning requirements (alternative outlets are for fresh consumption — domestic and export — and for drying, and because of the longer storage life of pears), and (3) the expected continued low rate of removal. For these reasons a further moderate increase in bearing acreage is also foreseen for 1980 — 23,000 to 23,500 acres.

The 1964 — 65 crop yield has been estimated at only 305 bushels to the bearing acre; a yield equal to the average recorded during the base period. As the large area of younger bearing trees approach peak production (around 15 years of age) average yields may be expected to show a marked increase. By 1970 average yields should be between 350 and 400 bushels per acre with rises in subsequent years to 400 to 450 bushels per acre by 1975 and 430 to 480 bushels in 1980.

86. Estimated from figures contained in the 1964 Orchard Census of the Goulburn Valley.

87. Australia's bearing pear trees are predominantly of a young age pattern and tree decline due to old age is at present a minor cause of tree removal. Since pear trees commonly bear adequate crops to 60 years of age and older, tree removal for old age will be of little importance before 1980.

In estimating canned pear output, two regression equations that could be used are given in the supply analysis (Table 6.5.6). The first (equation 6.5.9) relates the proportion of the crop canned to current price and trend. The second (equation 6.5.10) relates actual canned output to total fresh fruit production and current price. Both functions give good explanations of past trends; however, for projections equation (6.5.9) — which includes a trend variable — will give estimates that are probably too high. The rapid rise in the percentage canned during early post-war years has stopped and only small increases in the proportion canned can be expected in the future. Equation (6.5.10) on the other hand, is likely to underestimate future canned output, since the market for fresh and dried fruit is unlikely to expand as rapidly as is implicit in the mechanical projection of the equation. Projections given in Table 7.5.3 have therefore been arbitrarily fixed between the estimates provided by the two equations.

As in the case of peaches the final estimates of the output of canned pears are derived by subtracting the quantity of pears likely to be contained in canned mixed fruits. From a below normal level of just under 2.5 million standard cases in 1965 (base period = 2.3 million), output of canned pears in 1970 should approximate 3.8 million cases, given normal conditions of tree development and crop levels. Output may rise to around 4.6 million cases in 1975 and to over 5.0 million in 1980.

Canned mixed fruits: Assuming constant prices, production of canned mixed fruits (canned two-fruits, fruit cocktail, and fruit salad) should continue to rise in future years — although gains should be more modest than in 1963 — 64 and 1964 — 65. Production in 1964 — 65 was nearly 0.9 million standard cases, compared to the base period average of only 0.25 million. Canned mixed fruits afford processors an opportunity to diversify product output and so promote increased

Table 7.5.3

PROJECTED OUTPUT OF CANNED PEARS, AUSTRALIA, 1965, 1970, 1975, 1980

Factors Estimated	Units	Base Period	1965	1970		1975		1980	
		Actual (a)	Actual (a)	Low	High	Low	High	Low	High
Bearing acreage	acres	17,979	19,450	21,750	22,000	22,500	22,800	23,000	23,500
Yield/bearing acre	bus.	305	305	350	400	400	450	430	480
Fresh pear production	'000 bus.	5,483	5,930	7,612	8,800	9,000	10,260	9,890	11,280
Pears in cans predicted by equation (6.5.10)	'000 std. cases	(2,595)	(2,849)	3,806	4,482	4,596	5,313	5,102	5,893
Proportion of crop canned predicted by equation (6.5.9)	%	(53.3)	(58.3)	63.0		67.3		71.3	
Likely output of pears in cans (percentage canned in parentheses)	'000 std. cases	3,641 (54)	2,905 (53)	3,900 (57)	4,750 (60)	4,780 (59)	5,700 (62)	5,300 (60)	6,250 (62)
Pear content of mixed fruits	"	125	450	550	625	650	700	700	750
Net output of canned pears	"	2,516	2,455	3,350	4,125	4,130	5,000	4,600	5,500

(a) Source of actual data: Table A6.5.5. Base period is average of years 1958-59 to 1961-62. Average base price = £43 per ton.

consumption. Projections in Table 7.5.3 are based on a total output of canned mixed fruits of 1.25 million standard cases by 1970, then rising more slowly to nearly 1.5 million cases by 1980.

Pineapples: After dropping sharply from 1958—59 through 1962—63 the total area of bearing pineapples is at present increasing slowly. The 1965 area was 7,786 acres compared to a base period average of 8,754 acres. Assuming prices remain constant there should be a small average annual increase in bearing acreage of between 200 and 300 acres. Based on these assumptions, bearing acreage by 1970 can be expected to be between 8,700 and 9,400 acres; by 1975, between 10,000 and 10,600 acres, rising to 11,200 to 12,000 acres by 1980.

Since 1950 the rise in yield per bearing acre has been very marked; from about 350 bushels per acre (in 1950) to an average of 506 bushels in the base period and to an estimated 560 bushels in 1965. Increased specialisation by pineapple growers and the further application of improved techniques should enable the rise in yields to continue, but at a slower rate than that experienced over the past 15 years. We estimate that average yields will range between 600 and 640 bushels per acre by 1970, 650 to 700 bushels in 1975, and 680 to 730 bushels in 1980.

As shown earlier (Table 6.5.3), the proportion of the pineapple harvest processed by canneries rose quickly to around 50 percent by 1952—53, but since that time the percentage has mostly fluctuated between 40 and 50 percent.

In Table 6.5.8, equations (6.5.14) to (6.5.17) show canned output as a function of the quantity of fresh pineapples available and of various price quotations. With substantial increases expected in the future production of fresh pineapples there are likely to be further small rises in the proportion of the crop canned—but we believe that these increases will fall short of the increase in the proportion predicted by equations (6.5.14) to (6.5.17). For example, equation (6.5.14) — the most promising of the 4 functions — estimates a canned output in 1980 of nearly 4 million standard cases from 8.75 million bushels; i.e., that 64 percent of the total harvest will be canned.

Apart from the outlet for canned fruit, consideration must also be given to the quantity of fresh pineapples likely to be consumed as fresh fruit, juice extracts, etc. In the 8 years to 1963—64, the average per capita consumption of pineapples in these forms was about 0.2 bushels.[88] Future output of pineapples in cans (including the 60 percent pineapple content of tropical fruit salad) has been estimated from the following assumptions: (i) a rise in the per capita consumption of non-canning pineapples from 0.20 to 0.25 bushels by 1980 and (ii) a rise in the percentage of the harvest used by canneries from a current 48 percent up to 55 percent in 1980 (Table 7.5.4).

Possible future output of the canned pineapple product is obtained by subtracting from the above estimates the 60 percent pineapple content of likely tropical fruit salad production. Output of tropical fruit salad is expected to continue to rise fairly sharply. We believe that the rapid increase in the popularity of this product on both domestic and overseas markets will continue and that sufficient quantities of component fruits will be available for tropical fruit salad. Hence the "most likely" output of tropical fruit salad is expected to double by 1980. As a result, our projection of canned pineapple production rises from a base figure of 1.07 million standard cases and a similar figure from 1964—65 to a "most likely" output of almost 1.6 million cases in 1970, 1.9 million in 1975 and more than 2.3 million cases in 1980.

88. During the base period, average per capita consumption of non-canning pineapples was higher (about 0.215 bushels) due to a 2-year period of high production and low prices.

Table 7.5.4

PROJECTED OUTPUT OF CANNED PINEAPPLES AND TROPICAL FRUIT SALAD
AUSTRALIA, 1965, 1970, 1975 AND 1980

Factors Estimated	Units (a)	Base Period	1965	1970		1975		1980	
Bearing Acreage	acres	8,754	7,786	8,700	9,400	10,000	10,600	11,200	12,000
Yield/bearing acre	bus.	506	560	600	640	650	700	680	730
Fresh pineapple production	'000 bus.	4,436	4,363	5,220	6,016	6,500	7,420	7,616	8,760
Consumption of non-canning pineapples (per capita)	" bus.	2,230 (0.21)	2,300 (0.20)	2,580 (0.20)	2,850 (0.22)	3,170 (0.22	3,460 (0.24)	3,650 (0.23)	3,950 (0.25)
Proportion of crop canned	%	44	47	50	52	51	54	52	55
Output of pineapples in cans(b)	'000 std. cases	1,351	1,450	1,850	2,200	2,300	2,750	2,800	3,400
Tropical fruit salad	"	468	650	650	800	900	1,200	1,100	1,500
Canned pineapple production(c)	"	1,071	1,060	1,460	1,720	1,760	2,030	2,140	2,500

(a) To permit comparison of fresh pineapple production (and consumption) and canned output, the following conversion factors were used: 53 bushels ═ 1 ton (long) of fresh pineapples ═ 37 standard cases of canned pineapples.

(b) Includes the pineapple content (approximately 60 percent) of tropical fruit salad.

(c) Obtained by subtracting 60 percent of the tropical salad figures from the estimated output of pineapples in cans.

(b) Dried Fruits

(i) Vine Fruits

Changes in the post-war bearing acreage of vines grown for dried fruit have been relatively small — between a low of 55,500 and a high of 64,800 acres. The variation in bearing acreage of all grape varieties was even less than for drying grapes — between 121,800 and 127,250 acres. This is the result of growers changing the end uses of some of their dual-purpose grape varieties from one season to the next. It appears that growers are limited in the acreage they are able to change, due mainly to the absence of drying facilities or accessible alternative outlets. Therefore small relative price changes offered by the different outlets for grapes should not greatly affect the future acreage. For projections however, the assumption of constant prices (at base period levels) applies to the use of grapes for table and wine purposes as well as drying. Compared to an average base period area of 58,426 acres, the 1964—65 bearing acreage was 60,641 acres. By 1970 the area should increase slightly to between 61,000 and 62,500 acres; by 1975 to between 62,000 and 65,000 acres and by 1980 to between 62,500 and 66,000 acres (Table 7.5.5).

Although there was a significant upward trend during post-war years in average yield per bearing acre, annual fluctuations in yields have been marked. In equation (6.5.24), average yield as a function of time explains only 27 percent of total variation in yield and estimates of yield have a standard deviation of 0.8 tons per acre (around a present mean of just over 6 tons per acre). Apart from fluctuations in the size of the crop harvested, another factor contributing to year-to-year changes in yields, is that much of a crop reportedly harvested for drying may be sold for table or wine purposes — and vice versa.[89] Yield projections have been estimated from equation (6.5.24) plus or minus one standard deviation. Hence yields in 1970 are expected to range between 5.6 and 7.3 tons per bearing acre; between 6.1 and 7.8 tons in 1975 and 6.6 to 8.2 tons in 1980.

The quantity of fresh grapes required to produce 1 ton of dried fruit has remained constant at around 4 tons during the last decade. This provides a reliable factor for conversion of fresh fruit production into dried fruit output. The conversion factor in the base period was 3.95; for 1965 it has been estimated at 4.08. (This is probably too high since the current estimate of dried vine fruit output in 1965 is likely to be amended upwards. In the past, high conversion ratios have been associated with light yields and the lower ratios with heavy yields.) For our projection for 1970 we have used two limits — 4.05 (low output estimate) and 3.95 (high estimate). In subsequent years a slight increase in the ratio has been anticipated to allow for an even more extensive use of irrigation.[90] Using the acreage, yield, and conversion projections, total output of dried vine fruit in 1970 is estimated at 84,300 to 115,500 tons; the "most likely" estimate is around 100,000 tons, compared to a base period average of 83,804 tons and a preliminary estimate for 1965 of 107,200 tons. Production by 1975 should have increased to around 110,000 tons (92,900 to 126,700 tons) and by 1980 to just below 120,000 tons (100,000 to 135,300 tons).

89. The apparent 1965 yield of 7.22 tons per acre is 1.5 standard deviations above the predicted estimate while the 1963 yield of 4.80 tons is 1.3 standard deviations below the predicted estimate for that year. Both extremes were partly occasioned by price effects of the preceding years—dried vine fruit sold at good prices in 1964 and at poor prices in 1962.

90. Increased use of irrigation tends to raise the water content of grapes, so more grapes are needed to produce 1 ton of dried fruit.

Table 7.5.5

PROJECTED OUTPUT OF DRIED VINE FRUIT (SULTANAS, RAISINS AND CURRANTS), AUSTRALIA; 1965, 1970, 1975 AND 1980

Factors Estimated	Units	Base Period	1965	1970		1975		1980	
		(a)	(a)	Low	High	Low	High	Low	High
Bearing acreage	acres	58,421	60,641	61,000	62,500	62,000	65,000	62,500	66,000
Yield per bearing acre	tons	5.67	7.22	5.6	7.3	6.1	7.8	6.6	8.2
Production of fresh grapes for drying	tons	331,684	438,032	341,600	456,250	378,200	507,000	412,500	541,200
Conversion ratio, fresh grapes : dried fruit	tons	3.95	4.08	4.05	3.95	4.07	4.00	4.10	4.00
Output of dried vine fruit : Total	tons	83,804	107,125 (b)	84,300	115,500	92,900	126,700	100,600	135,300
Sultanas	tons	64,911	83,870 (b)	69,300	92,000	75,900	101,200	82,100	109,300
Raisins	tons	8,854	10,805 (b)	8,000	11,000	9,500	12,500	10,500	13,000
Currants	tons	10,039	12,450 (b)	7,000	12,500	7,500	13,000	8,000	13,500

(a) Actual data. Source: Tables 6.5.10 and 6.5.12. Base period is yearly average for years 1958-59 to 1961-62.

(b) Preliminary estimate.

Greater sultana production will represent most of the increase in total output of dried vine fruit. The estimated 1965 output of about 83,870 tons is nearly the highest on record (84,285 tons in 1964 compared to the base period average of 65,000 tons), but it is unlikely that production in 1970 will greatly exceed this amount. Moderate increases in output should occur in the next 10 years. By 1980 sultana production is estimated at around 100,000 tons.

Annual output of raisins has been fairly constant in recent years. With little prospect of increasing overseas sales (accounting for 40 to 50 percent of total sales at present), the future increase in output of raisins is expected to be limited to the rise in the domestic market. From a base period average of 8,800 tons, and a 1965 estimate of 10,800 tons, production in 1970 should be near 9,500 tons, about 11,000 tons in 1975, and around 11,800 by 1980.

Currant production varied over the past 7 years, but until 1963 the general trend appeared to be downward. It is now unlikely that further falls will occur in the average level of production, though production will probably continue to fluctuate annually. A slight rise in average production over the next 15 years is to be expected. In the event of a substantial improvement in the quality of currants grown, output may rise more rapidly because of increased exports. Compared to a base period average of 10,000 tons and 1965 estimate of 12,450 tons, currant production should approximate 10,000 tons (a range of 7,000 to 12,500 tons) in 1970, 10,500 tons (7,500 to 13,000 tons) in 1975 and 11,000 tons (8,000 to 13,500 tons) in 1980.

(ii) **Tree Fruits**

Prunes: In the past 10 years the bearing acreage of prunes grown for drying has remained almost constant — 3,481 acres in the base period, 3,475 acres in 1964—65. Future changes in the acreage should remain small. In New South Wales, the area at Young may decline slightly during the 1970's due to the removal of ageing trees, but this net decline should at least be compensated by the expansion of prune growing in the M.I.A. French forecast a substantial rise in M.I.A. bearing acreage on the basis of the 1963 Census.[91] However, we doubt whether the increase in this region will be as great as French suggests. The decline in non-bearing acreage has been continuous since 1961—62 and there is at present no evidence of any revival of the previous interest in planting prunes. With a decline occurring in the small acreage grown in South Australia and Victoria, our estimate of the bearing acreage anticipates an increase by 1980 of between only 125 and 325 acres over 1965.[92]

A sustained increase in prune yields has become evident only since 1959—60. With the growing maturity of the M.I.A. prune trees and the increased area under irrigation, further moderate increases in yield will probably take place through 1980. From an average of 3.04 tons per acre (fresh weight) during the base period and a 1965 figure of 3.69 tons, the following increases in prune yields are forecast: in 1970 yields should be between 3.5 and 4.2 tons, between 3.8 and 4.5 tons in 1975, and 4.0 to 4.7 tons per acre in 1980.

The quantity of fresh prunes required to produce 1 ton of the dried product is roughly estimated at 2.5 tons. This has been approximately the ratio in the past 2 years, and

91. B. Owen French, Irrigation Research and Extension Committee, Some Trends Revealed by the 1963 M. I. A. Fruit Tree and Grape Vine Census (February 1965).

92. The estimate for 1970 foresees virtually no change in bearing acreage. Estimates for 1975 and 1980 foreshadow a slight increase based on the prediction by French that there will be an increased planting rate in the M. I. A. during the late 1960's. However, we have not been able to accept French's estimate of an increase in M.I.A. bearing acreage from about 850 acres in 1967 to 1,500 acres by 1975 (B. Owen French, loc. cit.).

with dried prune prices constant at present levels, it should provide a reasonable conversion factor for future prune production (Appendix Table A7.5.1).[93] Assuming a 2.55 ratio for the "low" estimates and 2.45 for the "high" estimates and the yield and acreage assumptions made earlier, production of dried prunes in 1970 will range between 4,750 and 6,100 tons — a "most likely" output of 5,450 tons compared to a base period figure of 3,685 tons and 1965 output of 5,200 tons. Production in 1975 should approximate 6,000 tons (5,200 to 6,700 tons) and in 1980, 6,500 tons (5,650 to 6,700 tons). Table 7.5.6 gives our projections for all dried tree fruits.

Apricots: South Australia will continue to be almost the sole producer of dried apricots; projections have been made of future bearing acreage and apricot yields for that State. The planting of apricots in the irrigated regions of South Australia is continuing at a rate which will ensure further expansion of the bearing acreage. From a 1965 figure of 3,695 acres, the bearing area is expected to increase by 40 to 50 acres a year to between 4,280 acres and 4,400 acres in 1980.

Apricot yields have been much higher in South Australia than in other States and they should increase further as an increased proportion of the trees on the irrigated orchards reach a peak bearing age. From a recorded yield of 6.9 tons (about 317 bushels) in 1965, yields in 1970 should lie between 6.5 and 7.5 tons rising gradually to between 7.5 and 8.5 tons by 1980.

A suitable estimator of the quantity of apricots used for drying is equation (6.5.27) in which output is a function of the index of price received for dried apricots (lagged 2 years), the index of the F.I.S.C.C. minimum price for canning apricots, and the total harvest of apricots in South Australia. Assuming prices constant at the 1963 level for dried apricots and 1965 level for canning apricots, projections of the quantity of apricots that will be used for drying have been made from total crop estimates to 1980 (cf. Appendix Table A7.5.1). The expected output of dried apricots was derived by assuming a conversion ratio of fresh apricots to dry of 5.5:1. The projections for Australia in Table 7.5.6 are the South Australian estimates rounded to the next 50 tons to allow for the small output expected from New South Wales and Victoria. From a base period average of 1,907 tons, production of dried apricots in 1965 had risen to 2,775 tons. In 1970, production is likely to be around 3,100 tons (within a range of 2,750 to 3,400 tons), in 1975, about 3,650 tons (3,250 to 4,050 tons) and in 1980 close to 4,200 tons (3,750 to 4,600 tons).

Peaches: Dried peaches are also produced mainly in South Australia where present planting trends indicate a steady level, or slight decline, in the future bearing acreage of freestone peaches. Output of dried peaches since the late 1950's has been fairly constant — the major exception being 1960—61 when low prices for dried peaches in that and the previous years resulted in comparatively little production. With only a small increase expected in the use of freestone peaches for fresh consumption and a decline in cannery purchase of freestone peaches, it appears that sufficient fruit will be available for the future output of dried peaches to rise slightly from the current levels of production (present prices prevailing). Average production in the base period was 623 tons, and in 1965 it was 723 tons. Output in 1970 should approach 800 tons (between 700 and 850 tons), in 1975 it may rise to near 850 tons (75 to 900 tons) and by 1980, reach 900 tons (800 to 1,000 tons).

Pears: The acreage of Williams' pears in South Australia is continuing to rise and yields will also increase substantially as

93. This also assumes that the present alternative outlets to the fresh fruit market, jam, plum brandy, and prune nectar, will remain insignificant.

Table 7.5.6

PROJECTED OUTPUT OF DRIED TREE FRUITS, AUSTRALIA; 1965, 1970, 1975 AND 1980

Fruits	Base Period	1965	1970		1975		1980	
	(a)	(a)	Low	High	Low	High	Low	High
	tons							
Prunes	3,685	5,204	4,750	6,100	5,200	6,700	5,650	7,300
Apricots	1,907	2,775	2,750	3,400	3,250	4,050	3,750	4,600
Peaches	623	723	650	800	750	900	800	1,000
Pears	166	351	300	500	380	600	500	750
Figs	42	26	15	30	15	30	15	30
Nectarines	46	29	20	40	20	40	20	40
Apples	405	259	230	350	200	320	200	320

(a) Actual data. Source: Table 6.5.13. Base period is average of years 1958-59 to 1961-62.

the plantings of the past 10 years reach bearing maturity. In years of peak harvests it is expected that canneries will be unable to accept all the pears offered by growers. Domestic and export markets for fresh fruit will take some of the surplus, but the remainder will be offered for drying. Improved sales of dried pears during the past 6 years have enabled packers to take greater quantities of pears from growers, and if present prices remain constant, sales may increase further over the next 15 years. However, the sale of pears to dried fruit packers will probably remain a second choice for most growers and the output from year to year may fluctuate considerably between good and poor harvests. Production of dried pears in 1965 was 351 tons, following a base period average of 166 tons. By 1970, production should rise to about 400 tons (300 to 500 tons), to almost 500 tons (350 to 600 tons) by 1975 and production in 1980 should exceed 600 tons (500 to 750 tons).

Other dried tree fruits: Australia's production of dried figs and dried nectarines in post-war years has never assumed significant proportions; future production is unlikely to change greatly from the present levels of 15 to 30 tons for figs and 20 to 40 tons for nectarines. Dried apple production in Tasmania was quite substantial during and just after World War II. However, the decline in production has been fairly continuous since the War, although at a slower rate in the past decade. Future output of dried apples can be expected to fluctuate between 200 and 350 tons, but it is doubtful whether the downward trend will continue until 1980.

6. POULTRY PRODUCTS

(a) Eggs

Before the introduction of the C.E.M.A.A. Egg Marketing Plan in July 1965, about half the eggs produced in Australia came from "uncontrolled" sources — backyard producers and others who avoided the jurisdiction of the State Egg Marketing Boards. A large proportion of the "controlled" production came from small producers who responded quickly to changes in net returns by entering or leaving the industry. Under the new plan, it has become more difficult to avoid Egg Board levies, since the registration of birds in now enforced by Commonwealth legislation. In addition, the greater uniformity of prices and grades in the different States is discouraging the interstate trading of eggs undertaken to avoid State Egg Board charges. The fortnightly registration is frustrating and expensive for many small producers. As a result, backyard producers are probably reducing their flocks to less than 20 hens (which eliminates the obligation to register) or going out of egg production entirely.

In the statistical returns for the current year (1965 — 66), three trends are evident: (i) despite the low net returns to producers in 1964 — 65, the quantity of eggs handled by State Egg Boards has risen by 5 percent;[94] (ii) although retail prices have risen since 1964 — 65, domestic sales of shell eggs by Egg Boards rose 17 percent;[95] (iii) the number of producers registered in Victoria to November 1965 declined by nearly 700, but the number of birds increased by 120,000. Since the 1965 spring hatching was 10 percent less than in 1964, this was contrary to expectations.

From these trends it appears that while total egg production in Australia has declined since 1964 — 65, controlled production has increased. To date we have only very

94. The Egg and Poultry Producer, Vol. 17, No. 2 (Melbourne, March 1966), pp. 4-7.

95. A large proportion of this increase can be attributed to a transfer of demand from "uncontrolled" to "controlled" production. After allowing for bird levies net returns to producers supplying Egg Boards have risen by as much as 18 percent since 1964-65.

limited information about the effect of the new marketing plan on the distribution of production as between "controlled" and "uncontrolled" sources of supply but the rise of 5 percent in "controlled" production following a year of low prices suggests that the change will be considerable.

Our projections are based on constant base period prices for both farm eggs and wheat.[96] They are made in the following manner: (i) we expect unrecorded egg production to decline from the estimated 1964—65 level of 90 to 100 million dozen to between 60 and 70 million dozen within 10 years (though no further declines after 1975 are postulated); (ii) this will allow "controlled" producers to increase their share of the local market (Chapter V, Table 5.7.1); (iii) Since "controlled" growers in effect receive an equalised price from the home and lower-priced export sales, the larger share of the local market obtained by "controlled" producers can be expected to expand total output. We have assumed that exports will remain a similar percentage of total "controlled" production as before; within the last decade, exports fluctuated between 10 and 25 percent; However, 10 percent seemed an unrealistically low figure, which was reached only once in this period. Instead we used a "low" of 15 percent and a "high" of 24 percent. Our projections are given in Table 7.6.1.

(b) Broilers

The future of the broiler industry will be broadly determined by the trend in domestic demand for poultry, since it is unlikely that costs will fall to a level where exports are profitable. The level of domestic consumption will depend mainly on the price of chicken and competing meats. The price obtained for chicken will — in the medium run — be governed by production costs and productivity. Increased productivity is likely to be obtained through better management, improved genetic breeding, and more efficient feed conversion. It appears unlikely that any significant reduction will occur in the future price of poultry feed — reductions that may occur in some of the minor components of the mix (e.g., protein extracts) may be offset by increases in grain prices. The main reduction in average costs per bird will come from the continued shift to large-scale enterprises. Larger concerns also enable poultry farmers to operate at a lower net return per bird. The ability of the industry to continue reducing the price of broilers is an important factor in raising domestic consumption.

The local market is likely to remain virtually the sole outlet for Australian broilers. Future production has therefore been calculated to just satisfy demand projections made in Chapter V. Assuming an average dressed broiler weight of 2.4 lb per bird and applying "low" and "high" population projections, domestic consumption in 1970 is likely to require the slaughter of between 61.3 and 80.7 million broiler chickens. The corresponding estimates for 1975 are 75.7 to 108.4 million broilers and for 1980, 92.4 to 141.2 million.

Estimates of future broiler production in Australia are summarised in Table 7.6.2. The increase in total production of "other" poultry meats will comprise largely an increase in turkey output.[97] Modest increases are also expected in the slaughter of broiler hens and ducks.

96. The average base period net price for eggs was 34.9 cents, compared with a current (May 1966) price of 34 to 35 cents per dozen. The domestic price of wheat was £A1.52 per bushel (currently £A1.53).

97. In the first 6 months of 1965-66 turkey production in New South Wales rose 40 percent (and its share of total poultry meat from 4.6 to 5.5 percent). Similar increases are also expected in Victoria.

Table 7.6.1

PROJECTIONS OF EGG PRODUCTION, AUSTRALIA 1960 TO 1980
(All figures in million dozen)

Components of Egg Production	Base (a) Period	1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
Uncontrolled Production	80 to 100	90	100	70	80	60	70	60	70
Controlled Production Sold on Domestic Market	89.2	105		145	155	175	200	200	235
Sold Overseas	21.2	19		22	37	26	48	30	56
Total Production	190 to 210	214 to 224		237	272	261	318	290	361

(a) Base Period is the average of the 4 years 1958-59 to 1961-62. For method of estimation see text.

Source of base period data: For controlled eggs: Bureau of Agricultural Economics, The Egg Situation, Table No. 1 (Canberra) December 1965.
For uncontrolled production: Table 4.7.1 per capita consumption multiplied by mean population figures.

Table 7.6.2

ESTIMATED PRODUCTION OF BROILERS AND POULTRY MEAT, AUSTRALIA, 1965, 1970, 1975 AND 1980

Values Estimated	Broilers Produced (million)		Poultry Meat Production (thousand tons)					
			Broiler (a)		Other		Total	
	Low	High	Low	High	Low	High	Low	High
Base Period (b)	21.7		23.3		13.4		36.7	
1965	41.8	44.0	44.8	47.1	15.2	15.7	60.0	62.8
1970	61.3	80.7	65.7	86.5	21.9	28.8	87.6	115.3
1975	75.7	108.4	81.1	116.1	27.0	38.7	108.1	154.8
1980	92.4	141.2	99.0	151.3	33.0	50.4	132.0	201.7

(a) Assumes an average dressed broiler weight of 2.4 lb.

(b) Average of period 1958-59 to 1961-62. Figures obtained from a broad estimate of likely production in 1960.

7. MISCELLANEOUS PRODUCTS

(a) Cotton

The future output of cotton will depend very largely on the Federal Government's policy. Western Australia and Queensland have submitted proposals for ambitious irrigation schemes which would greatly enlarge future cotton production in Australia. It is unlikely that either State could obtain the necessary financial backing for dam construction and related expenditure unless the Federal Government agrees to the financial arrangements suggested by the States. In addition, the Federal Government's bounty policy will have a very important effect on the likely area planted to cotton in future years. The bounty scheme in operation at present was outlined in Chapter VI. The Government indicated that it intends to maintain the current scheme until the end of the 1967—68 crop year; it will then be reviewed. One important feature of the scheme which will tend to dampen the expansion of output is that the total amount allotted to annual cotton bounty payments has been fixed at $A 4 million. This is sufficient to pay the bounty at the standard rate of 13,432 Australian cents per lb of raw cotton on an annual production of about 30 million lbs of raw cotton. However, the 1965—66 crop will probably be between 45 and 52 million lbs (raw cotton); hence bounty payments for the 1965—66 year are likely to decline by 4.5 to 5.7 cents Australian per lb. In addition, as a result of the change in the U.S. cotton support price program a fall of about 2 cents is expected in world prices and these will also affect growers' returns directly. Since growers received about 30 to 38 cents per lb of cotton in 1964—65, the combined effect of lower bounty rates per lb and lower world prices is likely to be a reduction of 17 to 26 percent in the prices received by Australian cotton growers.

Cotton production increased about tenfold in the last 5 years; it was obviously very profitable at the prices ruling until 1964—65. At what price further expansion of production becomes unprofitable is impossible to estimate at this early stage in the development of irrigated cotton production in Australia.

Our projections of Australian cotton production are set out in Table 7.7.1; they were made separately for the three producing States — New South Wales, Queensland, and Western Australia. New South Wales is at present the largest cotton producing State and the Namoi-Gwydir region is the main producing region within N.S.W.; this region produced almost 75 percent of the Australian crop in 1965—66.[98] Cotton acreage expanded very rapidly since 1959—60, reaching an estimated 29,000 acres in 1965—66. The drought in New South Wales almost emptied the Keepit storage — the reservoir supplying water to the cotton growers; hence the area to be planted in 1966—67 (and possibly in the following season) is likely to be greatly curtailed. However, judging by past climatic experience, droughts of this magnitude are unlikely to occur within, say 10 to 15 years, so we ignored them for projections. The total cotton acreage which could be irrigated from the Keepit dam has been estimated at 35,000 to 50,000 acres.

In addition there is considerable irrigation potential for cotton in other parts of New South Wales. Some cotton is at present grown on the Murrumbidgee irrigation Area and at Coleambally, but yields tend to be lower than in the Namoi-Gwydir area because of lower temperatures during the growing season. Cotton varieties especially grown for the M.I.A. and other southern areas may raise yields in those areas.

98. W.J. Kerridge, "Cotton: The Effect of Current Trends on Producer Prices", Quarterly Review of Agricultural Economics, Vol. XIX, No. 2 (April 1966), pp. 57-72. We have drawn freely on Kerridge's discussion of the Australian cotton industry in this section.

Other possible water storages in New South Wales which could be used for cotton are: (i) the newly constructed Burrendong Dam which may provide irrigation for about 40,000 acres. The temperatures are lower than on the Namoi-Gwydir, but the comparative aridity of the area could be a significant advantage during harvesting. (ii) The Menindee Lakes storage provides sufficient water for irrigating about 30,000 acres and could be used for cotton, though the potential for this crop has not been examined fully so far. (iii) Storages may be constructed on the Gwydir, which would approximately double the irrigation potential of the Namoi-Gwydir region.

Our "low" 1970 projection for New South Wales provides for an area of 40,000 acres — about 35,000 on the Namoi (the lower limit of the capacity of the storage in a "normal" season) and 5,000 acres for the other areas mentioned above. Our "low" yield projection is below the yield actually realised in 1965—66. However, a dry year is ideal for cotton growers, provided they get surface water from accumulated storages; hence a lower yield seemed at least possible. For the "high" 1970 projection, we have made arbitrary allowance for some additional acreage, both on the Namoi and in the other areas mentioned above. Yields were also raised by extrapolating from the yield increase achieved in the past. For later years we left the "low" projection at the 1970 level on the grounds that world prices may decline and that a somewhat less favourable bounty scheme may be introduced by the Federal Government after 1967—68. In the "high" projection, further substantial increases in output are allowed for, because of the considerable potential for growth in output. These "high" levels of output are unlikely to be attained with the present limitation of the total Federal subsidy to $A 4 million annually.

In Western Australia, future output will depend on the decisions about the Ord Irrigation Scheme. So far a diversion dam has

Table 7.7.1

PROJECTIONS OF AUSTRALIAN COTTON PRODUCTION 1960 TO 1980*

State	Measure	Base** Period	1965†	1970		1975		1980	
				Low	High	Low	High	Low	High
Queensland	Acreage (in '000 acres)	29.8	15—16	4	10	4	20	4	40
	Production (raw cotton) lb per acre	149	250—350	500	1,000	600	1,100	600	1,100
	Total (in million lb)	0.07	4—4.5	2	10	2.4	22	2.4	44
New South Wales	Acreage (in '000 acres)	0.6	24—27	40	60	40	80	40	100
	Production (raw cotton) lb per acre	242	900—1,000	900	1,250	900	1,300	900	1,350
	Total (in million lb)	0.07	24—26	36	75	36	104	36	135
Western Australia	Acreage (in '000 acres)		6—8	10	12	10	36	10	64
	Production (raw cotton) lb per acre	NIL	650—750	600	1,100	700	1,200	700	1,250
Australia	Acreage (in '000 acres)	30.4	48—52	54	82	54	136	54	204
	Production (raw cotton) lb per acre	151	650—750	800	1,200	830	1,240	830	1,270
	Total	4.5	34—36	44	98	45	169	45	259

* For all years except 1965 "low" acreages multiplied by "low" yield projections provide "low" total production projections (and similarly for "high" projections). For 1965 "low" and "high" estimates of acreages, yields and total production were made separately.

** Base Period is the average of the 4 years 1958-59 to 1961-62.

† Average for 1964-65 and 1965-66.

Source of data: (for Base Period and 1965 estimates) W.J.Kerridge, "Cotton: The Effect of Current Trends on Producer Prices", Quarterly Review of Agricultural Economics, Vol. 19, No. 2 (April 1966) pp. 57—72.
Bureau of Agricultural Economics, Recent Trends in Agricultural Production and Exports, June 1966.

been constructed which can irrigate 12,000 acres of cotton annually. The Federal Government is under considerable pressure from the Western Australian Government to agree to the construction of the main Ord storage. So far, the Federal Government has refused to sanction this project. Our "low" projections are based on the assumption that it will continue to refuse; our "high" projections assume that it will sanction expenditure on the main dam in time to allow construction to be commenced in the 1967 dry season (the Australian winter months of 1967). Even if construction commenced in 1967, extra cotton would not be produced until 1971—72; the estimated ultimate acreage irrigable from the main dam (64,000 acres) would not be reached for a further 5 years. For our "low" yield projections for the Ord, we assumed that yields obtained in 1964—65 would remain essentially unchanged; for the "high" yield projections we assumed that average yields would gradually approach the highest yields at present realised by some commercial growers on the Ord.[99]

Until recently most Queensland cotton has been grown without irrigation. The yields have been very low and variable. The total acreage sown to cotton fell sharply from 22,000 acres in 1964—65 to an estimated 9,000 acres in 1965—66, because the new bounty scheme greatly reduced the profitability of cotton growing under natural rainfall conditions. Of the 9,000 acres grown in 1965—66, probably half were grown under irrigation.

Unless bounty payments per lb are increased above the 1964—65 level, it seems unlikely that nonirrigated cotton production will survive in Queensland. For our "low" projection for Queensland we therefore postulated that the cotton acreage which is at present being irrigated there, will remain at a constant level of about 4,000 acres. For our "high" projection we allowed for the possibility that the Emerald Irrigation Project will be started within the next 2 to 3 years. While irrigation water at Emerald can be used for a number of other products including wheat, sorghum, maize, and pasture, our "high" projection assumes that the maximum area which is at present envisaged as being suitable for cotton will in fact be so used. The Queensland State authorities have suggested the establishment of 130 farms with an average of 240 acres under cotton as part of the scheme. If we assume that yields in Queensland will gradually reach the upper levels which have been postulated for New South Wales, and allow for some expansion of private irrigation, it is possible that Queensland cotton production will exceed 20 million lbs of raw cotton by 1975 and 40 million lbs by 1980.

When we add the projections for the different States it will be seen that the Australian output of cotton could rise substantially over the next 10 to 15 years. Our "high" projections allow for the possibility that the main Ord River Scheme is completed and that the Emerald Scheme is undertaken. In addition, the high projection assumes a fairly high level of Government support for the cotton industry and further significant improvements in yields (especially in Queensland and Western Australia). This provides us with a wide range of possible outcomes. For 1980 total production is projected as falling between a low of 45 and a high of 259 million lbs of raw cotton. It seemed necessary to provide these wide limits because of the uncertainties which were mentioned earlier. However, on balance we believe it unlikely that the Federal Government will adopt the liberal bounty policy which is implied by the high projection and at present it appears unlikely that the main Ord River Scheme will be approved in the near future, whilst the Emerald Scheme has only recently been proposed and seems likely to be deferred for some years.

99. R. A. Patterson, "The Economic Justification of the Ord River Project", 38th Congress, Australia and New Zealand Association for the Advancement of Science, 20th August, 1965, Table No. 7, p. 23.

Our "most likely" estimate of future Australian cotton production should therefore be in the lower end of the range given in Table 7.7.1. It would perhaps be realistic to count on an output of 55 to 65 million lbs in 1970, 60 to 70 million lbs in 1975 and perhaps 65 to 75 million lbs by 1980. These forecasts can be compared with forecasts made by others. Thus a group of Namoi cotton growers is reported to have forecast total Australian cotton production in 1976 at 70 million lbs of raw cotton (without the construction of the main Ord dam).[100] A comparable estimate by two economists at the University of New England for seed cotton production in 1977—78 is 158.7 to 187.7 million lbs (or approximately 50 to 70 million lbs of raw cotton).[1]

(b) Tobacco

Our estimates of total Australian demand for tobacco products were given in Chapter V. Before we can estimate the quantities of cut tobacco, cigarettes and cigars which will be supplied by the local manufacturing industry, it is necessary to examine likely levels of imports of cut tobacco and cigarettes. Imports of manufactured cut tobacco have grown rapidly in recent years. They are mainly used for pipe smoking, which is likely to account for an increasing proportion of cut tobacco consumption. Granted the preference of many pipe smokers for the quality of the imported product, it seems reasonable to expect the growth in the proportion of cut tobacco supplied by imports to continue. We will assume that it will rise from the present level of 12 percent to 15 percent in 1970 and to 20 percent in 1980.

Imports of cigarettes and cigars declined sharply after 1951—52, falling to 1.3 percent of consumption in 1958—59. Since that year there has been a gradual increase to 3.7 percent in 1963—1964. We will assume some further slight increase to 5 percent in 1970 and to 10 percent in 1980. On the basis of these assumptions about imports, the projected requirements for Australian-made tobacco products can be estimated from Table 5.8.2. These projections are given in Table 7.7.2 below.

These projections have to be converted into requirements of stemmed and unstemmed tobacco leaf, using the conversion rates specified earlier (footnote 82, Ch. V). This is done in Appendix Table A7.7.1.

The next issue to be raised concerns the proportion of tobacco-leaf which will be produced locally and the proportion which will be imported. The Australian system of granting a duty rebate on imported leaf, conditional upon the use of a specified minimum percentage of Australian-grown leaf, was described in Chapter VI. We repeat that the statutory minimum percentage increased considerably over the years and is now 50 percent. In addition, under the Tobacco Marketing Act, 1965, an annual marketing quota for Australia as a whole was established at 26 million lbs. The scheme is administered by the Australian Tobacco Board. The overall annual marketing quota is divided amongst the tobacco-producing States of Victoria, Queensland, and New South Wales and quotas are allotted to individual growers in these States. Growers are free to produce tobacco in excess of their quotas, but there is no price guarantee for such non-quota production. No non-quota tobacco has been sold so far, but it seems likely that the price realised by such tobacco will be very considerably lower than the price realised for quota tobacco. Future levels of tobacco production will therefore depend, to a great extent on future Government policies — in particular on the level of the statutory minimum percentages specified in future and on the overall level of the

100. Maxwell Newton, "What Price Ord", Nation, 14 May, 1966.

1. D. R. Gallagher and W. F. Musgrave, "Location of the Australian Cotton Industry" (Faculty of Agricultural Economics, University of New England, March 1966), p. 6.

Table 7.7.2

ESTIMATED AND PROJECTED REQUIREMENTS OF AUSTRALIAN MANUFACTURED TOBACCO PRODUCTS[(a)]
(million lbs)

Period	Cut Tobacco		Cigars and Cigarettes		Total	
	Low	High	Low	High	Low	High
Base Period*	15.2		40.2		55.3	
1965 (Estimated)	10.0	11.0	47.0	48.0	57.0	58.0
1970	12.5	13.9	50.2	60.2	62.7	74.1
1975	13.2	15.0	53.3	74.5	66.5	89.5
1980	13.9	16.0	56.1	90.2	70.0	106.2

(a) Requirements for exports included.

* Base period is the average of the 4 years 1958-59 to 1961-62.

Source: (for Base Period Consumption): Commonwealth Bureau of Census and Statistics, Manufacturing Industries, No. 26 — Tobacco, Cigars and Cigarettes (Canberra), 1962 — 63, Table 5.

annual marketing quota. It seems likely that the minimum percentages will remain at 50 percent until 1968; however, in view of the expansion of irrigation in areas particularly suited to tobacco growing, we believe it unlikely that minimum percentages will remain constant after that. Instead, our projections are based on the assumption that the minimum percentages will be raised to 55 percent by 1970, 60 percent by 1975, and 65 percent by 1980.

Table 7.7.3 gives our estimates of the quantities of Australian-produced and imported leaf which will be used during the projection period. This table is based on the estimated total requirements for unstemmed tobacco leaf given in Table A7.7.1 and the assumptions about statutory minimum percentages given above.

Our production projections are thus based on likely changes in the domestic demand for tobacco and in Government policy. The reason for this is that there are unlikely to be any environmental limitations to the production either of the projected quantities or even of substantially larger amounts of tobacco leaf.

Our projections provide for an increase in Australian-produced leaf of 18.7 to 40 million lbs in the next 15 years. At current yields of around 1,000 lb per acre, this would require a maximum of 40,000 additional acres under tobacco.[2] With the recent completion of the Tinaroo Falls Dam in North Queensland an estimated additional 50,000 acres became available for tobacco production. Although the dam is completed, we understand that no further work on supplementary irrigation work is proceeding. The Queensland State Government is unlikely

2. In view of the—by overseas standards—relatively low yields in Australia at present, and the active research programme under way, some improvement in yields is probably likely. However over the last 10 years there has been very little change in average yields.

Table 7.7.3

ESTIMATED AND PROJECTED REQUIREMENTS FOR AUSTRALIAN-GROWN AND IMPORTED UNSTEMMED TOBACCO LEAF
(million lbs)

Period	Low			High		
	Australian Grown	Imported	Total	Australian Grown	Imported	Total
Base Period*	13.9	39.0	52.9	13.9	39.0	52.9
1965 (Estimated)	25.0	29.9	54.9	26.0	30.8	56.8
1970	33.2	27.1	60.3	39.2	32.1	71.3
1975	38.3	25.6	63.9	51.8	34.5	86.3
1980	43.7	23.6	67.3	66.7	35.9	102.6

* Base Period is the average of the 4 years 1958-59 to 1961-62.

Source: (for Base Period): Commonwealth Bureau of Census and Statistics, Manufacturing Industries, No. 26 - Tobacco, Cigars and Cigarettes (Canberra). Totals derived from Table A7.7.1; division between Australian and imported tobacco discussed in the text.

to proceed with the establishment of further tobacco farms unless it obtains an enlarged State marketing quota. In addition to potential developments in Queensland, there is still scope for some expansion in tobacco acreages in the Ovens River Valley in Victoria. Granted that non-quota production is likely to be unprofitable, likely changes in domestic demand and Government policy appears the most sensible basis for projecting output.

(c) Rice

Rice production in New South Wales is closely controlled by a Government instrumentality — the N.S.W. Water and Irrigation Commission — which determines the acreage farmers are allowed to plant to rice. At present acreages are controlled primarily to ensure a "reasonable" price to growers. In recent years the area sown to rice has increased yearly by about 4,000 acres. This expansion is the result of the Commission's development of the Coleambally Irrigation Area on the southern side of the Murrumbidgee Irrigation Area. Additional stages of the Coleambally Area are to be opened up in the next 10 years. Unless there is a serious decline in the price realised by growers, the area sown to rice can be expected to continue to increase at much the same rate as in the past 5 years. The possibility of increasing exports to Australia's major markets — Papua and New Guinea — would appear to be good. However, if production continues to expand at the recent rate other markets will be required to take a growing proportion of the crop.

For our "low" and "high" projections we have given progressively wider limits as the projection period lengthens. Given favourable conditions, there is little doubt that rice acreages could be stepped up substantially. Our "high" acreage projections allow for this, whilst the "low" projections allow for an expansion which (when coupled with our "low" yield projections) is approximately equivalent to the growth in the domestic market for rice.

For our projections of yields we have taken a constant 2.5 tons (paddy) per acre for the "low" and 3.0 tons for the upper limit. Yields have been increasing fairly rapidly and an average yield of 3 tons was forecast for 1965—66 by the Rice Marketing Board. However these are regarded as very high average yields which it would be difficult to exceed in normal seasonal conditions. In addition the likelihood of a larger proportion of the rice crop changing to lower-yielding long-grain varieties suggests that extrapolation of recent yield increases is not justified.

Table 7.7.4 gives our projections for future rice production in New South Wales. Production is expressed both in terms of paddy and milled equivalent. In addition, seed requirements are indicated. The spread between our "low" and "high" projections is very wide; in view of the dependence of output on Government decisions, it is difficult to give narrower limits. However our "most likely" estimates would be nearer to the lower than the upper end of our projections — possibly 135,000 to 145,000 tons (after seed requirements) in 1970, 145,000 to 155,000 tons in 1975, with an additional 10,000 tons in 1980.

So far little has been said about rice production in Northern Australia. In 1963—64 there were six rice holdings in Western Australia and the Northern Territory. Up to now, rice cultivation in Northern Australia has not been profitable—despite repeated attempts by governments and private organisations in many different areas in Northern Australia to establish rice growing on a commercial basis. In 1965—66, field-scale rice growing was carried out about 45 miles from Darwin on 100 acres on the Adelaide River. Similarly, trials have been under way for

Table 7.7.4

PROJECTIONS OF AUSTRALIAN RICE PRODUCTION

Measure	Unit	Base Period*	1965**	1970		1975		1980	
				Low	High	Low	High	Low	High
New South Wales									
Area Sown to Rice	'000 acres	48.1	63.0	70	90	75	120	80	140
Yield per Acre	Tons of paddy	2.57	2.6	2.5	3.0	2.5	3.0	2.5	3.0
Total Production									
Paddy	'000 tons	123.7	163.6	175	270	187½	360	200	425
Milled Equivalent	'000 tons	88.4	117.0	125	194	134	257	143	304
Production Minus Seed Requirements (milled equivalent)	'000 tons	86.0	114.0	122	189	130	251	139	297
Production from Northern Australia		negligible (included above)		0 to 10,000 tons		impossible to forecast			

* Base Period is average of the 4 years 1958–59 to 1961–62.

** Average of 1964–65 and forecast of 1965–66.

Source: (for base period data) Table 6.7.6.

some years in the Kimberley region of Western Australia. It is impossible to forecast whether these efforts will lead to the establishment of a rice industry by 1980; even if present efforts are more successful than those of the past, it seems very unlikely that the whole of Northern Australia would produce as much as 10,000 tons of rice by 1970.

(d) Tallow

Past changes in Australian tallow production can be explained reasonably well in terms of the number of cattle and adult sheep slaughtered. Regressing tallow production on total beef and mutton production gives the following relationships:

(7.7.1) $T_t = -\underset{(34.31)}{211.92} + \underset{(0.048)}{0.271}\, M_t + \underset{(0.072)}{0.543}\, B_t \qquad (R^2 = 0.939)$

(7.7.2) $T_{It} = -\underset{(20.45)}{175.52} + \underset{(0.029)}{0.198}\, M_t + \underset{(0.043)}{0.429}\, B_t \qquad (R^2 = 0.962)$

(7.7.3) $T_{Et} = -\underset{(18.50)}{36.40} + \underset{(0.026)}{0.074}\, M_t + \underset{(0.039)}{0.115}\, B_t \qquad (R^2 = 0.747)$

where T_t is the total production of tallow, in year t,
T_{It} the production of inedible tallow, in year t,
T_{Et} the production of edible tallow, in year t,
M_t the Australian production of mutton, in year t,
B_t the Australian production of beef, in year t

All figures are in '000 tons and the regressions are for 1952—53 to 1963—64.

Unfortunately, as shown by the large negative constant term, these relationships do not necessarily give an estimate of the quantity of tallow which can be obtained from additional mutton and beef production in the future. As pointed out in Chapter VI, Australian tallow production in recent years has grown considerably faster than beef and mutton output, because a much larger proportion of beef and mutton is now exported in boned-out form than previously. Boning-out in Australia raised the quantity of tallow produced locally; previously, a large amount of tallow was exported in carcass form. The proportion of mutton exported in boned-out form was 87 percent in 1962—63. If mutton continues to be exported primarily in this form, the production of mutton tallow will only rise at the same rate as the production of mutton. In the case of beef, only 40 percent was exported in boned-out form in 1962—63 (compared to 1.7 percent in 1952—53); if this proportion should rise the production of beef tallow would continue to increase more rapidly than the production of beef. However, it is difficult to forecast what will happen to the proportion of beef exported as carcass meat, and what proportion will be exported in boned-out form, because different overseas markets have different requirements. Thus most meat exported to the United Kingdom is exported as carcass meat, whilst beef exported to many other destinations is exported boneless.

The most reasonable assumption is probably that all additional exports of meat will be in boneless form. We used the tallow yields given to us by one of Australia's leading meat processors for purposes of projection. These yields are: 0.288 to 0.377 tons per ton of carcass mutton produced and 0.144 to 0.178 tons per ton of carcass beef produced. These estimates will only give reasonable figures provided the amount of mutton and beef exported as carcass meats remains a constant proportion of total mutton and beef production. In the case of mutton production, this seems a reasonable assumption, since most mutton is already boned-out and there is little evidence of a trend back to the export of carcass mutton. However in the case of beef, the proportion of production exported in carcass form may decline further and hence tallow production could rise beyond the levels we will indicate. Our actual projections will be undertaken in Chapter X when our final projections for beef and mutton production are made.

(e) Hides and Skins

Our projections will again be deferred to Chapter X. Projections of hides and skin production will be taken from slaughtering projections for cattle, calves, sheep and lambs. To allow for some wastage — both on farms and in abbatoirs — projections will be based on 98 percent of cattle and calf slaughterings and on 90 percent of slaughterings of sheep and lambs.

CHAPTER VIII

CONSTANT PRICE OVERSEAS TRADE PROJECTIONS FOR THE SELECTED FARM PRODUCTS (EXCLUDING WOOL)

In this chapter, analyses are made of international trade prospects at constant international prices. Trade prospects are analysed in some detail for the more important products (grains, dairy products, and meats, while for other products a looser treatment is adopted. For the more important products, where data availability permits, demand and supply have been initially projected separately, these projections then being married to produce constant price trade projections. Where data have not permitted this treatment, trade has been projected directly.

For such analyses the world has been divided into 12 regions:
(1) United Kingdom,
(2) European Economic Community,
(3) Other Non-Communist Europe (Austria, Denmark, Finland, Greece, Ireland, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, and Other),
(4) Communist Europe (Albania, Bulgaria, Czechoslovakia, Eastern Germany, Hungary, Poland, Rumania, U.S.S.R., Yugoslavia),
(5) Japan,
(6) Communist Asia (Mainland China, North Korea, Mongolia, North Vietnam),
(7) Other East, South and South-East Asia [Burma, Cambodia, Indonesia (including West Irian), South Vietnam, Laos, Thailand, Philippines, Malaysia (Malaya, Sabah, Sarawak), Singapore, Brunei, Portuguese Timor, Hong Kong, Macao, Taiwan, Ryukyu Islands, India, Pakistan, South Korea, Ceylon, Nepal, Bhutan, Sikkim, Maldive Islands],
(8) U.S.A. and Canada,
(9) Other Americas,
(10) New Zealand,
(11) Rest of World [Africa, South-West Asia (including Iran and Afghanistan), Melanesia, Polynesia and Micronesia; excluding Australia],
(12) Australia.

This classification has been determined partly by Australia's trade interests and partly by other economic and political factors. Within the regions numbered (2), (3) and (8) most projections have been made on a country basis; for regions (4), (6), (7), (9) and (11) projections have only been made for the regions as a whole. Availability of accurate data has partly required this; also Australia has traded comparatively little with countries in these latter categories, other than Mainland China. Mainland China, of course, dominates category (6).

1. METHOD OF CONSTANT PRICE DEMAND PROJECTION

Demand projections for the more important commodities in non-Communist regions for food purposes are based on projections of population and per capita income. It is assumed, in all cases, that the "population elasticity of demand" is unity. After establishing the dependence of demand for the various commodities on per capita income, per capita and total demand is projected on the assumption that prices remain at the levels of the base period (average of 1959, 1960, and 1961).

Population Projections

The population projections of the Department of Economic and Social Affairs of the United Nations[3] have been adopted for all countries and regions except Australia. The Australian population projection, which is of course not relevant for overseas demand projections but is simply included for completeness, is that used elsewhere in the report. Where the United Nations report provides more than one projection for a region or country, the "medium" projection has been adopted. Table 8.1.1 sets out the population projections and Table 8.1.2 the relevant population indices, with 1960 as the base year.

Income Projections

Assumptions regarding per capita income growth rates have been made in the light of four main factors: (i) the rates achieved through the 1950's, (ii) the rates achieved over the past century (where data are available), (iii) the rates assumed by other projectors (particularly the F.A.O.[4] and Bela Balassa[5]) and (iv) (for some countries) planned national growth rates. Table 8.1.3 presents relevant information and also indicates the yearly "high" and "low" (compound) growth rates adopted for this study. The implications of the adopted growth rates for per capita income are shown in terms of indexes in Table 8.1.4. The F.A.O.'s low income growth projections (see Table 8.1.3) are mainly based on trends during the 1950's while the high rates are based on national plans.[6] Both have been adjusted in the light of other factors. Balassa's main method is: "future levels of the gross national product are derived by extrapolating past trends in labour productivity, with the separate estimation of expected changes in size and composition of the labor force and in hours worked".[7] Projection I is that regarded by Balassa as most likely; projection II is that which he regards as possible "provided that appropriate economic policies are followed".[8]

A high level of precision was not sought in the projected growth rates; in most cases, the high and low assumptions differ substantially. There are too many other areas in which precision is lacking to make its pursuit worthwhile here. This particularly applies to the poorer countries where income elasticities, for example, are often virtually guesses. Because of this, no distinction was made between growth in gross national product and in national income.

When a fairly high rate of growth was assumed for the 1960's, a lower assumption was made for the 1970's. For "though nothing exceptional or unprecedented has happened yet [with respect to growth rates in the developed countries in the post-war period to 1959], it will be unprecedented if the rapid post-war rates are continued for

3. United Nations, Department of Economic and Social Affairs, Provisional Report on World Population Prospects, as assessed in 1963 (New York, 1964)

4. F. A. O. Agricultural Commodities - Projections for 1970 (Special Supplement to Commodity Review, 1962, Rome, 1962). This publiciation is hereafter referred to as F. A. O. Projections.

5. Bela Balassa, Trade Prospects for Developing Countries (The Economic Growth Centre, Yale University; Irwin, Illinois, 1964).

6. F. A. O., op. cit., p. A-5

7. Balassa, op. cit., p. 350.

8. Ibid., p. 14.

Table 8.1.1

POPULATION PROJECTIONS
(Thousands)

	1960 (Actual)	1965	1970	1975	1980
1. United Kingdom	52,510	54,000	55,100	56,200	57,250
2. E.E.C.					
Belgium-Luxembourg	9,470	9,680	9,910	10,190	10,450
France	45,680	47,800	49,500	51,500	53,250
West Germany	55,420	57,750	58,700	59,350	60,500
Italy	49,640	51,200	52,900	54,600	56,400
Netherlands	11,480	12,150	12,750	13,400	14,050
Total	171,690	178,580	183,760	189,040	194,650
3. Other Non-Communist Europe					
Austria	7,080	7,160	7,220	7,220	7,270
Denmark	4,580	4,730	4,890	5,040	5,200
Finland	4,430	4,630	4,830	5,050	5,250
Greece	8,330	8,620	8,920	9,200	9,500
Ireland	2,830	2,830	2,840	2,850	2,860
Norway	3,580	3,730	3,900	4,080	4,250
Portugal	8,830	9,120	9,320	9,520	9,750
Spain	30,300	31,700	33,100	34,500	36,000
Sweden	7,480	7,700	7,920	8,150	8,370
Switzerland	5,360	5,760	5,920	6,080	6,250
Turkey	27,820	31,780	36,600	42,270	48,480
Other	780	800	830	870	900
Total	111,400	118,560	126,290	134,830	144,080
4. Communist Europe	331,260	352,990	373,450	394,470	417,170
5. Japan	93,200	97,520	101,460	106,170	111,060
6. Communist Asia	677,000	726,000	776,000	830,000	885,000
7. Other East, South and South-East Asia	787,000	887,300	1,002,100	1,126,500	1,260,500
8. U.S.A. and Canada					
Canada	17,910	19,810	21,680	23,830	26,300
U.S.A.	180,680	194,410	207,550	223,000	240,890
Total	198,590	214,220	229,230	246,830	267,190
9. Other Americas	212,510	244,640	282,270	324,980	373,770
10. New Zealand	2,370	2,660	2,940	3,260	3,670
11. Rest of World	341,700	383,100	432,800	492,000	562,000
12. Australia	10,280	11,370	12,590	13,960	15,460
Grand Total	2,990,000	3,271,000	3,578,000	3,918,000	4,292,000

Sources: U.N. Department of Economic and Social Affairs, Provisional Report on World Population Prospects, as assessed in 1963 (New York, 1964). (All except Australia, for which the projections contained elsewhere in this work have been adopted.)

Table 8.1.2

POPULATION PROJECTIONS
(Indexes, 1960 = 100)

	1965	1970	1975	1980
1. United Kingdom	103	105	107	109
2. E.E.C				
Belgium-Luxembourg	102	105	108	110
France	105	108	113	117
West Germany	104	106	107	109
Italy	103	107	110	114
Netherlands	106	111	117	122
Average	104	107	110	113
3. Other Non-Communist Europe				
Austria	101	102	102	103
Denmark	103	107	110	114
Finland	105	109	114	119
Greece	103	107	110	114
Ireland	100	100	101	101
Norway	104	109	114	119
Portugal	103	106	108	110
Spain	105	109	114	119
Sweden	103	106	109	112
Switzerland	107	110	113	117
Turkey	114	132	152	174
Other	103	106	112	115
Average	106	113	121	129
4. Communist Europe	107	113	119	126
5. Japan	105	109	114	119
6. Communist Asia	107	115	123	131
7. Other East, South and South-East Asia	113	127	143	160
8. U.S.A. and Canada				
Canada	111	121	133	147
U.S.A.	108	115	123	133
Average	108	115	124	135
9. Other Americas	115	133	153	176
10. New Zealand	112	124	138	155
11. Rest of World	112	127	144	164
12. Australia	111	122	136	150
World Average	109	120	131	143

Source: Table 8.1.1.

Table 8.1.3

ACTUAL AND PROJECTED RATES OF GROWTH OF PER CAPITA NATIONAL INCOME AT CONSTANT PRICES
(percent per annum)

Region	Estimated Growth Rates					Projected Growth Rates									
	Long Term (Commencing Date in Brackets)		1950–1955	1955–1960	1950–1960	F.A.O		Balassa				Present Study			
						1957/9–1969/71		1960–1970		1970–1975		1960–1970		1970–1980	
						Low	High	I	II	I	II	Low	High	Low	High
	(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1. United Kingdom	(1857)	1.2	2.2	1.9	2.0	2.0	3.0	2.2	2.7	2.1	2.6	2.0	3.0	2.0	3.0
2. E.E.C.															
Belgium			2.8	1.8	2.3	} 2.0	3.1	{ 2.7	3.2	2.6	3.2	} 2.0	3.0	2.0	3.0
Luxembourg			4.3	3.2	3.7			2.7	3.2	2.7	3.2				
France	(1855)	1.5	3.7	3.2	3.4	3.6	4.4	3.6	4.1	3.3	3.8	3.0	4.5	2.5	4.0
West Germany	(1853)	1.5	8.0	4.7	6.4	4.0	4.8	3.0	3.5	3.5	4.0	3.5	4.5	3.0	4.0
Italy	(1863)	1.2	5.3	5.3	5.3	4.4	5.2	3.8	4.3	3.6	4.1	3.5	4.5	3.5	4.5
Netherlands	(1900)	1.1	4.2	2.5	5.3	4.1	4.9	3.1	3.6	2.5	3.0	3.0	4.0	2.5	3.5
Total						3.9	4.7					3.2	4.3	2.9	4.0
3. Other Non-Communist Europe															
Austria			6.5	5.0	5.7	4.0	5.0	2.8	3.3	2.7	3.2	2.5	4.0	2.5	4.0
Denmark	(1872)	1.6	1.2	4.2	2.7	2.0	3.0	2.7	3.1	2.1	2.7	2.0	3.0	2.0	3.0
Finland			4.1	3.0	3.5	3.0	4.0	2.4	2.9	2.1	2.6	2.5	3.5	2.0	3.0
Greece			5.9	4.4	5.2	4.0	5.0	3.4	4.4	3.6	4.6	3.0	4.5	3.0	4.5
Ireland			2.7	1.7	2.2	2.0	3.0	0.5	3.1	1.9	2.5	2.0	3.0	2.0	3.0
Norway	(1865)	1.6	2.6	2.4	2.5	2.0	3.0	0.3	2.8	2.3	2.8	2.0	3.0	2.0	3.0
Portugal			3.4	3.3	3.3	2.5	3.5	3.3	4.3	3.3	4.3	3.0	4.0	2.5	3.5
Spain				0.3		4.0	5.0	3.6	4.5	3.3	4.4	3.5	4.5	2.5	3.5
Sweden	(1863)	2.1	2.4	2.7	2.6	2.5	3.5	2.4	2.9	1.8	2.4	2.0	3.0	2.0	3.0
Switzerland			4.6	2.9	3.7	3.0	4.0	3.3	3.8	2.6	3.1	3.0	4.0	2.5	3.5
Turkey			3.4	3.4	3.4	1.4	2.5	3.5	4.5	3.3	4.3	2.5	4.0	2.5	4.0
Other												2.3	3.4	2.0	3.1
Total												2.3	3.4	2.0	3.1
5. Japan	(1880)	2.9		8.3		5.3	6.3	4.5	5.5	4.1	5.1	5.0	6.5	4.0	5.0
7. Other East, South and South-East Asia							(a)					1.0	2.5	1.0	2.5
8. U.S.A. and Canada															
Canada	(1872)	1.7	1.5	0.6	1.0	1.3	2.5	2.6	3.0	2.2	2.6	1.5	3.0	1.5	2.5
U.S.A.	(1871)	2.0	2.5	0.6	1.3	1.3	2.5	2.2	2.7	1.7	2.2	1.5	2.5	1.5	2.5
Total					1.5							1.5	2.5	1.5	2.5
9. Other Americas							(b)					2.0	3.0	2.0	3.0
10. New Zealand						1.0	2.0	1.3	1.9	1.3	1.9	1.5	2.5	1.5	2.5
11. Rest of World							(c)					1.5	3.0	1.5	3.0

(a) "Asia and Far East", Low 1.3, High 2.5.

(b) "Latin America (excluding Argentina and Uruguay)", Low 2.0, High 2.8.

(c) "Near East and Africa", Low 1.5, High 2.8.

Sources: Column (1): D.C. Paige, F.T. Blackaby and S. Freund, "Economic Growth: the Last Hundred Years", National Institute Economic Review, No. 16 (July 1961), p. 24.
Columns (2), (3), (4), (7), (8), (9), (10): Bela Balassa, Trade Prospects for Developing Countries (The Economic Growth Center, Yale University; Irwin, Illinois, 1964).
Columns (5), (6): F.A.O., Agricultural Commodities - Projections for 1970 (Special Supplement to Commodity Review, 1962, Rome, 1962).

Table 8.1.4

PROJECTED PER CAPITA NATIONAL INCOME
(Indexes, 1960 = 100)

Region	1965		1970		1975		1980	
	Low	High	Low	High	Low	High	Low	High
1. United Kingdom	110	116	122	134	135	156	149	181
2. E.E.C								
Belgium-Luxembourg	110	116	122	134	135	156	149	181
France	116	125	134	155	152	189	172	230
West Germany	119	125	141	155	163	189	190	230
Italy	119	125	141	155	168	194	199	241
Netherlands	116	122	134	148	152	176	172	209
3. Other Non-Communist Europe								
Austria	113	122	128	148	145	180	164	219
Denmark	110	116	122	134	135	156	149	181
Finland	113	119	128	141	141	163	156	190
Greece	116	125	134	155	156	194	181	241
Ireland	110	116	122	134	135	156	149	181
Norway	110	116	122	134	135	156	149	181
Portugal	116	122	134	148	152	176	172	209
Spain	119	125	141	155	160	184	181	219
Sweden	110	116	122	134	135	156	149	181
Switzerland	116	122	134	148	152	176	172	209
Turkey	113	122	128	148	145	180	164	219
5. Japan	128	137	163	188	198	240	241	306
7. Other East, South and South-East Asia	105	113	110	128	116	145	122	164
8. U.S.A. and Canada								
Canada	108	116	116	134	125	152	135	172
U.S.A.	108	113	116	128	125	145	135	164
9. Other Americas	110	116	122	134	135	156	149	181
10. New Zealand	108	113	116	128	125	145	135	164
11. Rest of World	108	116	116	134	125	156	135	181

Source: Calculated from Table 8.1.3.

another ten or fifteen years".[9] While this was not impossible, especially in view of the greater growth consciousness and economic knowledge of the modern world, we took the view that even if high rates are achieved in the 1960's they are unlikely to continue into the 1970's.

The Relationship between Income and Food Demand

Three different demand functions were used and the appropriate one in each case is indicated in the demand projections. Wherever possible demand functions and income elasticities of demand established by F.A.O.[10] have been utilized. However, F.A.O.'s commodity group income elasticities have been of limited use. For our purpose it is not sufficient to have estimates of the income elasticity of demand for cereals, for example. It is necessary that this elasticity should be broken down into income elasticites for rice, wheat, and other cereals. Even after taking into account data from many sources, this process necessarily involved many guesses. In general, attempts were made to reconcile the total elasticites implied by the synthesis of the projections within the commodity groupings with the income elasticities adopted for that commodity grouping by F.A.O. Projections.[11]

9. D.C. Paige, F.T. Blackaby and S. Freund, "Economic Growth: the Last Hundred Years", National Institute Economic Review, No. 16 (July 1961), p. 37.

10. F.A.O., op. cit., Annex on Methods.

11. The income elasticites of F.A.O. Projections refer to 1958 while 1960 is the base year for this study. As precision in other directions is lacking and the elasticities are (generally) calculated to one decimal point only, re-calculation motivated by this small change in the base year would be pointless, even though the income elasticities of demand derived from each demand function fall as incomes rise. In some cases (e.g. the category "Other East, South and South-East Asia") income elasticities of demand have been estimated from F.A.O. data referring to only a few countries in the region.

The three forms of demand equations which have been adopted are:[12]

Semi-logarithmic	$y = a + b \log_e x$
Log-inverse	$\log_e y = a - \frac{b}{x}$
Log-log-inverse	$\log_e y = a - \frac{b}{x} - c \log_e x$

where x is per capita income and y per capita demand for the commodity in question. From these respective functions the increase in demand brought about by an increase in income can quite easily be derived by means of the following formulae.[13]

$$\frac{y_t}{y_o} - 1 = 2.3026\, \eta_o \log_{10} \frac{x_t}{x_o}$$

$$\mathrm{Log}_{10} \frac{y_t}{y_o} = 0.4343\, \eta_o \left(1 - \frac{x_o}{x_t}\right)$$

$$\mathrm{Log}_{10} \frac{y_t}{y_o} = \frac{\eta_o}{1 - \frac{x_o}{x_m}} \left\{0.4343 \left(1 - \frac{x_o}{x_t}\right) - \frac{x_o}{x_m} \log_{10} \frac{x_t}{x_o}\right\}$$

where x_o and x_t are per capita income in the base year and final (projected) year respectively, y_o and y_t are per capita demand in the base year and final (projected) year respectively, η_o is the income elasticity of demand in the base year, and x_m is the per capita income level at which per capita demand for the relevant commodity reaches a maximum. The coefficient 0.4343 (or its inverse 2.3026) corresponds to the transformation of decimal into natural logarithms.

12. Ibid., Table M7, p. A-23.

13. The base period income elasticites of demand (η_o) are, respectively, $\frac{b}{y_o}$, $\frac{b}{x_o}$ and $\frac{b}{x_o} - c$.

2. METHOD OF CONSTANT PRICE SUPPLY AND TRADE PROJECTIONS

The methodology of constant price supply projection is not in as satisfactory state as that of demand projections. Variables dominant on the demand side such as population and per capita income are not nearly as relevant when supply is considered. Technical progress and the relative prices of products competitive for factors of production are probably the most important factors but the consideration of a model on a world scale incorporating such variables is beyond the scope of this chapter. So, rather primitive methods have been relied upon. Most important amongst these is least-squares trend fitting and extrapolation. Some national or regional plans have been considered. Also our supply projections have been compared with those of other workers in the field — even though, in general, their methodologies are no more satisfactory than ours. High and low limits have been given to the supply projections; these limits were decided upon in a fairly arbitrary manner. In some cases the low supply projection is the extrapolation of a linear trend and the high the extrapolation of an exponential trend. In other cases, an exponential trend would "obviously" give too high a supply projection and the high/low limits may be, e.g., ± 2 percent of the trend given by a linear equation. In other cases the linear trend has been used as the high estimate and 5 percent has been subtracted for the low. In other words our technique is basically trend fitting plus judgment or guess.

The projected high and low supply figures are intended as the limits to the long-term trend as it applies to a particular year and not the limits to the actual production that may occur in that year. That is, drought, cycles, etc. are not allowed for in setting these limits. Thus, a 1970 supply projection, for example, could roughly be interpreted as the average supply of the 3 or 5 years centred on 1970.

Constant price trade projections for all countries are also made. These have been designated I and II rather than low or high as the latter terms are confusing when both exports and imports are being considered. I is to be regarded as a pessimistic (low) projection from the point of view of implications for world prices, II as optimistic. I is generally derived by subtracting the low demand projection for a country or region from the high supply projection of that country or region and thus is the maximum level of (net) exports or minimum level of (net) imports to be expected for that country or region. It is calculated in a symmetrically opposite manner and is the minimum level of exports or maximum level of imports to be expected from a country or region.

As the E.E.C. is thought to be moving towards economic integration, it has been considered as a whole for some supply and trade projections. In other projections there have been advantages in considering separately several parts of the E.E.C. and other regions, particularly when the region includes one or more large exporter and/or one or more importer whose imports may be limited by balance of payments considerations.

The constant price Australian export projections are from Chapter VII. Analyses of the likely trends in world prices and the implications for Australian trade of the projected imports and exports are held over until Chapter X.

3. DAIRY PRODUCTS

Butter is the most important dairy product in international trade, followed by cheese and a variety of other products.

Table 8.3.1

MILK PRODUCTS : DESTINATION OF AUSTRALIAN EXPORTS

	Average 1955/56-1957/58	Average 1958/59-1961/62	1962/63	1963/64	1964/65	1965/66*
Butter ('000 metric tons)						
United Kingdom	59.8	62.8	66.1	75.6	76.9	64.0
Singapore	1.5	1.1	1.3	1.8)	2.6(b)	2.2
Malaya	0.6	1.0	0.9	1.0)		3.5(b)
Ceylon	1.0	1.1	1.2	1.4	1.0	1.0
Hong Kong	0.7	0.9	1.3	1.5	1.1	1.3
Other	7.5	7.6	7.9	7.9	10.1	12.6
Total	71.1	74.5	78.7	89.2	91.7	84.6
Value ($ million)	47.0	48.4	47.2	54.8	62.2	57.7
Cheese ('000 metric tons)						
United Kingdom	11.3	14.6	13.8	13.3	16.3	9.3
Japan	0.1	0.3	2.5	2.8	2.4	5.0
Philippines	0.6	0.5	0.7	1.3	1.5	1.9
U.S.A	(a)	(a)	2.6	1.5	1.6	1.6
Arabian States	0.6	0.9	1.4	1.9	1.5	2.2
Other	2.3	2.3	5.4	7.5	4.3	5.5
Total	14.9	18.6	26.4	28.3	27.6	25.5
Value ($ million)	6.2	9.6	12.2	13.6	14.2	13.6
Dried, Powdered, Preserved, Condensed and Concentrated Milk (excluding skim) ('000 metric tons)						
United Kingdom	0.7	0.7	0.3	0.4	0.2	0.1
Singapore	6.9	3.8	2.4	2.9)	24.4(b)	1.3
Malaya	12.7	10.8	12.1	12.0)		12.7(b)
India	1.5	0.2	0.1	0.1	0.7	1.1
Burma	1.1	2.6	9.0	9.5	6.2	4.5
Ceylon	2.7	4.2	4.3	1.4	1.7	1.5
Philippines	(a)	(a)	1.2	1.9	1.9	1.3
Other	10.3	10.2	7.5	14.0	14.1	13.3
Total	35.9	32.5	36.9	42.2	49.2	35.8
Value ($ million)	14.2	13.6	14.2	14.4	16.8	12.4

Table 8.3.1 (concluded)

	Average 1955/56-1957/58	Average 1958/59-1961/62	1962/63	1963/64	1964/65	1965/66*
Dried Skim Milk ('000 metric tons)						
United Kingdom	7.5	10.7	2.6	2.3	2.9	2.3
Singapore	0.1	0.3	0.4	0.6)	3.2(b)	2.2
Malaya	0.1	0.5	1.2	0.5)		0.8(b)
India	6.9	3.2	9.9	5.3	7.2	2.7
Burma	0.1	0.1	0.1	0.1	0.2	(a)
Ceylon	0.5	0.6	0.1	0.1	0.1	0.1
Philipinnes	0.1	0.2	2.4	2.6	1.8	2.5
Other	3.8	4.6	7.5	6.9	10.0	10.3
Total	19.1	20.2	24.2	18.4	25.4	20.9
Value ($ million)	3.6	3.4	3.8	3.0	6.0	5.9

* Preliminary.

(a) If any, included in "Other".

(b) Including other Malaysian territories.

Source: Commonwealth Bureau of Census and Statistics, Oversea Trade (various issues).

Table 8.3.2

PROJECTED CONSUMPTION OF MILK PRODUCTS AT CONSTANT PRICES

Region	Demand Function Adopted	Base Period Income Elasticity of Demand	Base Period Consumption Av. 1959—61	Projected Consumption[a]					
				1970		1975		1980	
				Low	High	Low	High	Low	High
			Thousand Metric Tons, Milk Equivalent						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. United Kingdom									
Milk and Cream	Log-inverse	-0.1	7,809	8,040	7,960	8,120	8,040	8,280	8,200
Butter	"	0.2	9,505	10,360	10,460	10,650	10,840	11,120	11,310
Cheese	"	0.1	2,502	2,680	2,700	2,750	2,780	2,800	2,850
Other Products	"	0.2	1,233	1,340	1,360	1,380	1,410	1,440	1,470
Feed and Waste			1,014	1,050	1,080	1,060	1,090	1,060	1,100
Total			22,063	23,470	23,560	23,960	24,160	24,700	24,930
2. E.E.C.	(b)	(b)							
Milk and Cream			16,228	17,900	18,160	18,680	19,100	19,600	19,860
Butter			20,329	24,780	25,850	26,780	27,540	28,750	30,880
Cheese			12,460	14,950	15,370	16,080	16,720	17,270	18,030
Other Products			2,740	3,480	3,780	3,950	4,280	4,350	4,790
Feed and Waste			11,784	14,860	15,070	16,340	16,570	17,800	18,060
Total			63,541	75,970	78,230	81,830	84,210	87,770	91,620
3. Other Non-Communist Europe	(b)	(b)							
Milk and Cream			9,838	11,430	11,730	12,250	12,740	13,120	13,900
Butter			7,768	8,880	9,110	9,570	9,880	10,190	10,820
Cheese			3,627	4,780	5,090	5,460	5,900	6,050	6,850
Other Products			1,588	1,770	1,810	1,860	1,910	1,940	2,010
Feed and Waste			3,549	4,110	4,230	4,370	4,510	4,650	4,800
Total			26,370	30,970	31,970	33,510	34,940	35,950	38,380
5. Japan									
Milk and Cream	Semi-log	2.1	1,453	3,210	3,690	4,020	4,710	4,930	5,800
Butter	"	1.8	260	530	610	660	760	800	930
Cheese	"	3.3	63	180	210	230	280	290	350
Other Products	"	1.1	336	560	620	670	750	790	890
Feed and Waste			162	370	420	470	530	560	640
Total			2,274	4,850	5,550	6,050	7,030	7,370	8,610
7. Other East, South and South-East Asia									
Total	Semi-log	1.8	32,750	48,780	59,910	59,590	78,250	71,370	98,870
8. U.S.A. and Canada	(b)	(b)							
Milk and Cream			30,263	31,120	29,040	31,830	29,020	32,640	29,630
Butter			16,590	16,740	15,320	17,000	15,050	17,260	15,150
Cheese			7,397	9,270	9,730	10,330	11,100	11,620	12,550
Other Products			8,190	9,230	9,090	9,770	9,620	10,460	10,380
Feed and Waste			1,520	1,460	1,660	1,490	1,700	1,530	1,740
Total			63,960	67,820	64,840	70,420	66,490	73,510	69,450
9. Other Americas									
Total	Semi-log	0.8	21,330	32,850	34,980	40,530	44,370	49,480	55,240
10. New Zealand									
Milk and Cream	Log-inverse	0	503	620	620	690	690	780	780
Butter	"	-0.1	810	1,000	990	1,090	1,090	1,210	1,210
Cheese	"	0.7	64	90	90	100	110	120	130
Other Products	"	0.1	76	100	100	110	110	120	120
Feed and Waste			146	160	180	170	190	170	200
Total			1,599	1,970	1,980	2,160	2,190	2,400	2,440
11. Rest of World									
Total	Semi-log	1.1	22,460	26,060	29,650	28,080	33,470	29,870	37,060

(a) "Low" and "High" refer to the income growth assumption. Apparent errors of addition are due to rounding.

(b) See Appendix Table A8.3.1.

Sources (for base period consumption): United States Department of Agriculture, Economic Research Service: Food Balances for 24 Countries of the Western Hemisphere, 1959—61 (ERS Foreign 86, Washington, D C., August, 1964). Food Balances for 16 Countries of Western Europe, 1959—61 (ERS Foreign 87, Washington, D.C., August 1964), Food Balances for 12 Countries in the Far East and Oceania (ERS Foreign 88, Washington, D.C., August 1964), Food Balances for 30 Countries in Africa and West Asia, 1959—61 (ERS Foreign 119, Washington, D.C., March, 1965), The World Food Budget, 1970 (Foreign Agricultural Economic Report No.19, Washington, D.C., October 1964), O.E.C.D., Food Consumption in the O.E.C.D. Countries (Paris, November, 1963).

Where these sources do not provide data for all countries in a region, the available data were scaled up by a factor representing the ratio of the total population of the region to the population of the countries for which data are available.

There is little trade in whole milk, though this is one direction in which trade could expand in the future, owing to a new process that greatly extends the time for which milk can be kept fresh without refrigeration. A considerable trade in dried skim milk exists, but this is mostly exports from the United States to underdeveloped countries under non-commercial arrangements. Trade prospects for dried skim milk are considered later in the chapter.

Both in weight and value, butter is by far the largest dairy product export of Australia (Table 8.3.1). Exports of all the major categories of dairy products have increased over the past 10 years. The United Kingdom has been easily the most important market for butter and cheese and it has, to a large extent, been the expansion of the U.K. market that has enabled increased exports of these products. The U.K. is the world's largest importer of butter and cheese, absorbing about two-thirds of total world exports of butter, and more than a quarter of total world imports of cheese. The U.K. imports almost 40 percent of its butter from New Zealand, more than 20 percent from Denmark, and around 15 percent from Australia. More than half its cheese comes from New Zealand and about 11 percent from Australia. In recent years West Germany has imported almost as much cheese as the U.K.

The international market for dairy products has been well described by the F.A.O.[14] Briefly, countries can be classified fairly easily into those with developed dairy industries and those with relatively undeveloped dairy industries. In the former, dairy industries are almost all protected and regulated, and imports are protectively restricted. Imports of the latter group of countries are generally restricted by balance of payments considerations. Thus there have been persistent tendencies to surplus production in many of the former group while low per capita consumption levels have persisted in the latter. The result has been a downward pressure on the international price of butter. Thus relatively cheap butter (by internal retail price standards) has been available on world markets, but few countries have been prepared to buy it. Even the U.K. imports less than half its dairy requirements and has imposed limitations, through country quotas, on the import of butter so as to limit the fall in the retail price of butter in the U.K. and hence protect the market of traditional suppliers.

As a consequence of the general political importance of dairy industries and the extensive network of subsidies and controls, it is unlikely that any great imbalance will develop over the projection period. Should any such imbalances tend to develop they will probably be corrected by changing controls rather than by a persisting change in international prices. This view is held despite the acknowledged narrowness of the international dairy product (particularly butter) market and the potentially large depressing effect on prices which could be brought about by relatively small increases in the volume of (subsidized) butter exports.

Demand Projections

Within the category of dairy products, projections were made for human consumption of liquid milk and cream, butter, cheese, and other full cream dairy products, and also for feed and waste demand for whole milk. Table 8.3.2 and Appendix Table A8.3.1 present the projections. The first problem associated with projecting demand for dairy products is to express the base period consumption of the various products in an additive manner. Consumption of each product was converted to a whole milk equivalent at the national rate given

14. F.A.O., Means of Adjustment of Dairy Supply and Demand (Commodity Bulletin Series No. 37, Rome, 1963).

by the F.A.O.[15] Where national rates were not available a standard conversion scale was used.[16] These conversions were reconciled with U.S.D.A. estimates of whole milk production and trade in the various dairy products. To avoid double counting, products made from skim milk were excluded as far as possible.

For the United Kingdom, E.E.C., most of the countries of "Other Non-Communist Europe", U.S.A. and Canada, and New Zealand, income elasticites were estimated on the basis of F.A.O. Projections and the F.A.O. study of the world dairy situation.[17] Income elasticities for Japan were adopted from a study of Japanese import requirements undertaken for the Department of Agriculture — hereafter referred to as Japanese Import Requirement.[18] The income elasticity for total milk products implied by adding the separate milk products projections for Japan closely approximates the elasticity in F.A.O. Projections. In "Other East, South and South-East Asia", "Other Americas" and "Rest of World" consumption of milk products is projected as a whole.

For the countries for which data on feed (mainly milk fed to calves) and waste are available for the base period, these demands are projected. The technique used was to establish a trend relationship between feed and waste on the one hand and total production on the other, and to project on this basis.

15. F.A.O., Technical Conversion Factors for Agricultural Commodities (Rome, 1960).

16. F.A.O., Means of Adjustment of Dairy Supply and Demand op. cit., p. 97.

17. Ibid., Appendix Table 4, pp. 104-105.

18. Institute of Agricultural Economic Research, Department of Agricultural Economics, University of Tokyo, Japanese Import Requirement: Projections of Agricultural Supply and Demand for 1965, 1970 and 1975 (Tokyo, March, 1964), Ch. 11.

Supply and Trade Projections

Supply and trade projections for whole milk products are presented in Tables 8.3.3 and 8.3.4 and Appendix Tables A8.3.2 and A8.3.3. In most regions production of whole milk was projected and compared with the whole milk equivalent of projected consumption. The difference, after a consideration of balance of payments implications, was assumed to be trade. Such trade, for most countries, will be in the form of butter and cheese; however the analysis is not extended to consider imbalances in the several dairy products. In projecting production no allowance was made for the changing butterfat content of milk; it was assumed that this will probably be a relatively small element in the complete supply/demand picture.

Substantial portions of the base period dairy product imports of "Other East, South and South-East Asia", "Other Americas", and "Rest of World" were of dried skim milk. An attempt was made to remove this trade from the base period imports for these regions but its extent can only be estimated — largely on the basis of United States exports of skim milk to these regions.

United Kingdom

Between 1952 and 1962, production of whole milk in the U.K. increased by almost a quarter. For the 1970 supply projection, this trend is extrapolated ±5 percent for high and low limits. The 1970 high projection is very close to the National Plan objective for that year.[19] The low projection is close to an E.E.C. study group's projection

19. Government of the United Kingdom, The National Plan (H.M.S.O., London, September 1965), p. II-10.

Table 8.3.3

ESTIMATED AND PROJECTED PRODUCTION OF WHOLE MILK AT CONSTANT PRICES
(Thousand Metric Tons)

Region	Base Period Production Av. 1959—61	Estimated Production 1965	Projected Production					
			1970		1975		1980	
			Low	High	Low	High	Low	High
1. United Kingdom	12,227	12,680	13,520	14,940	14,120	15,650	14,720	16,360
2. E.E.C.	64,538	67,400 (1964)	79,340	82,580	87,190	90,750	95,030	98,910
3. Other Non-Communist Europe	31,650	n.a.	34,630	37,260	36,590	39,380	38,490	41,490
5. Japan	1,905	3,251	4,220	4,650	5,310	5,840	6,400	7,040
8. U.S.A. and Canada	64,488	65,010	66,710	68,680	68,390	70,430	70,070	72,190
9. Other Americas	20,350	22,200	26,240	27,310	29,280	30,480	32,320	33,640
10. New Zealand	5,355	5,959	5,990	6,240	6,350	6,610	6,700	6,970

Sources: (for base period and 1965 production): As for Table 8.3.2; also United States Department of Agriculture, Indices of Agricultural Production for East Asia, South Asia and Oceania (Economic Research Service, Foreign Regional Analysis Division, December 1965) and Indices of Agricultural Production for the 20 Latin American Countries (Economic Research Service, ERS-Foreign 44, January 1966); F.A.O., Monthly Bulletin of Agricultural Economics and Statistics (various issues); Commonwealth Economic Committee, Dairy Produce, 1965 (H.M.S.O., London, 1966).

Table 8.3.4

ESTIMATED AND PROJECTED TRADE IN MILK PRODUCTS (EXCLUDING SKIM) AT CONSTANT PRICES [(a)]

(Thousand Metric Tons, Whole Milk Equivalent; Net Exports represented by [-], Net Imports by [+]

Region	Base Period Trade Av. 1959 - 61	Estimated Trade 1965	Projected Trade [(b)]					
			1970		1975		1980	
			I	II	I	II	I	II
1. United Kingdom	+9,836	+11,030	+8,530	+10,040	+8,310	+10,040	+8,340	+10,210
2. E.E.C.	-997	-1,440	-6,610	-1,110	-8,920	-2,980	-11,140	-3,410
3. Other Non-Communist Europe	-5,280	-5,080	-6,760	-3,810	-6,800	-3,540	-6,780	-3,000
4. Communist Europe	+30	n.a.	0	+50	0	+60	0	+70
5. Japan	+369	+120	+200	+1,330	+210	+1,720	+330	+2,210
6. Communist Asia	0	n.a.	0	0	0	0	0	0
7. Other East, South and South-East Asia	+750	n.a.	+1,120	+1,370	+1,360	+1,790	+1,630	+2,260
8. U.S.A. and Canada	-528	-742	-3,840	+1,110	-3,940	+2,030	-2,740	+3,440
9. Other Americas	+500	n.a.	+900	+1,200	+1,200	+1,500	+1,500	+1,800
10. New Zealand	-3,756	-4,927	-4,270	-4,010	-4,450	-4,160	-4,570	-4,260
11. Rest of World	+900	n.a.	+1,040	+1,190	+1,130	+1,340	+1,200	+1,480
12. Australia [(c)]	-2,070	-2,269	-3,137	-2,025	-3,666	-2,291	-3,977	-2,161
Total (Excess of Exports or Imports)	-246		-12,830	+5,330	-15,570	+5,510	-16,210	+8,640

(a) Allowance has been made in this table for balance of payments etc. restrictions on imports.

(b) The sum of the I (II) trade projections provides the maximum (minimum) expected export surplus of the minimum (maximum) expected import surplus.

(c) Under assumption that existing restrictions on margarine production are maintained.

Sources: (for base period and 1965 trade): As for Table 8.3.2, also F.A.O. Monthly Bulletin of Agricultural Economics and Statistics, (various issues).

for the U.K.[20] and somewhat above that of the F.A.O.[21] The projections for 1975 and 1980 assume a smaller increase in production in that the high estimates are on the trend while the low are trend values minus 10 percent. The trade implications of such projections are that imports should continue at approximately their base period level, though with a possible small downward bias.

E.E.C.

Within the E.E.C. countries, production of milk increased by 30 percent over the 1952—62 decade in an almost perfectly linear manner. As it appears to be policy that the average levels of protection should not be reduced, this trend has been projected ± 2 percent for high/low limits. Such projections approximate closely, for 1970, projections by the E.E.C. study group[22] and also that of the F.A.O. The effect on trade, under both trade projections, will be for net exports to increase substantially. While it is E.E.C. policy to protect the existing dairy exports of member countries, through what amount to export subsidies (termed "refunds"), it appears that exports will not be permitted to increase without limit.[23] The level that would be countenanced is not clear, though it is possible that the I trade projections exceed likely levels. However as the I trade projection for 1970 is somewhat below that of the E.E.C. study group for that year it has been retained.

20. Communauté Economique Européene, Le Marché Commun de Produits Agricoles, Perspectives "1970" (Collection: Etudes; Serie: Agriculture No. 10, Bruxelles, 1963), Tableau No. 56A (p. 107). (The projection referred to is that which assumes increasing numbers of cows.)

21. F.A.O., Means of Adjustment..., op. cit., Appendix Table 1 (p. 98).

22. Op. cit.

23. General Agreement on Tariffs and Trade, Trade in Agricultural Products; Reports of Committee II on Consultations with the European Economic Community, the United States of America and the United Kingdom (Geneva, 1965), pp. 15-17, 92-96.

Other Non-Communist Europe

This region is a substantial net exporter of dairy products, Denmark accounting for the major portion of the total. Supply projections have been based on extrapolation of past trends or the F.A.O. projections. While it is not anticipated that Danish exports will change significantly, those of Austria and Ireland could increase substantially. Spain and Sweden could develop into large importers — in the former case because of rapidly growing consumption, in the latter because of decreasing production.

On the basis of projected supply and demand, Turkey would become a substantial importer. However as this would conflict with Turkish policy toward agricultural imports,[24] imports have been projected at a much lower level: the pessimistic trade projection was that there will be no imports. In the aggregate under the I trade projection net exports for the whole region increase until 1970 and then remain fairly constant, while under the II trade projection net exports fall fairly rapidly at first and more gradually thereafter.

Japan

It is anticipated that production of whole milk will continue to expand rapidly in Japan in response to substantial consumption growth. The low production projections are derived simply by the extrapolation of a linear trend fitted to past data, while the high estimates are 10 percent above the low. Japanese Import Requirement projects a more rapid growth of production, but that study also projected a substantially higher rate of consumption growth. Its import projections are in the region of the II trade projections herein.

24. G.A.T.T., Trade in Agricultural Products; Reports of Committee II on Country Consultations (Geneva, 1962), pp. 433 - 444.

U.S.A. and Canada

For Canada, production was projected on the basis of past trend ± 5 percent for high/low limits. For the United States, a small, steady increase in production was projected, and this accorded fairly well with the views of other projectors. For the two countries together, under the I trade projection net exports rise until 1975 and then fall in 1980; under the II trade projection sizeable imports develop; the growth will be particularly rapid after 1975.

Other Americas

Production for this region has been projected on the basis of linear trend extrapolation, ± 2 percent. But such a projection, when combined with the projected consumption, produces import projections far beyond likely levels when balance of payments is considered. The trade projections in Table 8.3.4 were therefore arrived at directly, without reference to consumption and production projections. For the I trade projection, a trebling of net imports (excluding skim) by 1980 was assumed; the II trade projection was assumed to treble by 1975.

New Zealand

New Zealand is the world's largest exporter of dairy products. However, expansion of output in recent years was not particularly rapid. Extrapolation of a linear trend (±5%) gives a production projection similar to that of F.A.O. On this basis, the I trade projection was that the 1980 export figure should be about 20 percent greater than that of the base period, while on the II projection it would be about 13 percent greater.

Other Regions

Within Communist Europe, Poland can be anticipated to maintain its position as a large exporter, and the rest of the region, considered together, will continue as a substantial net importer. For the I trade projection the region as a whole was assumed to have zero net trade, while under the II trade projection a doubling of net imports by 1975 was assumed.

No data are available for Communist Asia and no trade was projected.

Within "Other East, South and South-East Asia" and "Rest of World", a substantial import trade could develop but for foreign exchange shortages. Because of this factor net imports were projected to expand at the same rate as total consumption of milk products.

Dried Skim Milk

Australian exports of dried skim milk increased somewhat in recent years, with increases in Asian markets outweighing the fall in that of the U.K. (Table 8.3.1). In view of the recent growth of Asian markets and with expectations that this trend will continue, Australia should be able to export any likely domestic surplus without any significant effect on price. Further, it is unlikely that this price will be greatly changed by any other factor in the international market for skim milk.

4. MEATS

Australia has exported mainly bovine and sheep meats (Table 8.4.1) and it is to these meats (in all forms except live) that attention is devoted. It is not anticipated that a substantial export trade will develop in poultry, pig, or other types of meat.

Australia's beef and veal exports increased rapidly in recent years; the quantity exported multiplied two and a half times and the value of exports almost five times over the past decade. Australia is the second largest exporter of beef and veal, accounting for about 20 percent of the world's exports in recent years. Two markets are of great importance to Australia — the United States and the United Kingdom. Together these two countries purchased about 90 percent of Australia's beef and veal exports in 1963 — 64 and over 85 percent in 1965 — 66 (Table 8.4.2). While Britain relied on imports for a little more than a quarter of its beef and veal requirements, the United States' imports were marginal with regard to its total requirements — 5 percent or less.

The growth of Australian exports of beef and veal was largely due to the emergence of the United States as a substantial importer. During the last few years, Australia supplied that country with slightly over more than half its imports of beef and veal. The size of this proportion to a large degree depended on American regulations prohibiting non-canned imports from countries in which foot-and-mouth disease exists — including the major South American exporters. However if the United States imported non-canned meat from that area, it is reasonable to expect that Australia's exports to other markets — particularly the U.K. and E.E.C. — would have been correspondingly greater.

Australian (and New Zealand) beef and veal is not fully comparable to the home-produced product of the major importing countries, or with that of the other major exporting area — South America. Because of the distance to be travelled to the major markets, nearly all Australian non-canned meat exports are frozen. Freezing tends to lower quality below that of similar fresh or chilled meat — the latter being the form in which most South American meat is exported.

Production, consumption, and trade statistics for mutton and lamb do not, in most countries, separate the two products. This is unfortunate as recent trends have been such that separation would be desirable: international trade in lamb in recent years has been fairly static while mutton trade, though totalling much less than lamb, rapidly increased. Mutton is, of course, a much cheaper meat than lamb.

The international market for sheep meats is dominated by one exporter, New Zealand, and one importer, the U.K. Trade between the two countries accounts for approximately 60 percent of total world trade in mutton and lamb. This dominance applies to a much greater extent for lamb than for mutton.

Australia's exports of mutton have grown substantially in the last few years. Until 1960 Australia's exports of lamb greatly exceeded those of mutton in practically every year but since then the situation changed so that in 1964 — 65 the value of mutton exports was almost three times that of lamb. Australia accounted for at least a third of world mutton exports[25] and possibly substantially more. Australia's share of the international lamb market is relatively small. In 1963, for example, Australia sent about 70 percent of its exports of lamb to the U.K. and this accounted for only 5 percent of total U.K. lamb imports.

Table 8. 4. 3. shows Australian exports of mutton and lamb by destination. Major changes have been the growth of the U. S., Japanese, and Greek markets.

Demand Projections

The results of the demand projections for beef and veal and mutton and lamb are

25. This fraction is calculated by relating Australia's mutton exports to total world exports of mutton and lamb less Australia's and New Zealand's exports of lamb and the U.K.'s imports of lamb from sources other than Australia and New Zealand in 1963.

Table 8.4.1

AUSTRALIAN EXPORTS OF MEAT AND MEAT PRODUCTS
(Million Australian Dollars)

	Average 1955/56-1957/58	Average 1958/59-1961/62	1962/63	1963/64	1964/65	1965/66*
Fresh or Preserved by Cold Process						
Beef and Veal	45.6	104.8	158.6	176.6	200.4	195.5
Beef Offals	4.0	5.2	5.8	6.6	9.6	9.1
Lamb	12.6	10.4	10.4	7.8	10.8	8.2
Mutton	3.6	13.0	23.4	24.8	29.6	37.2
Pork	0.6	0.4	0.2	0.2	0.4	0.4
Poultry	0.4	0.2	0.2	0.2	0.4	0.3
Rabbit and Hare	4.8	5.4	3.6	3.8	3.8	4.2
Other	2.0	3.8	4.2	4.2	5.8	6.7
Preserved in Airtight Containers						
Beef and Veal	24.4	14.6	6.6	5.4	8.2	7.1
Ham and Pork Shoulders	1.0	0.4	-	-	-	-
Meat and Vegetables Combined	1.0	1.0	0.8	1.0	1.2	1.5
Mutton	1.8	3.0	1.0	0.8	0.8	1.1
Other	2.8	5.4	4.8	5.2	5.6	4.9
Bacon and Ham	0.4	0.2	-	-	0.2	0.3
Meat Extracts	1.4	1.4	1.0	1.0	2.6	3.1
Sausage Casings (Natural)	4.2	3.8	5.2	5.4	5.4	6.7
Other including Salted	0.6	0.4	0.4	0.4	1.6	1.5
Total	111.2	173.4	225.6	243.6	286.2	287.8

* Preliminary

Source: As for Table 8.3.1.

Table 8.4.2

BEEF AND VEAL : DESTINATION OF AUSTRALIAN EXPORTS
(Thousand Metric Tons)

Country	Average 1955/56-1957/58	Average 1958/59-1961/62	1962/63	1963/64	1964/65	1965/66*
Fresh or Preserved by Cold Process						
United Kingdom	103.9	76.9	27.1	37.6	108.8	81.7
Belgium-Luxembourg	3.4	1.6	0.5	(a)	1.1	0.4
France	(a)	(a)	(a)	0.6	5.2	1.3
Italy	1.2	0.2	(a)	2.6	15.2	6.0
Greece	(a)	(a)	(a)	1.2	9.0	1.9
Japan	3.8	2.5	3.1	4.4	8.1	7.7
Hong Kong	2.8	1.2	1.0	1.3	1.1	0.7
Malaysia (including Singapore)	5.2	4.1	4.1	3.9	3.7	1.2
Philippines	3.4	1.0	1.2	1.3	1.2	1.1
Canada	(a)	1.0	5.0	3.6	1.8	1.4
U.S.A.	2.4	92.3	215.1	222.0	144.1	158.0
West Indies	1.2	1.8	1.8	2.1	2.9	(a)
Other	8.8	6.2	5.1	5.5	19.1	16.5
Total	136.1	188.8	264.0	286.0	321.3	277.9
Preserved in Airtight Containers						
United Kingdom	35.0	16.6	5.6	4.9	7.5	8.7
Canada	3.1	2.7	2.2	1.7	1.9	1.3
Papua-New Guinea	3.0	1.5	1.2	1.2	1.3	1.8
Other	3.4	3.6	1.1	1.8	1.8	2.5
Total	44.5	24.4	10.1	9.6	12.5	14.3

* Preliminary.

(a) If any, included in "Other".

Source: As for Table 8.3.1.

Table 8.4.3

MUTTON AND LAMB : DESTINATION OF AUSTRALIAN EXPORTS
(Thousand Metric Tons)

	Average 1955/56-1957/58	Average 1958/59-1961/62	1962/63	1963/64	1964/65	1965/66*
Fresh or Preserved by Cold Process						
Mutton						
United Kingdom	9.7	9.5	7.0	5.4	11.8	3.8
Canada	0.1	3.8	12.4	10.7	7.7	10.1
U.S.A.	1.5	17.6	32.1	20.4	9.3	26.8
Malaya	0.3	0.6	0.5	0.5 }	3.2 (b)	{ 1.0 (b)
Singapore	0.9	1.1	1.7	2.0 }		{ 1.5
U.A.R. (Egypt)	0.4	0.6	0.3	0.3	1.7	(a)
Japan	(a)	1.3	4.2	19.3	17.0	25.7
Greece	(a)	1.3	0.7	4.3	15.1	4.3
Other	2.2	2.6	3.1	5.1	8.1	6.8
Total	15.1	38.4	62.0	68.0	73.9	80.0
Lamb						
United Kingdom	26.1	21.5	16.9	13.3	17.3	8.6
Canada	1.6	2.7	2.6	1.3	2.0	2.6
U.S.A.	0.3	1.7	3.7	0.6	0.9	1.7
Other	2.1	2.7	2.5	3.7	4.4	3.2
Total	30.1	28.6	25.7	18.9	24.6	16.1
Preserved in Airtight Containers						
Mutton						
United Kingdom	3.3	4.7	1.2	1.1	0.8	0.8
Other	0.7	0.8	0.4	0.2	0.4	0.8
Total	4.0	5.5	1.6	1.3	1.2	1.6

* Preliminary. (a) If any, included in Other. (b) Including other Malaysian territories.

Source: As for Table 8.3.1.

Table 8.4.4

PROJECTED CONSUMPTION OF MEATS AT CONSTANT PRICES

	Base Period Income Elasticity of Demand (a)	Base Period Consumption (Av. 1959 - 61)	Projected Consumption (b)					
			1970		1975		1980	
			Low	High	Low	High	Low	High
		Thousand Metric Tons						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. United Kingdom								
Beef and Veal	0.5	1,161	1,340	1,400	1,430	1,520	1,520	1,640
Mutton and Lamb	0.2	604	660	670	680	710	710	740
2. E.E.C.	(c)							
Beef and Veal		3,606	4,780	5,110	5,370	5,870	5,990	6,670
Mutton and Lamb		201	253	267	283	305	312	341
3. Other Non-Communist Europe	(c)							
Beef and Veal		1,088	1,480	1,600	1,690	1,890	1,930	2,220
Mutton and Lamb		386	570	620	670	760	790	920
5. Japan								
Beef and Veal	1.2	148	256	284	306	346	363	411
Mutton and Lamb	3.0	35	94	100	122	145	152	182
7. Other East, South and South-East Asia								
Total	1.5	2,760	4,000	4,800	4,800	6,150	5,740	7,670
8. U.S.A. and Canada	(c)							
Beef and Veal		7,925	10,260	11,000	11,560	12,780	13,180	14,880
Mutton and Lamb		423	520	540	570	610	640	690
9. Other Americas								
Beef and Veal	(c)	4,811	6,800	7,110	8,100	8,630	9,610	10,450
Other	0	2,315	3,080	3,080	3,540	3,540	4,070	4,070
10. New Zealand								
Beef and Veal	0.2	143	169	173	184	191	204	214
Mutton and Lamb	0.2	99	117	120	128	132	142	148
11. Rest of World								
Total	1.3	5,133	7,750	8,980	9,550	11,700	11,600	14,890

(a) Semi-log demand functions have been adopted except where the income elasticity of demand is zero, in which cases the income elasticity has been assumed constant over the projection period.

(b) "Low" and "High" refer to the income growth assumption.

(c) See Appendix Table A8.4.1.

Source: (for base period consumption): As for Table 8.3.2 and also a privately supplied mimeographed paper which is a development of Ch. II of Institute of Agricultural Economic Research, Department of Agricultural Economics, University of Tokyo, Japanese Import Requirement: Projections of Agricultural Supply and Demand for 1965, 1970 and 1975 (Tokyo, March, 1964).

Table 8.4.5

ESTIMATED AND PROJECTED PRODUCTION OF BEEF AND VEAL AT CONSTANT PRICES
(Thousand Metric Tons)

Region	Base Period Production (Av. 1959 — 61)	Estimated Production 1965	Projected Production					
			1970		1975		1980	
			Low	High	Low	High	Low	High
1. United Kingdom	815	832	1,000	1,040	1,020	1,080	1,030	1,100
2. E.E.C.	3,388	3,721	4,750	4,840	5,410	5,520	6,080	6,200
3. Other Non-Communist Europe	1,126	1,340	1,490	1,640	1,650	1,900	1,830	2,190
5. Japan	144	220	226	238	268	282	309	325
8. U.S.A. and Canada	7,690	9,752	10,400	10,630	11,610	11,870	12,830	13,120
9. Other Americas	5,438	n.a.	6,460	7,070	6,950	7,700	7,520	8,380
10. New Zealand	239	276	343	369	383	438	423	521

Source (for base period and 1965 production): As for Table 8.4.4; also United States Department of Agriculture, World Beef Trends (Foreign Agricultural Service, FAS-M-173, Washington, D.C., June, 1966).

Table 8.4.6

ESTIMATES AND PROJECTED TRADE IN BEEF AND VEAL AT CONSTANT PRICES[a]

(Thousand Metric Tons, Net Exports represented by [-], Net Imports by [+])

Region	Base Period Trade Av. 1959—61	Estimated Trade 1965	Projected Trade [b]					
			1970		1975		1980	
			I	II	I	II	I	II
1. United Kingdom	+346	+411	+300	+400	+350	+500	+420	+610
2. E.E.C.	+218	+357	-60	+360	-150	+460	-210	+590
3. Other Non-Communist Europe	-38	-4	-113	+71	-153	+137	-212	+188
4. Communist Europe	+2	+7(1964)	0	+5	0	+5	0	+5
5. Japan	+5	+11	+18	+58	+24	+78	+38	+102
6. Communist Asia	n.a.	n.a.	0	0	0	0	0	0
7. Other East, South and South-East Asia	+7	n.a.	+15	+25	+25	+35	+35	+45
8. U.S.A. and Canada	+234	+376	-370	+600	-310	+1,110	+60	+1,190
9. Other Americas	-627	-607	-680	-320	-630	-290	-640	-230
10. New Zealand	-96	-145	-200	-170	-254	-192	-317	-205
11. Rest of World	+6	n.a.	+50	+100	+75	+125	+100	+150
12. Australia	-305	-406	-378	-153	-437	-138	-428	-73
Total (Excess of Imports or Exports)	-248	-	-1,420	+980	-1,460	+1,830	-1,150	+2,370

(a) Allowance has been made in this table for balance of payments etc. restrictions on imports.

(b) The sum of the I (II) trade projections provide the maximum (minimum) expected export surplus or the minimum (maximum) expected import surplus.

Source (for base period and 1965 trade): As for Table 8.4.5 and also United States Department of Agriculture, Economic Research Service, Food Balances for S. Eastern European Countries, 1959 — 61 (ERS Foreign 124, Washington, D.C., May 1965).

Table 8.4.7

ESTIMATED AND PROJECTED PRODUCTION OF MUTTON AND LAMB AT CONSTANT PRICES
(Thousand Metric Tons)

Region	Base Period Production Av. 1959—61	Estimated Production 1965	Projected Production					
			1970		1975		1980	
			Low	High	Low	High	Low	High
1. United Kingdom	248	253	270	280	275	290	280	300
2. E.E.C.	196	n.a.	232	244	254	267	273	285
3. Other Non-Communist Europe	378	n.a.	553	599	665	717	780	840
5. Japan	20	n.a.	16	30	14	35	12	40
8. U.S.A. and Canada	369	310	416	462	449	501	483	541
10. New Zealand	445	460	524	580	584	646	645	713

Source (for base period and 1965 production): As for Table 8.3.3.

Table 8.4.8

ESTIMATED AND PROJECTED TRADE IN MUTTON AND LAMB AT CONSTANT PRICES
(Thousand Metric Tons, Net Exports represented by [-], Net Imports by [+])

Region	Base Period Trade Av. 1959 — 61	Estimated Trade 1965	Projected Trade (a) 1970		1975		1980	
			I	II	I	II	I	II
1. United Kingdom	+366	+351	+380	+400	+390	+435	+410	+460
2. E.E.C	+5	+6	+9	+35	+16	+51	+27	+68
3. Other Non-Communist Europe	+8	n.a.	-29	+62	-47	+90	-50	+138
4. Communist Europe	-3	n.a.	-7	0	-9	0	-10	0
5. Japan	+15	+45	+64	+94	+89	+131	+112	+170
6. Communist Asia	n.a.	n.a.	0	0	0	0	0	0
7. Other East, South and South East Asia	+4	n.a.	+6	+7	+7	+9	+8	+11
8. U.S.A. and Canada	+55	+34	+53	+121	+68	+163	+104	+205
9. Other Americas	-41	n.a.	-30	-10	-20	+10	-10	+30
10. New Zealand	-342	-351	-463	-404	-518	-452	-571	-497
11. Rest of World	+8	n.a.	+12	+14	+15	+18	+18	+23
12. Australia	-72	-73	-37	+26	+59	+75	+125	+166
Total (Excess of Imports or Exports)	+3	+12	-42	+345	+50	+530	+163	+774

(a) The sum of the I (II) trade projections provides the maximum (minimum) expected export surplus or the minimum (maximum) expected import surplus.

Sources (for base period and 1965 trade): As for Table 8.3.4. For Australia, lamb trade projections are based on Tables 7.2.3 and 5.4.2; for mutton on equation 6.4.1 and the same tables.

Table 8.4.9

PROJECTED WORLD IMBALANCE IN MUTTON AND LAMB AT CONSTANT PRICES*
(Thousand metric tons; [-] represents an export surplus, [+] an import surplus)

Year and Projection (a)	Lamb			Muton		
	Australia	Rest of World	Total	Australia	Rest of World	Total
1970 I	+ 26	- 20	+6	-146	+ 15	-131
II	+109	+ 73	+182	0	+246	+246
1975 I	+ 87	- 38	+ 49	-126	+ 29	- 97
II	+201	+ 90	+219	- 28	+365	+337
1980 I	+145	- 43	+102	-132	+ 81	- 51
II	+298	+ 93	+391	- 20	+515	+495

* Australia's trade projections are given separately as they tend to swamp the prospects of constant price imbalance elsewhere. In addition the projection of our Australian import surplus for lamb should be made explicit. While some Australian imports of lamb may eventuate, it seems unlikely that an import surplus of such magnitude would be allowed to arise. It should perhaps be stressed that these are constant base period price projections — and that prices have risen substantially since then.

(a) The sum of the I (II) trade projections provides the maximum (minimum) expected export surplus or the minimum (maximum) expected import surplus.

Sources: Table 8.4.8 and sources cited here.

presented in Table 8.4.4 and Appendix Table A8.4.1. Little information is available for offal consumption, and hence demand is not projected. Assumptions regarding income elasticities of demand for bovine and sheep meats were formed mainly on the basis of works by L.M. Goreux,[26] an E. E. C study[27] and the authors of Japanese Import Requirement.[28] These elasticities were compared with the total meat elasticity adopted in F.A.O. Projections. Colin Clark's view[29] that, in the United Kingdom, demand for mutton and lamb is more income elastic than demand for beef and veal has been rejected, as it conflicts with recent trends. Also, it is at variance with experience in other countries, including those with per capita consumption of bovine and sheep meats similar to the U.K. In Japan, mutton is largely demanded for processing and projections for its demand were affected by evidence regarding the income elasticity of demand for processed meat.

For "Other East, South and South-East Asia" and "Rest of World" it was not possible to divide meat consumption into its components, and the income elasticities used were those covered in F. A. O. Projections.

Supply and Trade Projections

(i) Beef and Veal

Table 8.4.5 (and Appendix Table A8.4.2) contains domestic supply projections for most of the non-Communist regions in our study. Table 8.4.6 contains trade projections, after making allowance for balance of payments implications, etc., for some countries, of the projected supply and demand, and also includes trade projections for Communist regions and regions for which few production data exist.

United Kingdom

For the United Kingdom the supply projections shown may be compared with F.A.O. Projections[30] figure for 1970 of 920,000 to 930,000 metric tons and with C. Clark's[31] projections of 966,000 to 987,000 for 1965 and 975,000 to 998,000 for 1975. The 1970 supply figures of the F.A.O. appear far too low — they were exceeded in 1963. Clark's supply projections appear to be more realistic but again rather low for 1975. The National Plan of 1965 states that "home production of beef and veal could be increased by 125,000 [long] tons by 1970".[32] As beef and veal production is given emphasis in this plan,[33] it was assumed that, for our high supply projection, this target will be achieved, but that increases in production will be relatively modest in the following decade. (This assumed rate of growth is below the extrapolation of a linear trend fitted to data for 1949 — 64.) For the "low" supply projections it was also assumed that substantial

26. L.M. Goreux, Income Elasticity of the Demand for Food (mimeographed, Economic Commission for Europe Committee on Agricultural Problems, in Co-operation with F. A. O., June 1959), Table B. 2.

27. Communauté Economique Européene, op. cit., Tableau No. 3, p. 13.

28. A privately supplied mimeographed paper being a development of Ch. 11 of Japanese Import Requirement.

29. C. Clark et al., United Kingdom: Projected Level of Demand, Supply and Imports of Farm Products in 1965 and 1975 (United States Department of Agriculture, Economic Research Service [ERS-Foreign-19], Washington D. C., 1962), Table 4.

30. The projections have been adjusted to fit a higher base period production than that used by F. A. O.

31. Op. cit. The lower figures are Clark's "Ab" projection at high feed prices; the high his "Ac" projection at low feed prices. "Ab" and "Ac" correspond most closely to our assumptions regarding population and income growth.

32. Government of the United Kingdom, The National Plan (H. M. S. O., London, September, 1965), pp. II—9.

33. Ibid., p. 141.

increases will occur, but that the 1970 objective of the National Plan will not have been achieved by 1980.

Both demand and domestic supply in 1965 were well below the trend values implied by this study for that year. The supply deficiency can be explained by large exports of live cattle to the Continent and by herd-building; the lower level of consumption can be attributed to substantial increases in beef and veal prices.

U.S.A. and Canada

Until 1959, exports of Australian meat to the United States were limited by the 15 year Meat Agreement with the U.K.[34] Thus the growth in United States imports (dating from 1958) almost exactly coincided with the commencement of Australia's ability to supply that market. U.S. net imports (excluding canned) rose from 36,000 metric tons in 1957 to a maximum of 443,000 metric tons in 1963.

Australian (and New Zealand) beef and veal has been used almost entirely for manufacturing purposes in the United States. There is evidence to suggest "that the market for manufacturing beef constitutes a greater share of the total market for beef than 10 years ago".[35] However, the expansion of beef production in the United States has mainly been of the higher grades so that prices of these grades fell during 1963 and the first half of 1964, despite the overall expansion of demand for beef. This decrease in price — though it did not occur in grades directly competitive with imported beef — gave rise to pressure by cattle interests for restricted imports. A number of actions were taken,[36] the most important being attempts to stimulate consumption in the United States and, in early 1964, the signing of a series of agreements between the U.S. and the major suppliers under which these countries agreed to limit exports of beef and veal (and in the case of Australia, mutton) to the United States. These voluntary restrictions were made obsolete by meat legislation enacted in August 1964 under which the United States could set quotas on imports of beef and veal, goat, and mutton if it appeared that in any year, imports of these meats would exceed 110 percent of an annually adjusted base quantity.[37] In 1965 imports failed to reach the level at which quotas were to be applied. Despite the fact that United States imports fell during 1964 and 1965, by early 1966 many States had passed legislation discriminating against imported meat while others were contemplating such action. However in March 1966 such legislation was declared unconstitutional by a U.S. Federal Court.[38]

The aforementioned factors make any projection of import demand by the United States very difficult. It appears, however, that political pressures are such in the United States that a good deal of time will have to pass before a level of imports much in excess of that reached in 1963 will be tolerated.

Between 1949 and 1964 production of beef and veal in the United States increased by about 75 percent. Growth was not steady but varied in a cyclical manner around a linear trend — the cycle was associated with a similar cycle in cattle numbers. For the low production projections

34. J. H. Sault, "Recent Developments in the Market for Beef in the U.S.A.", Quarterly Review of Agricultural Economics, Vol. 13, No. 1 (January 1965), p. 36.

35. J. L. Sault, op. cit., p. 33.

36. Ibid., p. 40-42.

37. For further details see Ibid., p. 41 or Bureau of Agricultural Economics, The Beef Situation, No. 9 (Canberra, November, 1964), pp. 23-24.

38. The Australian Financial Review, 15th March, 1966, p. 4.

the linear trend line has been extrapolated; for the high production projections 2 percent was added (Appendix Table A8.4.2) because of recent encouragement to production. Trade projections appear fairly reasonable with the exception of the projection II for 1975 and 1980 of imports of 1060 and 1860 thousand metric tons respectively. Because of the political pressure of U.S. producers these were reduced to 1 million metric tons in Table 8.4.6.

Supply and trade projections for Canada were added to those of the United States in Tables 8.4.5 and 8.4.6. Canada's production (Appendix Table A8.4.2) was projected on the basis of an extrapolated linear trend for low and + 5 percent for high limit.

E.E.C.

In 1950—63, beef and veal production in the E.E.C. increased by approximately 86 percent, the expansion being in a regular cyclical manner around a very well fitting linear trend. Production dropped quite sharply in 1964 to a level a little above that of 1961. Past cycles would have led one to expect a fall, though not, perhaps, of such magnitude. The result has been a sharp rise in imports, particularly from South America (the main supplier of imports for the E.E.C.), though Australia also met some of the demand (Table 8.4.2). E.E.C. policy is to expand beef and veal production so it appears reasonable to assume that the production trend established during 1950—63 will continue. Consequently this trend (± 2 percent for high and low figures) was extrapolated for the projection years. This may be compared with production projections (for 1970) by the E.E.C. of 4,682 to 5,180 thousand metric tons.[39]

Under the "II" trade projection substantial imports develop. While it is E.E.C. policy to limit imports, these restrictions can be relaxed if the internal situation warrants such action.[40] The relatively high import projections have therefore been allowed to stand. The range of trade projections for 1970 compares fairly closely to that of the E.E.C. study.[41]

Other Non-Communist Europe

Since 1951 this regions has been a net exporter of beef and veal; the main exporters are Denmark and Ireland. These countries also export large numbers of live cattle, mainly to West Germany and the United Kingdom, respectively. For projection purposes it was assumed that live exports will continue and beef and veal production from these animals is included in the production of the importing, rather than the exporting, country.

Extrapolation of past trends is the main method of supply projection for the region. The trade projections suggest that Austria and Sweden will become exporters rather than importers of beef and veal. Spain, on the other hand, could develop into a substantial importer as could Turkey if imports are permitted. However, as Turkey has not been in the past a meat importer, its projected imports have been limited for Table 8.4.6 to 40,000, 60,000 and 80,000 metric tons for 1970, 1975 and 1980 respectively. High production projections for Turkey have been made so that the "I" trade projections would see Turkey maintain its beef and veal autarky.

39. Communauté Economique Europèene, op. cit., Tableau No. 14, p. 42.

40. General Agreement on Tariffs and Trade, Trade in Agricultural Products; Reports of Committee II on Consultations with the European Economic Community, the United States of America and the United Kingdom, op. cit., pp. 25–41.

41. Communauté Economique Europèenne, op. cit., Tableau No. 61, p. 144.

Japan

Imports of beef and veal (but not mutton and lamb) into Japan are controlled by quotas imposed by the Government, which aims to keep prices high and to stimulate domestic production. In 1965 the quota (for all sources) was 7,000 tons. In view of the rapid growth expected in demand for beef and veal, it is unlikely that such a low quota will be maintained. Production expanded rapidly in recent years and particularly, due to heavy slaughterings,[42] during 1963 and 1964. A linear trend fitted to 1950 — 1964 data was extrapolated to provide high production estimates. The low production projections are 5 percent below the high.

Other Americas

This region includes the world's largest beef and veal exporter, Argentina, and a number of other exporting countries. About 40 percent of the region's exports are of canned or otherwise processed beef and veal. Demand for and supply of beef and veal was considered separately for the countries that were, in the base period, substantial exporters: Argentina, Uruguay, Brazil, Paraguay, and Mexico. The rest of the area has been considered as a whole (and is hereafter designated as "Other").

Production has been projected partly on the basis of past trends, partly on the basis of F. A. O. Projections and on U.S.D A. projections[43] and partly through semi-informed guesses. Production in the area was generally erratic. The downward trend in Uruguayan production over the past 15 years has not been extrapolated.

42. Bureau of Agricultural Economics, The Beef Situation, No. 10, (Canberra, November, 1965), p. 27.

43. United States Department of Agriculture, Economic Research Service, Food Balances for 24 Countries of the Western Hemisphere Projected 1970 (Supplement I to the World Food Budget, 1970, Foreign Agricultural Economic Report No. 19, Washington, November, 1964).

On the basis of the projected demand and supply, it is anticipated that Argentinian and Uruguayan exports will continue near their base period levels. On the same basis it could be expected that Brazil, Mexico and "Other" will have a substantial import demand in the future — due both to the great population growth anticipated in these areas and the high income elasticities of demand for beef and veal. It is unlikely that imports will be permitted to develop to the extent implied by these supply and demand projections. It has therefore been assumed that consumption will be restrained so that the maximum net imports permitted for Brazil, Mexico and "Other" as a whole will be 100,000 metric tons for projection I and 200,000 tons for projection II. It has been further assumed that Paraguay will not permit imports. With the high production estimate for 1980 plus the maximum permitted imports, per capita consumption of beef and veal for Brazil, Mexico, Paraguay and "Other" as a whole would be 3 percent lower in 1980 than it was in the base period.

New Zealand

In the base period, New Zealand was the third largest exporter of beef and veal. Production and exports increased rapidly during the 1950's. The high production estimate resulted from an extrapolation of a fitted exponential trend, the low from an extrapolation of a fitted linear trend. Substantial increases in exports are anticipated.

Communist Europe

Output has grown rapidly and steadily in all countries in this region and can be expected to grow in a similar manner in the future. In view of the fairly low (estimated) per capita beef and veal consumption in these countries[44] it is unlikely that the

44. United States Department of Agriculture, Economic Research Service, Food Balances for 8 East European Countries, 1959-1961 (ERS Foreign-124, Washington, May 1965).

region will become a net exporter, but it is also unlikely that imports will increase substantially.

Communist Asia

While we have no information for this region we assumed that the countries in the region will not engage in any significant international trade in beef and veal over the projection period.

Other East, South and South-East Asia

This region has been a small net importer. Balance of payments considerations are likely to hamper the substantial growth in imports which could develop on a free market. However some growth will probably occur, particularly from Malaysia, Singapore, the Philippines, and Hong Kong.

Rest of World

Considerations identical to the previously considered region apply here. The U. S. D. A. estimates that net imports will reach about 90,000 metric tons by 1970 — Israel, the United Arab Republic, and Morocco being the major importers.[45] This figure may be a little high, but is taken as a guide.

(ii) Mutton and Lamb

High mutton and lamb consumption and production is confined to relatively few countries of the world and it is on these that attention is concentrated. Production projections appear in Table 8.4.7 and Appendix Table A8.4.3 and trade projections in Table 8.4.8.

United Kingdom

Production of mutton and lamb increased rapidly during 1950—63 and the extrapolation of a linear trend fitted to production over that period would give 1970 production substantially above the level suggested for that year in the National Plan[46] (roughly 280,000 metric tons). The National Plan figure is therefore used as a benchmark. Projected trade, being mainly in lamb, will be of more interest to New Zealand than to Australia.

E.E.C.

Within the Common Market, mutton and lamb production and consumption is concentrated mainly in France and Italy. Production was projected for these countries separately and for the rest of the Community as a whole (Appendix Table A8.4.3).

After increasing slowly and erratically throughout the 1950's, production of mutton and lamb in France in 1960—62 was substantially above the earlier levels, only to fall somewhat in 1963. It was assumed that the rate of increase of production in the future (over that achieved in 1960—62) will be a little lower than that achieved on average in the 1950's. This projection suggests that France will increase imports over the projection period.

Italy experienced a downward trend in the production of mutton and lamb. It was assumed that the production decline will be arrested and that modest growth will be achieved. However, Italy will probably depend to a large extent on imports for mutton and lamb in the future.

In the rest of the E.E.C. it is unlikely that any great disparity will occur between production and consumption. There may,

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45. United States Department of Agriculture, Economic Research Service, Food Balances for 30 Countries in Africa and West Africa Projected 1970 (Supplement 3 to the World Food Budget, 1970, Foreign Agricultural Economic Report No. 19, Washington, March 1965).

46. Op. cit., p. II-9.

however, be some increase in Dutch exports, probably to France.

Other Non-Communist Europe

In this region, Greece was the only significant importer in the base year (18,000 metric tons) while Ireland, with about 8,000 tons, and Iceland, with 3,000 tons, were the only exporters of mutton and lamb. Norway, Portugal, Spain, and Turkey were substantial producers but were self-sufficient.

Production in Ireland and Greece was projected by the extrapolation of a linear trend fitted to data for 1950—63 in the former case and 1952—53 to 1961—62 in the latter, ± 5 percent for high/low limits. For Norway, Portugal, Spain, and Turkey, production was projected so as to give virtually no trade under the I trade projection. It is anticipated that Icelandic exports will rise to a maximum (projection I) level of 10,000 metric tons in 1980.

The region as a whole develops as an exporter under projection I mainly due to the projected growth in Irish production.

Japan

Little information is available on production of mutton and lamb in Japan. Japanese Import Requirement[47] assumes that production will decline consistently between 1960 and 1975. This view was accepted for our low supply projections, while for the high projection it is assumed that production will double between 1960 and 1980. Imports will increase greatly under both trade projections and at present it appears unlikely that they will be restricted by Government regulation. Imports will probably be mainly of mutton for use in processed meats.

47. Op. cit., p. 9, n. 2.

U.S.A. and Canada

Production of mutton and lamb varied around an upward trend over the period 1950—64 and it is an extrapolation of this linear trend (± 5 percent for high/low limits) that has been used for projection. Imports — mainly of mutton for processing — developed in recent years and it can be anticipated that further growth will occur in future. While the U.S. meat import legislation applies to mutton (but not lamb) together with beef and veal, it is assumed that any restrictions which may be applied will be because of growth in imports of beef and veal rather than of mutton, the latter being small relative to the former.

Production in Canada has exhibited no trend over the last 15 years or so. For the low supply projection it was assumed that production will remain constant while a small steady increase was assumed for the high projection. A steady growth of imports is therefore anticipated. Canada grants substantial tariff preference to mutton and lamb (as well as beef and veal) imports from Australia and New Zealand,[48] so it can be anticipated that these countries will continue to supply the major part of the demand.

Other Americas

In recent years Argentina has been the only significant exporter in the region. Production in the Argentine has been erratic and has exhibited no trend. As consumption is expected to rise, albeit rather slowly, it can be anticipated that exports will fall. From their level of 41 thousand metric tons in the base period they have been projected at 30, 20, and 10 thousand metric tons for 1970, 1975 and 1980 respectively, for both trade projections. For projection I it has been assumed that the

48. Commonwealth Economic Committee, Meat (H.M.S.O., London, 1965), p. 146.

rest of the area does not import; for projection II imports of 20,000, 30,000 and 40,000 metric tons have been assumed. Sufficient data are not available to project production and consumption of mutton and lamb for the region.

New Zealand

Production of mutton and lamb increased substantially over the period 1950 — 63; in particular there was a large lift in production in 1959. New Zealand production in the base period was roughly 38 percent mutton and 62 percent lamb, while exports were 25 percent mutton and 75 percent lamb.[49] Production in New Zealand has been projected by extrapolation of a linear trend fitted to 1950 — 63 data, ± 5 percent for high/low limits.

Other Regions

Communist Europe was a small exporter in the base period. For projection I, it has been assumed that exports will treble by 1975; for projection II, zero trade is assumed.

No data are available for Communist Asia and no trade has been projected.

For "Other East, South and South-East Asia" and "Rest of World" it has been assumed that imports will grow at the same rate as projected consumption.

Separation of Mutton and Lamb Trade Projections

In the base period approximately 15 percent of the United Kingdom's mutton and lamb imports were mutton, while the ratio for New Zealand's exports was 25 percent. Data are not available for other areas (excluding Australia) but it seems that most United States imports were of mutton, while for Canada imports of the two may have been roughly equal. Argentine exports were perhaps divided between mutton and lamb in the ratio 1 : 2. If projected trade is divided so that the imports of the U.K. are assumed to be 15 percent mutton, those of Japan and U.S.A. and Canada to be 80 percent mutton, and those of all other importing regions to be 100 percent mutton, while exports of Other Americas are assumed to be one-third mutton, those of New Zealand 25 percent mutton and those of other exporters (excluding Australia) to be 100 percent mutton, then the projected world imbalances for mutton and lamb (separately), at constant prices, are as shown in Table 8.4.9.

5. GRAINS

Wheat is by far the most important, and most rapidly increasing, grain export of Australia (Table 8.5.1). The substantial increase in the world market for wheat in recent years, and the increase in Australian exports, have been brought about by very large purchases by Mainland China and the U. S. S. R. In 1965 — 66 Mainland China purchased, on credit terms,[50] about 40 percent of Australian wheat exports, this being more than three times as much as the United Kingdom which was the next largest buyer from Australia in that year. In 1964 — 65 (figures not being available at the time of writing for 1965 — 66), Australia supplied China with about 42 percent of its wheat imports, with Canada, providing about 35 percent, being the next largest supplier. In early 1966 Canada signed 3-year contracts to supply very large quantities of wheat with both China and U.S.S.R. The former contract will probably lead to Australia's displacement as the principal exporter to China.

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49. Calculated from data in various issues of New Zealand Official Yearbook (Department of Statistics, Wellington).

50. Bureau of Agricultural Economics, The Wheat Situation, No. 25 (August 1965) p. 5.

Table 8.5.1

GRAINS : DESTINATION OF AUSTRALIAN EXPORTS

Commodity and Destination	Average 1955/56-1957/58	Average 1958/59-1961/62	1962/63	1963/64	1964/65	1965/66*
	'000 metric tons					
Wheat						
United Kingdom	517	632	444	766	521	634
Hong Kong	40	69	68	56	59	78
India	266	266	194	206	477	169
Singapore	(a)	(a)	(a)	(a)	} 100(b)	{ 122 (b)
Malaya	16	17	15	4		{ 102 (b)
New Zealand	269	194	166	182	166	149
Pakistan	99	58	152	56	59	55
China (Mainland)	(a)	765	2,075	2,543	2,276	2,006
Iran	18	48	19	32	244	165
Iraq	48	140	(a)	133	67	1
Japan	195	342	345	512	443	364
Korea (North)	(a)	(a)	(a)	(a)	(a)	102
Lebanon	6	44	85	144	74	31
Norway	(a)	24	75	113	77	19
U.S.S.R.	(a)	(a)	1	1,381	862	575
Other	358	818	497	778	290	585
Total	1,832	3,417	4,136	6,906	5,715	5,156
	million dollars					
Value	90.01	172.47	216.90	362.02	297.20	264.02
	'000 metric tons					
Flour						
United Kingdom	58	50	60	44	41	30
South Arabia	(b)	15	35	37	41	27
Ceylon	105	113	94	105	173	154
Singapore	42	39	47	} 129(b)	88(b)	{ 2
Malaya	68	90	77			{ 29
Philippines	14	3	9	46	25	1
Other	284	198	155	263	154	115
Total	571	508	477	624	522	358
	million dollars					
Value	37.45	32.73	31.67	42.53	37.63	26.35

Table 8.5.1 (concluded)

Commodity and Destination	Average 1955/56-1957/58	Average 1958/59-1961/62	1962/63	1963/64	1964/65	1965/66*
	'000 metric tons					
Rice						
United Kingdom	6	10	9	6	8	5
Papua-New Guinea	13	16	14	19	23	29
Other	16	32	35	32	34	31
Total	35	58	58	57	65	65
	million dollars					
Value	4.35	6.17	6.89	7.25	7.97	8.13
	'000 metric tons					
Oats						
United Kingdom	10	31	22	4	12	17
China (Mainland)	(a)	28	27	100	42	(a)
West Germany	65	148	155	86	180	143
Italy	(b)	(b)	(b)	(b)	(b)	27
Netherlands	13	51	57	61	22	14
Other	33	48	61	52	109	37
Total	121	306	322	303	365	238
	million dollars					
Value	5.04	12.94	14.14	12.62	15.62	11.36
	'000 metric tons					
Barley						
United Kingdom	63	152	67	114	39	35
Belgium-Luxembourg	40	17	1	(a)	(a)	(a)
Italy	7	73	49	26	53	59
Japan	263	78	(a)	118	168	41
Netherlands	58	89	34	79	49	12
Other	74	274	83	66	61	78
Total	505	683	234	403	370	227
	million dollars					
Value	21.79	28.61	10.46	18.30	18.00	11.51

* Preliminary.
(a) If any, included in "Other".
(b) Including other Malaysian territories.

Source: As for Table 8.3.1.

As a consequence of increased purchases by Communist countries and also of low wheat crops in other countries, world stocks of wheat decreased in recent years so that the world situation no longer appears to be one of a persistent tendency to "over-produce".[51]

Australia's total exports of coarse grains — mainly oats and barley — have not shown any substantial change in recent years. The United States is easily the largest producer and exporter of coarse grains — in the base period of this study (1959—61) the U.S.A. produced about 30 percent of world output of coarse grains[52] and accounted for almost 50 percent of total world exports of these grains. Maize is the grain in this category in which most trade is undertaken (both by the United States and the world as a whole) and it is solely in maize that world trade in coarse grains has expanded in recent years. In 1959—61, approximately 50 percent of world trade in coarse grains was in maize and about 25 percent in barley. In 1963 the percentages were 60 and 18 respectively. While Australia's exports of coarse grains comprise only about 5 percent of world exports, about a quarter of the world's oat exports and about a tenth of barley exports come from this country. Australia does not export maize and is not expected to export major quantities in the foreseeable future.

Australia's exports of rice have been predominantly to nearby islands — Papua - New Guinea, New Zealand, and other Pacific Islands — and to the United Kingdom. Export potential is more likely to depend on conditions in these markets than on the world rice situation. This is particularly so as the bulk of Australian production is of a type of rice not generally favoured in Asian markets. Hence world rice supply has not been projected. Food demand for rice has, however, been projected in regions in which it forms a substantial portion of total grain consumption.

Demand Projections

(i) Food Purposes

Consumption projections (for food purposes only) are contained in Table 8.5.2 and Appendix Table A8.5.1. The projections are in "gross" terms (i.e., wheat equivalent of flour, etc.) as it has not been possible to project extraction rates: they have been assumed constant. Time series data are not available for extraction rates and inter-country comparisons tell us little, for efficiency and flour quality considerations cannot be separated.

For the "developed" regions (excluding Japan), it has been assumed that the income elasticity of demand for both wheat and coarse grains is that adopted in F.A.O. Projections for total cereals. (The food demand for coarse grains is, in most cases, a small portion of the total demand for these grains.) The income elasticities adopted for Japan (wheat 0.2, rice and total -0.1) are based on F.A.O. Projections and on Japanese Import Requirement.[53] The demand for coarse grains is treated as a residual.

Following an E.C.A.F.E. study,[54] the region "Other East, South and South-East Asia", was divided into rice importers (Ceylon, Indonesia, Singapore, Malaysia, and Pakistan) and rice exporters (Burma,

51. "F.A.O. Group on Grains: Report on World Grain Situation", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 15, No. 5 (May 1966), p. 8.

52. In this chapter "coarse grains" refers to all grains other than wheat and rice.

53. Ibid., Ch. 4.

54. Economic Commission for Asia and the Far East, Long-Term Projections of Supply and Demand for Agricultural Food Products in the Developing E.C.A.F.E. Region up to 1980 (Fifth Group of Experts on Programming Techniques: Preliminary discussion paper, Bangkok, 1966).

Table 8.5.2

PROJECTED CONSUMPTION OF GRAINS AT CONSTANT PRICES

Region	Demand Function Adopted	Base Period Income Elasticity of Demand	Base Period Food Consumption Av. 1959 – 61	Projected Consumption (a)					
				1970		1975		1980	
				Low	High	Low	High	Low	High
			Thousand Metric Tons						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. United Kingdom									
Wheat	log-inverse	-0.4	5,486	5,380	5,210	5,270	5,100	5,270	5,050
Coarse Grains	"	-0.4	433	420	410	420	400	420	400
2. E.E.C.									
Wheat	(b)	(b)	20,013	20,170	19,740	20,180	19,830	20,620	19,920
Coarse Grains	(b)	(b)	2,639	2,600	2,550	2,550	2,500	2,580	2,500
3. Other Non-Communist Europe									
Wheat	(b)	(b)	13,520	14,810	14,550	15,690	15,390	16,700	16,270
Coarse Grains	(b)	(b)	2,990	3,300	3,240	3,470	3,380	3,710	3,600
5. Japan									
Wheat	Semi-log	0.2	3,506	3,860	3,960	4,000	4,140	4,140	4,280
Rice (Paddy)	"	-0.1	14,412	15,130	15,130	15,560	15,420	16,140	16,000
Coarse Grains	(c)	___	1,700	1,610	1,500	1,630	1,430	1,690	1,500
Total	Semi-log	-0.1	19,618	20,600	20,600	21,190	20,990	21,970	21,780
7. Other East, South and South-East Asia									
Wheat	Log-log-inverse	1.2	19,493	27,480	31,390	32,550	38,400	38,010	45,810
Rice (Paddy)	"	(d)	106,003	139,900	147,700	161,300	170,800	183,100	195,600
Coarse Grains	(c)	___	25,704	32,200	34,100	37,500	37,300	42,000	41,300
Total	Log-log-inverse	0.5	151,200	199,600	213,200	231,300	246,500	263,100	282,700
8. U.S.A. and Canada									
Wheat	(b)	(b)	15,037	16,180	15,670	16,830	16,030	17,780	16,540
Coarse Grains	(b)	(b)	4,785	5,100	5,000	5,300	5,100	5,600	5,200
9. Other Americas									
Wheat	Semi-log	0.1	10,206	13,880	13,980	16,130	16,230	18,680	19,090
Coarse Grains	"	0.1	10,780	14,660	14,770	17,030	17,140	19,730	20,160
10. New Zealand									
Wheat	Log-inverse	-0.4	256	300	290	320	310	360	330
Coarse Grains	"	-0.4	16	20	20	20	20	20	20
11. Rest of World									
Wheat	Semi-log	0.3	14,231	18,780	19,640	21,910	23,200	25,480	27,610
Rice (Paddy)	"	0.3	5,937	7,840	8,190	9,150	9,670	10,630	11,520
Coarse Grains	(c)	___	25,452	34,450	35,110	38,870	40,320	45,010	46,650
Total	Semi-log	0.2	46,620	61,070	62,940	69,930	73,190	81,120	85,780

(a) "Low" and "High" refer to the income growth assumption.
(b) See Table A8.5.1.
(c) Projected by deducting the sum of rice and wheat from total grains.
(d) See text.

Sources (for base period consumption): As for Table 8.3.2.

Cambodia, Taiwan, and Thailand)[55] and others. The income elasticity of demand for rice in rice importers has been taken as 0.5, in rice exporters 0.3 and in others 0.25. In all cases the income elasticity of demand for wheat has been taken as 1.2 and for total cereals, 0.5. The demand function used for cereals by F.A.O. Projections — the log-log-inverse function — requires, for projection, an estimate of the ratio of per capita income in the base period to the per capita income level at which per capita consumption of the commodity reaches a maximum: i.e. $\frac{x_o}{x_m}$. As F.A.O. did not supply the parameters of the fitted demand equations, and as the values of $\frac{x_o}{x_m}$ were not provided in particular cases, this ratio has been estimated from F.A.O's projections. On the basis of this estimation, a value of 0.4 has been adopted for the three areas in the region (rice importers, rice exporters and others) and also for the three commodity projections (rice, wheat, and total). It has also been assumed that the per capita income growth rate is the same for rice exporters, rice importers, and others. However, separate population projections were applied in each case. The projected food demand for coarse grains is again derived by subtraction.

For the region "Rest of World" it was assumed that income growth will switch demand from coarse grains to rice and wheat. Consequently income elasticities of 0.3 were assumed for rice and wheat and 0.2 for total cereals. For "Other Americas" it was assumed that demand for wheat and coarse grains will grow at the same rate (income elasticity of 0.1).

In all regions except "Other East, South and South-East Asia", "Other Americas" and "Rest of World" it was assumed that grains are inferior commodities — the income elasticities of demand are negative. In most countries, however, the positive effect of population growth on demand outweighs the negative income effect.

55. Vietnam, though an exporter in the past, has herein been included in "others".

(ii) Non-Food Purposes

Non-food usage (feed, seed, industrial, and waste) forms, in most countries, a substantial portion of total grain consumption, particularly of coarse grains. This demand is particularly difficult to project, and the methods used here are admittedly unsatisfactory. For countries where feed was the largest section of non-food usage, demand was projected on the basis of trends, insofar as these could be discerned. These projections were compared with, and adjusted in the light of, opinions of other projectors. Where non-food usage is largely seed and waste (as it is in a number of European countries for wheat), demand was projected as a constant proportion of projected supply. Projections of non-food usage of wheat and coarse grains are contained in Table 8.5.3 and Appendix Table A8.5.2.

Supply and Trade Projections

Table 8.5.4 and Appendix Table A8.5.3 contain wheat and coarse grain supply projections for non-Communist regions, while Tables 8.5.5 and 8.5.6 contain trade projections for all regions. As high non-food usage will generally depend upon high production and low non-food usage on low production, they are joined in this manner for calculating trade projections.

United Kingdom

U.K. wheat production was projected roughly in agreement with a linear extrapolation of post-war trends. Though substantially above the projections contained in other studies, recent trends suggested that the higher projections are more

Table 8.5.3

PROJECTED NON-FOOD USAGE OF GRAINS AT CONSTANT PRICES
(Thousand Metric Tons)

Region	Base Period Non-Food Usage Av. 1959—61	Projected Non-Food Usage					
		1970		1975		1980	
		Low	High	Low	High	Low	High
1. United Kingdom							
Wheat	2,049	2,100	2,300	2,100	2,400	2,100	2,400
Coarse Grains	10,829	13,500	15,000	15,000	17,000	16,000	19,000
2. E.E.C.							
Wheat	7,244	9,000	10,750	9,900	11,700	10,700	12,500
Coarse Grains	33,320	40,200	44,000	43,900	48,000	47,900	53,300
3. Other Non-Communist Europe							
Wheat	4,060	4,900	5,200	5,200	5,600	5,500	6,000
Coarse Grains	22,320	28,200	31,100	30,500	34,400	33,100	38,300
5. Japan							
Wheat	565	750	900	900	1,100	1,100	1,300
Coarse Grains	2,699	5,500	6,000	6,500	7,500	8,000	9,500
7. Other East, South and South-East Asia							
Wheat	2,230	2,670	2,930	3,000	3,330	3,330	3,730
Coarse Grains	3,640	4,500	5,000	5,000	5,700	5,500	6,500
8. U.S.A. and Canada							
Wheat	5,127	8,900	9,800	9,300	10,400	9,800	11,400
Coarse Grains	124,480	145,500	150,500	156,200	163,700	167,000	177,000
9. Other Americas							
Wheat	1,283	1,690	1,830	1,830	2,040	2,040	2,320
Coarse Grains	14,254	17,500	19,000	18,700	21,000	20,000	23,000
10. New Zealand							
Wheat	150	140	160	140	160	140	160
Coarse Grains	100	130	150	140	170	160	200
11. Rest of World							
Wheat	1,963	2,340	2,600	2,510	2,770	2,680	2,940
Coarse Grains	9,793	11,000	12,000	11,700	13,200	12,500	14,500

Sources (for base period consumption): As for Table 8.3.2.

Table 8.5.4

ESTIMATED AND PROJECTED PRODUCTION OF GRAINS AT CONSTANT PRICES
(Thousand Metric Tons)

Region	Base Period Production Av. 1959—61	Estimated Production 1965	Projected Production 1970 Low	1970 High	1975 Low	1975 High	1980 Low	1980 High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. United Kingdom								
Wheat	2,828	3,974	4,100	4,300	4,500	4,700	4,800	5,000
Coarse Grains	6,772	9,400	11,000	12,000	12,000	13,500	13,000	15,000
2. E.E.C.								
Wheat	24,459	29,648	32,000	34,000	34,000	36,000	35,000	37,000
Coarse Grains	27,820	29,600	35,000	37,000	39,000	41,500	43,500	45,500
3. Other Non-Communist Europe								
Wheat	15,520	17,600	18,100	19,600	19,100	20,900	20,200	22,300
Coarse Grains	22,340	25,000	27,400	28,700	29,100	30,900	31,300	33,800
5. Japan								
Wheat	1,576	1,286	1,400	1,600	1,500	1,700	1,600	1,900
Coarse Grains	2,603	1,513	1,200	1,500	1,100	1,400	1,000	1,300
7. Other East, South and South-East Asia								
Wheat	16,725	19,210	20,000	22,000	22,500	25,000	25,000	28,000
Coarse Grains	29,722	35,610	36,500	39,500	41,000	44,000	46,000	49,000
8. U S.A. and Canada								
Wheat	44,448	53,015	56,000	61,000	59,000	65,000	62,000	68,000
Coarse Grains	146,561	149,450	174,000	180,000	187,000	196,000	210,000	212,500
9. Other Americas								
Wheat	9,114	11,500	12,000	13,000	13,000	14,500	14,500	16,500
Coarse Grains	27,995	33,000	36,200	39,000	42,000	42,500	47,000	50,000
10. New Zealand								
Wheat	213	245	270	300	300	330	320	350
Coarse Grains	116	154	150	170	160	190	180	220
11. Rest of World								
Wheat	11,346	n.a.	13,500	15,000	14,500	16,000	15,500	17,000
Coarse Grains	36,508	n.a.	48,000	48,600	52,600	54,500	59,500	62,100

Sources (for base period and 1965 production): As for Table 8.3.3; also United States Department of Agriculture: Indices of Agricultural Production in 29 African Countries (Economic Research Service, December 1965); Indices of Agricultural Production in 10 Near East Countries (Economic Research Service, December 1965); Indices of Agricultural Production for the 20 Latin American Countries (Economic Research Service, ERS-Foreign 44, January 1966).

Table 8.5.5

ESTIMATED AND PROJECTED TRADE IN WHEAT AT CONSTANT PRICES

(Thousand Metric Tons, Net Exports represented by [-], Net Imports by [+])

Region	Base Period Trade[a] Av. 1959 — 61	Estimated Trade 1965	Projected Trade [b]					
			1970		1975		1980	
			I	II	I	II	I	II
1. United Kingdom	+4,707	+4,690	+3,210	+3,380	+2,700	+2,970	+2,350	+2,670
2. E.E.C.	+2,798	-850	-3,510	-2,830	-4,920	-4,470	-4,580	-3,680
3. Other Non-Communist Europe	+2,060	+1,800	+380	+1,550	+50	+1,770	+20	+2,010
4. Communist Europe	+2,834	+7,800	+2,000	+5,000	+1,000	+4,000	0	+3,000
5. Japan	+2,497	+3,508	+3,160	+3,310	+3,400	+3,540	+3,540	+3,780
6. Communist Asia	+2,317	+5,110[c]	+3,000	+6,000	+2,000	+6,000	+2,000	+6,000
7. Other East, South and South-East Asia	+4,998	n.a.	+8,410	+14,060	+10,880	+18,900	+13,740	+24,140
8. U.S.A. and Canada	-24,284	-31,920	-34,630	-30,920	-38,580	-32,880	-40,060	-34,430
9. Other Americas	+2,375	n.a.	+2,710	+3,670	+3,670	+5,060	+4,500	+6,630
10. New Zealand	+193	+160	+150	+170	+140	+160	+140	+180
11. Rest of World	+4,848	n.a.	+6,380	+8,480	+8,680	+11,210	+11,420	+14,790
12. Australia	-4,020	-5,960	-10,700	-6,030	-12,600	-7,170	-14,500	-8,270
Total (Excess of Imports or Exports)	-1,323	-	-19,440	+5,840	-23,580	+9,090	-21,430	+16,820

(a) Including stock changes.

(b) The sum of the I (II) trade projections provides the maximum (minimum) expected export surplus or minimum (maximum) expected import surplus.

(c) Mainland China only.

Sources (for base period and 1965 trade): As for Table 8.3.4; also Bureau of Agricultural Economics, The Wheat Situation, and Australian Wheat Board.

Table 8.5.6

ESTIMATED AND PROJECTED TRADE IN COARSE GRAINS AT CONSTANT PRICES
(Thousand Metric Tons; Net Exports represented by [-], Net Imports by [+]

Region	Base Period Trade[a] Av. 1959—61	Estimated Trade 1965	Projected Trade[b]					
			1970		1975		1980	
			I	II	I	II	I	II
1. United Kingdom	+4,490	+3,360	+2,900	+3,400	+3,400	+3,900	+3,400	+4,400
2. E.E.C.	+8,139	+11,470	+7,800	+9,500	+7,400	+8,900	+6,900	+10,200
3. Other Non-Communist Europe	+2,970	n.a.	+4,200	+5,770	+4,880	+6,940	+6,180	+8,410
4. Communist Europe	-1,597	n.a.	-500	+500	0	+1,000	+500	+1,500
5. Japan	+1,796	+3,500	+5,600	+6,300	+6,700	+7,800	+8,400	+10,000
6. Communist Asia	+398	+280[c]	+200	+500	+200	+800	+200	+1,000
7. Other East, South and South-East Asia	-378	n.a.	-500	+500	-1,000	+1,000	-1,000	+1,000
8. U.S.A. and Canada	-17,296	-17,370	-24,300	-22,800	-27,300	-25,000	-30,500	-28,000
9. Other Americas	-2,961	-4,500	-5,200	-4,000	-6,300	-4,500	-7,300	-6,000
10. New Zealand	0	0	0	0	0	0	0	0
11. Rest of World	-263	n.a.	-2,500	-1,500	-2,000	-1,000	-2,000	-1,000
12. Australia	-990	-600	-2,540	+821	-2,530	+1,018	-2,550	+1,234
Total (Excess of Imports or Exports)	-5,692	-	-14,840	-1,010	-16,550	+860	-17,770	+2,740

(a) Including stock changes.
(b) The sum of the I (II) trade projections provide the maximum (minimum) expected surplus or minimum (maximum) expected import deficit.
(c) Mainland China only.

Sources (for base period and 1965 trade): As for Table 8.4.4, also Bureau of Agricultural Economics, The Coarse Grain Situation.

realistic. On the basis of these expectations imports will tend to decrease until, in 1980, they reach about half the base-period level.

Coarse grain production increased rapidly in the early 1960's in the U.K. so some earlier projections were dramatically low. Production was therefore projected substantially above that of trends of the 1950's.

E.E.C.

Production of wheat in the E.E.C. has not increased as rapidly in recent years as in the 1950's so that the projections adopted are below a linear extrapolation for 1950. They are comparable to those of F.A.O. Projections and a little above those of the E.E.C. study group.[56] Coarse grain production is projected in line with levels suggested by a trend line. The production estimate for 1965 is not a particularly accurate reflection of trend developments owing to a poor harvest in that year.

The E.E.C. became a net wheat exporter by 1965; indications are that this will continue and that exports will increase. Imports of coarse grains, on the other hand, should continue near base-period levels.

Other Non-Communist Europe

This region is a net importer of both wheat and coarse grains and will probably continue as such. While wheat imports could fall substantially, coarse grain imports, on both trade projections, increase greatly over base-period levels. In projecting production for a number of countries in this region, use has been made of stated Government intentions with respect to degrees of self-sufficiency.[57]

Communist Europe

Despite the multi-year contracts for supply of wheat recently entered into by the U.S.S.R., indications are that net imports of Communist Europe will in the future tend to be below the levels reached in 1964 and 1965. Nevertheless we have chosen not to follow the U.S.D.A. in projecting surplus production for the region by 1970.[58] While the U.S.S.R. has been increasing coarse grain exports, the rest of Eastern Europe has been increasing imports. We projected that the latter trend will more than counter-balance the former and that imports will develop.

Japan

Although Japanese wheat production decreased since the base period, we projected modest increases in production. Our projections are below those of Japanese Import Requirements. The 1970 wheat import projections approximate those of F.A.O. Projections, with both production and consumption projections being substantially above those of that publication.

Coarse grain production has been declining rapidly in Japan while consumption has been increasing. In contrast to Japanese Import Requirements, we took the view that the fall in production will continue. We anticipated that Japanese imports of coarse grains will continue to grow rapidly.

Communist Asia

The future of the world wheat market, and particularly of Australian exports, lies to a great extent in Mainland China. That country appears, in recent years, to have been following the dictates of comparative advantage — concentrating resources on rice production rather than wheat, exporting

56. Communauté Economique Européene, op. cit., Tableaux No. 71A and 71B, pp. 126-7.

57. F.A.O., National Grain Policies 1963 and 1964 (Rome, 1963 and 1964).

58. United States Department of Agriculture, The World Food Budget 1970, Table 37.

the former and importing the latter. There are no indications that this policy is to be changed. Our optimistic trade projection is that imports of wheat will increase somewhat; the pessimistic projection is that imports will continue, but at a substantially lower level than in the early 1960's. It is not anticipated that coarse grain imports will increase greatly.

Other East, South, and South-East Asia

Projection of wheat in this region has been projected on the basis of recent trends and U.S.D.A. projections.[59] Projection of production for this regions is, of course, very hazardous. The resulting wheat import projections are consistent in order of magnitude with those (for 1970) of the U.S.D.A. and F.A.O. Projections but are substantially above those (for 1970 and 1980) of E.C.A.F.E.[60] Substantial portions of the base period and 1965 import figures were of imports on concessional terms, mainly by India from the United States, and it has been assumed that such imports will continue.

This region was a net importer of coarse grains in the base period, mainly due to Thailand's exports of maize. The view was taken that the region is unlikely to become either a substantial net exporter or importer of coarse grain.

U.S.A. and Canada

Owing to production controls in the United States, it is difficult to project production or trade of grains for this region. Should any marked imbalance occur in the world markets for wheat or coarse grains, balance will be secured through changing American controls rather than through price. Nevertheless an attempt has been made to project U.S. production of these commodities. The 1970 wheat supply projections approximate those of U.S.D.A. rather than the higher F.A.O. Projections estimates. These would seem realistic in view of recent developments — but for these our supply projections for the U.S. would be lower. Such projections result in relatively small increases in exportable supplies over the projection period.

With rapidly increasing coarse grain (mainly maize) yields in the United States it would appear that production of coarse grains will increase rapidly to rather more than match the anticipated rapid growth in consumption. (The recorded 1965 production estimate is rather misleading as there was a low harvest in 1964—65.) It is anticipated that exports of coarse grains will increase.

With the emergence of Communist markets, Canadian wheat production increased rapidly in the early 1960's. It is anticipated that rises in the future will be more modest. Exports are expected to continue to grow as the bulk of any production increase will be available for sales abroad. Exports of coarse grains from Canada have developed over the last few years and it is to be expected that this trend will continue.

Other Americas

Projections of wheat production for 1970 for this region approximate the U.S.D.A. and F.A.O. Projections, and projections further ahead are based on these. It is anticipated that net imports of wheat and net exports of coarse grains will increase steadily. Coarse grain production projections approximate those of U.S.D.A.

New Zealand

Trade in both wheat and coarse grains is expected to remain near present levels.

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59. Ibid.

60. Economic Commission for Asia and the Far East, op. cit., Table 25.

Table 8.5.7

RICE : AUSTRALIAN EXPORTS AND PROJECTED EXPORTS AT CONSTANT PRICES
(Thousand Metric Tons, Milled Equivalent)

	Base Period Exports (Average 1958/59 — 1961/62)	Exports Average 1964/65 — 1965/66	Projected Exports					
			1970		1975		1980	
			Low	High	Low	High	Low	High
Pacific Islands (including Papua-New Guinea)	29.6	45.7	42.0	46.0	51.0	57.0	61.0	70.0
United Kingdom	9.6	6.6	6.0	7.0	6.0	7.0	6.0	7.0
New Zealand	4.9	3.0	3.0	5.0	3.0	5.0	3.0	5.0
Other	11.1	9.7	9.0	11.0	9.0	11.0	9.0	11.0
Total	55.2	65.0	60.0	69.0	69.0	80.0	79.0	93.0

Source (for base period, 1964—65 and 1965—66): As for Table 8.3.1.

Rest of World

Projections of wheat production are based on U.S.D.A. projections and are expected to be modest compared to consumption growth. Imports, therefore, are projected to increase. On the other hand the region is an exporter of coarse grains (the main source being South Africa) and it is anticipated that these exports will increase until 1970 and then remain relatively static.

Rice. The major market for Australian rice in recent years has been the nearby Pacific Islands (including Papua-New Guinea). It appears reasonable to assume that demand for Australian rice in this region will rise at least as rapidly as the area's total consumption. To project future rice consumption in the area, we assumed that the base period income elasticity of demand for rice was 0.5 (and fitted a semi-log equation), that per capita income growth over the projection period is 3 to 5 percent yearly and that population growth is that projected by the United Nations. The region's projected demand for Australian exports is shown in Table 8.5.7. The purchases of Australian rice by other regions have been projected more or less at base period levels.

6. OTHER PRODUCTS

The major Australian overseas market for canned fruit has been the United Kingdom and in recent years Australia generally supplied the U.K. with approximately one-fifth of its imports of canned fruits.[61] It was assumed that Australia will retain its percentage share of the U.K. market and that demand for Australian imports will rise at the same rate as total consumption. Consumption was projected on the

61. Commonwealth Economic Committee, Fruit (H.M.S.O., London, 1965), Tables 108 and 110.

basis of an income elasticity of demand of 0.8 [62] applying a semi-log equation.

For other markets, it is difficult to project demand — the sudden jump in purchases in 1965 by countries in the "Other" category, mainly Western Germany, were of the lower grades of fruit and at lower prices. It is quite possible, however, that this market may expand if prices are lowered. Substantial increases in the Canadian purchases would have to be at the expense of Californian producers and are perhaps unlikely. The projections are contained in Table 8.6.1.

Australian exports of other products — dried fruits, hides and skins, tallow, and eggs, will probably be determined more by available supplies than by overseas demand. There should not be any great change in the demand for dried fruit or eggs — though unpredictable markets (such as Kuwait for eggs in liquid form) could develop. The existence of the home price scheme in Australia for eggs makes domestic production inelastic with respect to changes in overseas demand. Tallow and hides and skins, being by-products, are also unlikely to respond to changes in export demand.

62. This has been adopted on the basis of the expenditure elasticity for fruits in C. Clark et al., op. cit., Table 4. We assumed that demand for canned fruit will be somewhat more income elastic than demand for fruit as a whole.

Table 8.6.1

CANNED FRUIT : AUSTRALIAN EXPORTS AND PROJECTED EXPORTS AT CONSTANT PRICES
(Thousand Metric Tons)

	Exports			Projected Exports					
	Base Period (Average 1958—62)	1964	1965	1970		1975		1980	
				Low	High	Low	High	Low	High
U.K.	73	85	78	89	94	97	107	105	117
Canada	3	13	14	10	20	12	23	15	25
N.Z.	1	1	1	1	1	1	1	1	1
Other	3	7	28	10	20	15	25	20	30
Total	81	106	121	110	135	125	156	141	173

Source: (for base period, 1964 and 1965): Commonwealth Economic Committee, Fruit (H.M.S.O., London, 1965) and Australian Canned Fruits Board, Annual Report and Accounts, 1965, (Canberra, 1966).

Chapter IX

WOOL — TRENDS AND PROSPECTS

1. PAST TRENDS IN PRODUCTION, CONSUMPTION, AND WOOL PRICES

World production of wool has been increasing steadily since the end of World War II. From 1948—49 to 1963—64 world wool production (clean basis)[63] increased at an annual average rate (compound) of about 3 percent. About two-thirds of this increase was the result of the expansion in sheep numbers (1.9% per annum) with increases in wool cut per sheep being responsible for the remainder. However these averages conceal significant annual fluctuations in the rate of growth. These result from climatic variations and from changing technical and economic conditions. In the 6-year period, 1950—51 to 1956—57, growth of output was particularly rapid (annual average — 4.3 percent). Since then world production continued to increase but at a smaller annual average (1.8%). Over the most recent 5-year period — 1959—60 to 1964—65 — the average annual increase has been even less (0.6%). Table 9.1.1 gives wool production figures for the world as a whole and separately for the major wool producing countries.

63. Raw or "greasy" wool as it is shorn from the sheep consists of the wool itself, a water content, a "yolk" or grease, usually a dirt fraction, and sometimes some burr or vegetable matter. The average "clean yields" – the proportion of clean wool in greasy wool – varies from clip to clip and from season to season. For Australia as a whole it is normally between 56½ and 58%. (On average carpet wools yield about 50%, merino wool 55%, and crossbred wool 60%).

Australia is by far the largest producer of wool, accounting for about 30 percent of world production (greasy basis) in recent years. The second largest producer is the U.S.S.R. (about 13—14%), followed by New Zealand (10—11%), Argentina (7%), South Africa (6%), the United States (5%) and Uruguay (3%).

Over the last 10 years, wool production increased particularly rapidly in the Soviet Union. New Zealand also increased its production at a faster rate than world output. Australia slightly increased its share of the world's production, whilst the output of the two South American countries and South Africa remained fairly constant and their share has declined. Production in the United States declined by almost half between the mid 1930's and 1950; between 1950 and 1960 there was a slight recovery but since then production has again declined to the low levels of 1950.

Wool is a raw material with a very wide variety of uses, ranging from carpets made from the coarsest wools, to blankets, furnishing fabrics, and wearing apparel made from the finer qualities. There is a rough correspondence between the different end uses to which wool is put and the multitude of different types which are distinguished by the wool trade. Of the various characteristics of wool, commercial count or quality number is the most important economic characteristic. Quality number is an assessment of the spinning potential of wool. Thus

Table 9.1.1

WORLD WOOL PRODUCTION (GREASY BASIS) AVERAGE 1934–38
AND 1948–49 TO 1964–65
(million lbs)

Year	Australia	New Zealand	South Africa	Argentina	Uruguay	United States	United Kingdom	Other	Total Non-Communist Countries	U. S. S. R.	Main-land China	Eastern Europe	Total Communist Bloc	World Total
1934–38	995	300	261	376	114	451	111	730	3,338				450	3,788
1948–49	1,030	367	227	425	144	296	81	739	3,309				467	3,776
1949–50	1,111	390	225	415	163	264	88	801	3,457				484	3,841
1950–51	1,093	390	240	430	185	259	89	726	3,412				522	3,934
1951–52	1.080	407	251	408	188	272	93	791	3,490	419	195		614	4,104
1952–53	1,281	418	274	406	190	290	102	821	3,782	478	206		684	4,466
1953–54	1,246	426	283	397	203	304	103	846	3,808	507	216		723	4,531
1954–55	1,283	455	306	364	198	310	111	851	3,878	500	233		733	4,611
1955–56	1,410	462	314	390	188	305	104	837	4,010	556	244		800	4,810
1956–57	1,584	491	321	388	190	311	104	866	4,255	567	146	137	850	5,105
1957–58	1,434	496	299	409	200	296	114	879	4,127	631	153	139	923	5,050
1958–59	1,591	540	314	421	175	295	119	890	4,345	700	165	145	1,010	5,355
1959–60	1,680	577	303	423	159	319	124	915	4,500	776	180	157	1,113	5,613
1960–61	1,625	588	299	431	181	323	121	900	4,468	777	181	162	1,120	5,588
1961–62	1,698	587	319	413	185	320	131	898	4,551	798	175	171	1,144	5,695
1962–63	1,673	620	300	408	190	300	131	905	4,527	806	170	171	1,147	5,674
1963–64	1,783	616	303	395	192	287	127	904	4,607	803	170	172	1,151	5,758
1964–65	1,789	625	285	419	187	265	128	890	4,588	800	170	172	1,142	5,730

Source: Commonwealth Economic Committee, and International Wool Textile Organisation and Wool Study Group, Wool Statistics (London, monthly issues from 1948–49 through 1964–65).

a 64's quality wool was originally so called because of its ability to be spun into 64 "hanks" of yarn (each of 560 yards length) from 1 lb of clean scoured wool. The higher the quality number the finer the wool. Table 9.1.2 gives world production of wool in greasy and clean weights, with a broad classification into apparel and other (mainly carpet) types. As shown in Table 9.1.2, apparel wool production increased somewhat more rapidly than the production of carpet wool. Thus between 1948—49 and 1964—65, world apparel wool production increased by 56 percent, compared with an increase of 50 percent for carpet wools; again carpet wool production declined slightly in the 5 years after 1959—60, whilst apparel wool production was still rising until 1963—64.

Apparel wool is often classified into Merino and Crossbred wool; this classification is also given on a world basis in the table. The distinction between Merino, Crossbred, and carpet types is roughly parallel to that by quality numbers: 60's and above for Merino wools, 58's to 40's for Crossbreds, and all numbers below 40's for carpet wools.

Different wool-producing countries specialise in growing different classes of wool. About 70 to 72 percent of Australia's wool clip in recent years has been of Merino wools, with the proportion of fine Merino wools (64/70's quality count) increasing. South Africa's wool production is also overwhelmingly of Merino types (over 84 percent in 1962—63) with a relatively larger proportion of fine Merino wool produced than in Australia. New Zealand produces primarily crossbred wool, with some 82 percent of its production in the 52's and lower quality counts. The Argentinian and Uruguayan clips are predominantly in the 58/60's category.

Wool constitutes one of the most important internationally traded agricultural products; over 60 percent of the world's output enters international trade. Some 85 percent of the wool entering world trade comes from the five southern hemisphere countries — Australia, New Zealand, South Africa, Argentina, and Uruguay. Apart from the United States and Russia, the major producers are not large consumers of wool (although their per capita consumption tends to be relatively high); most of the output of the five southern hemisphere countries is exported to the large industrial nations in the northern hemisphere. Thus, during 1958—60 some three-fifths of wool consumption in the non-communist world was concentrated in six countries: the United States (20%), the United Kingdom (12%), Western Germany (11%), Japan (8%), France (6%), and Italy (4%).

The quantity of wool available for home consumption for individual countries or major country groupings is given in Table 9.1.3 which also shows trends over time. Per capita consumption in the major wool-consuming countries between 1948 and 1963 is given in Table 9.1.4. These figures were compiled by the Food and Agriculture Organisation. They were estimated from mill-consumption data, adjusted by the balance of external trade measured in terms of the estimated fibre content of traded manufactured goods.[64]

In the immediate post-war period, the U.S.A. and Canada consumed approximately 600 - 700 million lbs of wool (clean weight) annually, but in the years after 1950 this market declined to about 450—500 million lbs per annum. U.K. consumption remained static at around 250—300 million lbs, with a marked dip in 1951 and 1952 when wool prices reached unprecedented heights.

64. The need to make adjustments for external trade to arrive at realistic estimates of home consumption accounts for the fact that there is a substantial lag in the estimates. Mill consumption figures for most countries are available for 1965, but these can be misleading for individual countries.

Table 9.1.2.

WORLD WOOL PRODUCTION ACCORDING TO BROAD QUALITY GROUPINGS

Year	Apparel				Total Apparel		Other		Total		Total Clean in '000 metric tons	Merino wool as a percentage of total apparel (clean basis)
	Merino		Crossbred									
	Greasy	Clean	Greasy	Clean	Greasy	Clean	Greasy	Clean	Greasy	Clean		
	million lbs											
1934-38	1,475	693	1,518	965	2,993	1,658	795	400	3,788	2,058	933.5	41.8
1948-49	1,302	678	1,668	1,072	2,970	1,750	806	403	3,776	2,153	976.6	38.7
1949-50	1,344	707	1,709	1,101	3,053	1,808	788	394	3,841	2,202	998.8	39.1
1950-51	1,352	732	1,758	1,139	3,110	1,871	824	412	3,934	2,283	1,035.1	39.1
1951-52	1,509	815	1,652	1,070	3,161	1,885	943	472	4,104	2,357	1,069.1	43.2
1952-53	1,713	924	1,744	1,124	3,457	2,048	1,009	505	4,466	2,553	1,158.0	45.1
1953-54	1,740	923	1,769	1,134	3,509	2,057	1,022	511	4,531	2,568	1,164.8	44.9
1954-55	1,785	947	1,797	1,157	3,582	2,104	1,029	515	4,611	2,619	1,188.0	45.0
1955-56	1,874	1,010	1,879	1,206	3,753	2,216	1,057	529	4,810	2,745	1,245.1	45.6
1956-57	2,083	1,160	1,863	1,211	3,946	2,371	1,159	579	5,105	2,950	1,338.1	48.9
1957-58	2,044	1,108	1,832	1,194	3,876	2,302	1,174	587	5,050	2,889	1,310.4	48.1
1958-59	2,172	1,165	1,973	1,279	4,145	2,444	1,210	605	5,355	3,049	1,383.0	47.7
1959-60	2,307	1,254	2,041	1,334	4,348	2,588	1,275	632	5,613	3,220	1,460.6	48.5
1960-61	2,239	1,227	2,115	1,381	4,354	2,608	1,234	617	5,588	3,225	1,462.8	47.0
1961-62	2,301	1,255	2,159	1,398	4,460	2,653	1,235	617	5,695	3,270	1,483.2	47.3
1962-63	2,277	1,245	2,177	1,407	4,454	2,652	1,220	610	5,674	3,262	1,479.6	46.9
1963-64[a]	2,351	1,302	2,195	1,426	4,546	2,728	1,212	606	5,758	3,334	1,512.3	47.7
1964-65[a]	2,344	1,298	2,173	1,411	4,517	2,709	1,213	607	5,730	3,316	1,504.1	47.9

(a) Preliminary estimates.

Sources: Commonwealth Economic Committee, and International Wool Textile Organization and Wool Study Group, Wool Statistics (London, monthly issues from 1948-49 through 1964-65).

Table 9.1.3

TOTAL WORLD CONSUMPTION OF WOOL 1948 TO 1963
(clean weight in million lbs)

Year	U.K.	E.E.C.	Other Non-Communist Europe*	Communist Europe	Japan	Mainland China	Other East, South and S.E. Asia	U.S.A. and Canada	Other Americas	New Zealand	Rest of World	Australia	Total**
1948	303.8	459.4	261.2	255.7	6.4	51.1	42.8	736.6	156.5	18.5	108.0	64.6	2510.9
1949	304.0	506.0	264.3	291.0	12.6	48.1	48.5	560.0	172.0	18.1	96.6	64.8	2420.7
1950	295.2	554.2	272.7	282.0	39.0	46.7	35.3	701.1	174.2	21.4	89.3	61.5	2621.3
1951	224.9	399.7	253.1	304.2	67.0	49.6	43.2	551.2	178.6	21.6	102.5	61.3	2286.3
1952	211.1	491.2	232.1	315.3	108.2	55.3	50.5	560.0	154.3	15.9	95.2	37.4	2332.4
1953	297.0	546.7	267.4	350.5	143.7	68.0	51.4	571.0	154.3	13.9	94.4	26.2	2638.8
1954	276.0	522.7	254.6	429.9	101.2	72.5	58.2	454.2	160.9	17.6	102.5	49.4	2559.5
1955	281.5	507.5	256.4	427.7	115.1	81.6	65.0	507.1	163.1	18.5	104.7	54.7	2647.8
1956	271.6	572.3	273.8	480.6	165.6	88.2	67.5	540.1	152.1	14.6	101.9	50.7	2850.5
1957	278.9	644.2	282.2	531.3	168.2	89.1	67.7	467.4	163.1	18.5	108.0	39.0	2938.7
1958	258.4	548.7	266.5	557.8	144.2	107.1	62.2	436.5	152.1	16.5	102.3	43.7	2769.0
1959	313.5	589.4	287.0	633.8	200.8	104.9	55.1	559.1	160.9	13.4	105.4	58.0	3150.3
1960	272.7	629.6	290.4	653.9	230.8	72.5	71.9	535.1	163.1	17.2	138.9	59.7	3309.1
1961	285.3	586.2	327.6	757.1	299.8	64.6	70.8	533.1	148.6	18.1	127.0	55.1	3337.8
1962	290.1	604.5	329.8	754.9	259.9	70.8	84.0	563.7	128.7	16.5	126.3	56.0	3331.2
1963	272.7	625.7	351.0	733.7	273.6	62.8	95.7	532.2	126.3	16.5	120.4	62.8	3326.8

* There are differences in the figures for wool consumption in Greece over the period 1961–63 as given by the April 1964 issue of the Monthly Bulletin of Agricultural Economics and Statistics and World Apparel Fiber Consumption 1961 to 1963. As a more recent publication the latter has been used above.

** World total given in Sources below. The columns (from the same sources) add to a slightly smaller sum.

Sources: F.A O. Per Caput Fiber Consumption Levels 1948 to 1958 (Rome, 1960).
F.A.O. "Per Caput Fiber Consumption Levels", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 11, No. 1 (January 1962), pp. 1—28.
F A.O. "World Apparel Fiber Consumption, 1960 to 1962", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 13, No. 4 (April 1964), pp. 1—33.
F.A O. World Apparel Fiber Consumption 1961 to 1963 (Rome, August 1965).

Table 9.1.4

PER CAPITA WOOL CONSUMPTION IN SELECTED COUNTRIES AND REGIONS 1949 TO 1962
(lbs clean weight)

Year	U.K.	E.E.C.	Other Non-Communist Europe	Communist Europe	Japan	Mainland China	Other East, South and S.E. Asia	U.S.A. and Canada	Other Americas	New Zealand	Rest of World	Australia
1949	6.0	3.3	2.7	1.0	0.2	0.09	0.06	4.0	1.1	10.3	0.4	8.0
1950	5.5	3.1	2.7	1.0	0.5	0.09	0.06	3.6	1.1	10.5	0.4	7.6
1951	4.8	3.0	2.5	1.0	0.8	0.09	0.06	3.6	1.0	10.1	0.4	6.3
1952	4.8	3.0	2.5	1.1	1.2	0.12	0.07	3.2	1.0	8.6	0.4	4.8
1953	5.2	3.2	2.5	1.2	1.4	0.12	0.08	3.0	0.9	7.7	0.4	4.3
1954	5.6	3.2	2.5	1.3	1.4	0.12	0.08	2.8	0.9	8.0	0.4	4.8
1955	5.4	3.3	2.5	1.4	1.4	0.13	0.09	2.7	0.9	7.9	0.4	5.6
1956	5.4	3.5	2.6	1.5	1.7	0.14	0.09	2.7	0.9	7.9	0.4	5.1
1957	5.2	3.5	2.6	1.6	1.8	0.15	0.09	2.5	0.8	7.4	0.3	4.6
1958	5.5	3.5	2.6	1.8	1.9	0.15	0.08	2.5	0.8	7.1	0.3	4.7
1959	5.4	3.5	2.6	1.9	2.1	0.14	0.07	2,6	0.8	6.7	0.4	5.3
1960	5.5	3.5	2.7	2.1	2.6	0.12	0.09	2.7	0.7	6.8	0.4	5.6
1961	5.4	3.5	2.8	2.2	2.8	0.10	0.09	2.7	0.7	7.1	0.4	5.4
1962	5.3	3.5	2.9	2.2	2.9	0.09	0.10	2.6	0.6	6.9	0.4	5.4

Source: See Table 9.1.3.

Table 9.1.5

WOOL PRICES IN THE POST-WAR PERIOD

Year	Average Price of Australian Greasy Wool		U.K. Average Price of Clean 64's	U.K. Average Price of Clean 46's	Price of 46's as a Percentage of 64's %
	(pence Australian per lb.)	(cents Australian per lb.)	(pence sterling per lb)		
1948—49	48.07	40.06	96.9	32.6	33.6
1949—50	63.35	52.79	117.5	51.3	43.7
1950—51	144.19	120.15	231.2	145.6	63.0
1951—52	72.42	60.35	130.3	66.6	51.1
1952—53	81.80	68.17	141.4	69.1	48.9
1953—54	81.50	67.92	139.5	74.2	53.2
1954—55	70.88	59.07	116.0	73.5	63.4
1955—56	61.46	51.22	102.5	70.2	68.5
1956—57	79.66	66.38	128.9	79.9	78.0
1957—58	62.45	52.04	104.0	64.4	61.9
1958—59	48.57	40.48	82.5	56.5	68.5
1959—60	57.78	48.15	95.3	69.0	72.4
1960—61	52.06	43.38	86.6	63.5	73.3
1961—62	54.13	45.11	91.8	61.8	67.3
1962—63	58.96	49.13	98.8	63.4	64.2
1963—64	69.70	58.08	109.7	72.2	65.8
1964—65	57.40	47.83	93.7	68.9	73.5

Source: Bureau of Agricultural Economics, Statistical Handbook of the Sheep and Wool Industry, (Third Edition, Canberra, 1961); and Supplement to the Statistical Handbook of the Sheep and Wool Industry (Canberra, June 1964).

E.E.C. wool consumption rose steadily from 450 million lbs immediately after the war to almost 650 million lbs in 1957. Since then, it has fluctuated between 550 and 630 million lbs. Consumption in the rest of non-Communist Europe increased from around 250 million lbs in 1951 to 350 million lbs in 1963. Consumption increased markedly in both communist Europe (especially in the U.S.S.R.) and in Japan. In 1963, Japan became the third largest consumer and is by far the largest purchaser of Australian wool.

Wool prices are notoriously unstable, but some broad trends in prices can be observed in the post-war period. At the end of World War II, large stocks of wool — more than two years' world exports — had accumulated. It was estimated by an intergovernmental Wool Conference held in London in April 1945 that "on reasonably optimistic assumption, the period required to dispose of existing Empire stocks alongside new clips would be on average 13 years from June 30th 1945".[65] In fact it took only about 5 years to dispose of this vast stockpile; the final liquidation of stocks in 1950—51 was followed by the greatest wool price rise ever experienced.

Average prices realised for Australian greasy wool are given in Table 9.1.5. The very sharp rise in price during the Korean war boom was short-lived; in 1951—52, the average price received was almost exactly half that of the preceding year. In the next 2 years, prices remained fairly stable around 80d (Australian) or 68 cents per lb — a very remunerative level for Australian woolgrowers. In the succeeding 5 years, prices declined (except for a rally between April 1956 and May 1957) to a 10-year low of 48d, or 40 cents in 1958—59. Since then there has been some recovery, but little indication of any long-term trend, with prices fluctuating between 52d or 43 cents (1960—61) and 70d or 58 cents (1963—64).

There is some slight evidence suggesting that wool price fluctuations have become less marked in recent years.[66] This development might have been expected as a result of the increasing importance of synthetic substitutes.

Another noteworthy feature is the movement in prices of different types of wool. Table 9.1.5 also gives the average annual prices of two broad types of wool in London — 64's quality count, which is roughly representative of merino or the finer apparel wools and 46's, representative of crossbred or the coarser apparel wools. It has been argued that when wool prices rise, the price of coarser wools tends to rise relatively more than that of finer wools. This relation is supposed to prevail because "during such periods manufacturers try to substitute lower for higher quality, in an attempt to avoid price increases to their customers. When wool prices are falling, the movements will be reversed".[67] There were some periods (1950—51, 1956—57) when the behaviour of prices followed this pattern; there are others (1963—64, 1958—59) when no such clear relationship prevailed. There appears to have been a longer term trend for the gap between 64's and 46's to narrow since the early fifties. Rainnie attributed this to a shift in fashion from worsted products (which use mainly merino wools) to woollens (predominantly from crossbreds) and to an increasing demand for crossbred wools as a substitute for increasingly scarce carpet wools.[68]

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65. Cited by Gerda Blau "Wool in the World Economy", Journal of the Royal Statistical Society, Vol. 109, Part III, 1946, p. 180.

66. Report of the Wool Marketing Committee of Enquiry, Commonwealth of Australia (Canberra, February 1962), p. 157.

67. G.F. Rainnie, The Woollen and Worsted Industry. An Economic Analysis, Clarendon Press, Oxford, 1965, p. 11.

68. Ibid., p. 12.

Another possible explanation is that synthetics competed more strongly with merino-type wools — at least up to now.

2. PLAN OF PRESENT PROJECTION STUDY FOR WOOL

To assess the likely future demand for wool, it would be desirable to consider separately the effects of expected changes in many different factors which may influence wool consumption. This was impossible within the scope of our investigation. Here it was necessary to confine our attention to the major factors which affected wool consumption in the past and to consider how far they are likely to be dominant in the future.

Factors considered separately were (i) the effect of income on the consumption of wool and "wool-type" fibres; (ii) the competition among fibres — particularly the competition from the newer non-cellulosic synthetics; (iii) expected future trends in technology, promotion expenditure, and the prices of the other fibres which may affect future fibre consumption.

On the basis of these considerations, we then forecast likely future wool consumption in the light of the assumed changes in population and per capita incomes, which were outlined in the preceding chapter.[69] These forecasts were made on the assumption of constant wool prices. This was followed by an examination of future trends in the supply of wool and wool-type fibres, again assuming constant wool prices. In the next chapter, these demand and supply projections will be reconciled by allowing wool prices to vary.

3. INCOME AND THE CONSUMPTION OF "WOOL-TYPE" FIBRES

As pointed out earlier, statistical estimates of the annual consumption of the major fibres — cotton, wool, rayon and synthetics — for a large number of countries have been published by F.A.O. for 1948—63.[70] On the basis of these estimates, it was possible to make various comparisons between changes in wool consumption and changes in national incomes.

It was possible to examine the historical trends in per capita wool consumption in the different countries and relate them to growth in real incomes which occurred in these countries over the relevant period.

(a) Donald, Lowenstein, and Simon attempted to explain variations in the annual consumption of both apparel and carpet wool for the United States for 1935—40 and 1948—60 (1941—47 were omitted because of the influence of World War II on the variables).[71] For apparel wools the following equation gave the best statistical results:

$$(9.3.1)\quad \text{Log } X_1 = 0.18 + \underset{(0.09)}{0.34} \log X_2 - \underset{(0.13)}{0.32} \log X_3 - \underset{(0.06)}{0.28} \log X_4 - \underset{(0.04)}{0.31} X_5$$

$$(S_{1.2345} = 0.03;\ R^2 = 0.91),$$

69. The first approximation to which attention should be drawn is our assumption that a given percentage increase in population will lead to an equal percentage increase in wool consumption. Becuase of changes in the age-sex composition of populations, this assumption is unlikely to be completely accurate. Thus Donald, Lowenstein and Simon have pointed out that "one of the explanations for the relative decline in consumer expenditure for wearing apparel in the postwar period has been changes in the age-sex composition of the [U. S.] population. This decline reflects increases in the relative percentages of younger and older people in the population who, on average, tend to spend less for apparel than do people of other ages". James R. Donald, Frank Lowenstein, and Mark S. Simon [The Demand for Textile Fibres in the United States, U.S. Department of Agriculture Technical Bulletin No. 1301 (Washington D.C., Nov. 1963), p. 71.] The type of data which could allow conversion from population to "clothing expenditure units" as used by Donald, Lowenstein, and Simon is only available for a few of the countries which concern us here.

70. F.A.O. op. cit.

71. Donald, Lowenstein and Simon, op. cit., p. 81.

where X_1 is the domestic consumption of apparel wool per clothing expenditure unit;

X_2 = deflated personal disposable income per capita;

X_3 = price of Australian 64's, 70's clean wool at Boston deflated by the Wholesale Price Index leading 6 months;

X_4 = domestic consumption of non-cellulosic staple fibre per capita

X_5 = deviations from normal of the ratio of stocks to unfilled orders for wool apparel fabrics.

For carpet wool the following equation gave the best results:

$$(9.3.2)\quad \text{Log } X_1 = -1.83 + \underset{(0.10)}{0.86} \log X_2 - \underset{(0.07)}{0.41} \log X_3 - \underset{(0.05)}{0.26} X_4$$

$$(S_{1.234} = 0.04;\; R^2 = 0.88),$$

where X_1 is the domestic consumption of carpet wool per clothing expenditure unit;

X_2 = deflated disposable income per capita;

X_3 = deflated annual prices per pound, Buenos Aires, 5's and 6's clean basis, leading 8 months;

X_4 = deviations from normal of the ratio of stocks to unfilled orders for wool apparel fabrics.

Since both equations are of the double-logarithmic form, the income coefficients (i. e. 0.34 and 0.86) gave the estimates of the income elasticity of demand for apparel and carpet wool at all income levels for the period.

(b) A study of Wool in Japan by Jenkins and Brunswick of the Australian Bureau of Agricultural Economics contained two attempts to fit equations which related changes in Japanese wool consumption to changes in Japanese national income.[72] These are:

$$(9.3.3)\quad X_1 = -9.58 + 6.05 \log X_2$$

$$(R^2 = 0.95)$$

where X_1 is the wool consumption per capita (averaged over three years) — in lbs per head;

X_2 = deflated personal disposable income per head — in '000 yen at 1960 prices.

With this semi-logarithmic regression the income elasticity of wool declined from about 2.1 in 1952 to about unity at 1960 incomes.[73] To allow for two other factors which influenced wool consumption over this period in Japan, Jenkins and Brunswick estimated another regression between "adjusted" wool consumption and income. For this equation, two adjustments were made — the first to allow for changes in the price of wool clothing and the second for substitution between wool and other fibres.

$$(9.3.4)\quad X_{A1} = -7.82 + 5.19 \log X_2$$

$$(R^2 = 0.95)$$

where X_{A1} is wool availability in lbs per capita adjusted to allow for differences in clothing prices and proportionate use of different fibres, and X_2 is as defined above.

Using this equation the income elasticity of wool was estimated at 0.86 at 1960 incomes.

(c) A subsequent study by Jenkins of the Bureau of Agricultural Economics entitled Wool in the EEC examined the relation between wool consumption and income in a number of European countries (EEC countries, Austria, Denmark, Greece, Ireland,

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72. Bureau of Agricultural Economics, Wool Economic Research Report No. 5, Wool in Japan (Canberra, August 1963), pp. 107 and 126.

73. Ibid., p. 126.

Table 9.3.1

RELATION BETWEEN INCOME AND WOOL USE PER CAPITA: SELECTED EUROPEAN COUNTRIES

Equation	Within Countries		Between Countries	
	Income elasticity	R^2	Income elasticity	R^2
Semi-logarithmic	0.54*	0.31	0.44*	0.44
Double-logarithmic	0.59	0.32	0.49	0.52

* Measured at average level of income. Income measured in 1954 constant prices based on U.S. dollars converted at 1950 purchasing power parity rates.

Norway, Sweden, and the United Kingdom).[74] Double-logarithmic and semi-logarithmic functions were fitted to the data. As the data referred to a number of countries over 8 years (1952—59) two sets of comparisons were obtained:

(i) by estimating the relations for each country over the period and then obtaining a weighted average of the country relations. This was described as the within-countries regression.

(ii) by estimating the relations for each year based on the data for the individual countries and then obtaining a weighted average of the yearly regressions. This is called here the between-countries regression.

Some results are given in Table 9.3.1.

Jenkins pointed out that the elasticities obtained from the two sets of comparisons could be expected to be biased. The within-countries elasticity coefficient could be expected to be biased upwards because, over the period, textile prices declined relative to those of other products. This should have tended to add to the rise in fibre consumption which is attributed by the regression to the growth in incomes over time. On the other hand, the between-countries income elasticity coefficient might be expected to be biased downwards because higher income countries tended to use a greater proportion of the newer man-made fibres.[75]

74. Bureau of Agricultural Economics, Wool Economic Research Report No. 6, Wool in the EEC (Canberra, September 1964), pp. 9-11.

75. Whether this introduces a bias (for projections) depends on the reasons for the greater proportionate use of man-made fibres in the higher income countries. Higher income countries may use more of the newer man-made fibres because manufacturers have moved into the higher income markets first as these are likely to be more profitable. They may then be expected to move into the other countries more rapidly at a later stage. The income coefficients may therefore be biased downwards. While it is true that the earliest growth of synthetics occurred in the United States, the succeeding growth does not necessarily conform to this pattern; thus there is some evidence to suggest that synthetics were adopted earlier in Japan than in France and Germany, and even later in the United Kingdom; c.f. M. Polasek and A. Powell, "Wool versus Synthetics: An International Review of Innovation in the Fibre Market", Australian Economic Papers, Vol. 3, Nos. 1 and 2, (June - December 1964), p. 59, Table III.

On the other hand the reason for the greater proportionate use of man-made fibres in the higher income countries may be the result of other factors. Thus if, as a result of higher incomes, consumers place greater emphasis on the particular qualities of the newer synthetics (the easy-care features, the softness, and lack of irritation from these fibres), then this is part of the "true" income response which should be associated with higher incomes.

In our study we primarily used comparisons between countries rather than comparisons within countries over a given period of time. The major reasons why between-countries comparisons seemed preferable are:

(i) It is generally acknowledged that statistical estimates of annual changes in wool stocks (and therefore of wool consumption) are very unreliable. One research worker pointed out that the stock figures obtained from annual world production and disappearance data (computed stocks) differ by a wide margin from reported stocks. Thus at the start of 1951 computed stocks were about 531 million lbs smaller than reported stocks, whilst 2 years later computed stocks were 433 million lbs larger. This made it advisable to use consumption over a period longer than 1 year; the FAO publications suggest using a 3-year period. This obviously greatly reduces the number of observations available for time series analysis.[76]

(ii) As pointed out by Houthakker, when discussing price elasticities, within-countries comparisons, being based on annual deviations from mean rates of change for each country, capture primarily short-run effects, whilst the between-country regressions are of a longer-run nature.[77] As we are here concerned primarily with long-run projections, between-country comparisons seemed more appropriate.

(iii) With the use of between-countries regressions, the stability of income coefficients over time can be tested.

This is not to deny that between-countries comparisons raise their own particular problems. First, in the case of wool, it seemed advisable to make certain climatic distinction. Our inter-country comparisons exclude tropical countries, which will be considered separately. Second, there is the problem of real income comparisons between different countries. The income variable used here is expressed in constant 1955 United States dollars; the actual figures were published by Balassa.[78] They were based on a variety of sources, but in the main on a Twentieth Century Fund study.[79] The countries used included the major non-communist wool-using nations and accounted for about 80% of non-communist consumption between 1952 and 1960.

Three time periods were used — 1953, 1956, and 1959. For each period an average of 3 years centred on the given year was used to overcome the statistical unreliability of the annual consumption estimates. To allow for declining income elasticities with increases in incomes, two functions were used — the semi-logarithmic and the log-inverse. In addition, it seemed desirable to test a third function which would allow the possibility of a zero income elasticity with a finite income. For this purpose, a log-log-inverse function was also

76. Alternatively moving averages could be used, but this leads to serious problems in the statistical estimation of relationships.

77. H.S. Houthakker, "New Evidence on Demand Elasticities", Econometrics, Vol. 33, No. 2 (April 1965), p. 283.

78. B. Balassa, Trade Prospects op. cit., Tables 2.6.2 and A2.6.1. The twenty countries used are: United States, Canada, Belgium, France, Germany, Italy, Netherlands, United Kingdom, Austria, Denmark, Finland, Ireland, Norway, Sweden, Switzerland, Greece, Portugal, Turkey, Yugoslavia, Japan.

79. J.F. Dewhurst and Associates, Europe's Needs and Resources (Twentieth Century Fund, 1961, New York).

fitted.[80] We therefore have 9 regressions — 3 functions for 3 time periods. The relevant regressions are given in Table 9.3.2.

The following conclusions can be drawn from comparing the various functions at the different dates:

(i) The semi-logarithmic functions produced a substantially worse fit (in terms of lower R^2) than either the log-inverse or the log-log-inverse functions.[81] There is comparatively little to choose between the statistical fit produced by the latter 2 functions.

(ii) In the case of the semi-logarithmic and the log-inverse functions, the coefficients of the income variable do not change systematically over time; each coefficient is within 1 standard error of the coefficients for the other 2 time periods. This is also true for the log-log-inverse functions. However, in the case of log-log-inverse functions there is a more systematic movement over time; both coefficients decrease over time, though the differences are again not statistically significant. The real income per head at which the income elasticity becomes zero has gradually decreased (from $1,698 in 1952-54 to $1,073 in 1955-57 and $956 in 1958 - 60).

(iii) From the point of view of projections, a more disturbing conclusion emerges from a comparison of the regressions between the different time periods: The proportion of the variation in wool consumption which is explained by differences in real incomes between countries declines over time. In other words, for each type of function, the R^2 for the most recent period (1958-60) is lower than the R^2 for the preceding period and similarly for the two earlier periods. This suggests that income is likely to become a less satisfactory guide of future trends in wool consumption. To ascertain whether this was caused by the increasing use of synthetics, similar regressions were run with wool plus synthetics as a dependent variable. But this poses two problems. First, synthetic fibres are used extensively in other branches of textile manufacture, where they compete more directly with cotton and rayon and there is at present only a very rough basis for deciding what quantities of non-cellulosic synthetics compete with wool. Following other research workers, we confined attention to staple non-cellulosics which compete more directly with wool than synthetics marketed as continuous filaments.[82] Second, how should one add wool and synthetics together? We tried to add a kilogram of wool and the same weight of synthetic staple fibres. It also seemed advisable to allow for the differing proportions of waste involved in manufacturing fabrics from different fibres and the differences in the average weight of generally comparable end-products produced from the different fibres. According to Donald, Lowenstein, and Simon the poundages of cotton approximately

80. This function also has the advantages that positive income elasticities are not constrained to decline as incomes rise. A brief discussion of these different functions is given by L. M. Goreux, "Income and Food Consumption", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 9, No. 10 (October 1960), p. 2. See also Ch. 8 supra.

81. On the other hand, since the regressand for the semi-log function is in natural numbers, whereas the regressand for the other two functions is in natural logs, simple comparisons between the semi-log and the other two functions are not strictly valid.

82. M. Polasek and A. Powell, op. cit.

Table 9.3.2

RELATION BETWEEN CAPITAL WOOL CONSUMPTION AND INCOME: 20 NON-TROPICAL COUNTRIES (a)

Equation No.	Type of Equation (c)	Years	Constant	Coefficients (b) of Independent Variables		Standard Error of Estimate	R^2
				Log Income	Reciprocal of Income		
9.3.5	Semi-log	1952-54	-2.69	0.66 (0.14)		0.38	0.57
9.3.6	"	1955-57	-3.04	0.72 (0.18)		0.49	0.48
9.3.7	"	1958-60	-2.60	0.64 (0.18)		0.46	0.42
9.3.8	Log inverse	1952-54	0.95		-239.8 (37.2)	0.26	0.70
9.3.9	"	1955-57	0.92		-274.2 (45.2)	0.27	0.67
9.3.10	"	1958-60	0.87		-268.8 (56.6)	0.29	0.56
9.3.11	Log-log-inverse	1952-54	2.16	-0.18 (0.37)	-310.7 (150.6)	0.26	0.70
9.3.12	"	1955-57	4.12	-0.44 (0.43)	-470.2 (198.8)	0.27	0.69
9.3.13	"	1958-60	5.24	-0.59 (0.52)	-563.9 (267.3)	0.28	0.59

(a) The twenty countries are United States, Canada, Belgium, France, Germany, Italy, Netherlands, United Kingdom, Austria, Denmark, Finland, Ireland, Norway, Sweden, Switzerland, Greece, Portugal, Turkey, Yugoslavia and Japan.

(b) Standard errors of coefficients are shown in parentheses.

(c) For a discussion of these functional forms, see Ch. 8, supra.

Sources of data:

Incomes per capita (in U.S. dollars per caput) - Bela Belassa, Trade Prospects for Developing Countries (The Economic Growth Centre, Yale University; Irwin, Illinois, 1964), p.37. Table 2.6.2.

Wool Consumption (in kg. per capita) - F.A.O., Per Caput Consumption Levels 1948 to 1958 (Rome, 1960).
F.A.O., "Per Caput Fiber Consumption Levels", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 13, No. 4 (April 1964), pp. 1-33.
F.A.O., "World Apparel Fiber Consumption, 1960 to 1962", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 13, No. 4 (April 1964), pp. 1-33.
F.A.O., World Apparel Fiber Consumption 1961 to 1963 (Rome, August 1965).

equivalent (in terms of the production of the same yardage of fabric) to one lb. of the following fibres are: 0.55 lbs for wool and 1.37 lbs of non-cellulosic staple fibre.[83] A second alternative labelled "wool plus synthetic equivalent" was therefore tried, where we converted non-cellulosic staple fibres to "wool equivalents" by using the ratio 1 to 2.49.

We then proceeded to re-run the three types of functions given above (each for the three time periods) for two alternative measures of "wool-type" fibres — the first a straight addition of quantities of wool and non-cellulosic staple fibres; this was labelled "wool and synthetics" and the second one labelled "wool and synthetics equivalents" where each unit of synthetics was multiplied by 2.49 before being added to the quantity of wool consumed per capita.

The results obtained for the "wool and synthetics equivalents" data are given in Table 9.3.3. Because the statistical fit obtained with this dependent variable was better in every case than that obtained for the variable "wool and synthetics", the results from the latter regressions have been relegated to Appendix Table A9.3.1.

The following conclusions can be drawn from comparing the various functions at the different dates:

(i) As in the case of Table 9.3.2, the semi-logarithmic functions produced a substantially worse fit than either of the other two functions. Again there is comparatively little to choose between the log-inverse and the log-log-inverse functions, but as the former gives a slightly smaller standard error of estimate (with the loss of one degree of freedom), the log-inverse seems slightly preferable.

(ii) Comparing the R^2 of the functions in Tables 9.3.3 with those in Table 9.3.2 (which relate to wool only), inter-country differences in real incomes provide a better (more complete) explanation of variations in the consumption of "wool-type" fibres than of wool only.

(iii) The disturbing conclusion reached from Table 9.3.2 — that the proportion of the variation in the dependent variable which is explained by differences in real incomes declines over time — is somewhat less marked in Table 9.3.3; but it is not entirely absent.

(iv) For each function, the income coefficients change in such a way over time that — at any given level of real income — the most likely income elasticity of "wool and synthetics equivalent" rises between 1953 and 1956 and again to 1959; however all income coefficients (for different time periods) are within one standard error of each other.

To test further the possibility that there may have been a systematic change over time in the income coefficients, it seemed desirable to fit yet another set of functions which would allow income responses to change over time. Since the log-inverse function had given the most satisfactory fit, a function of this form with a time trend was fitted to the pooled observations for the 3 periods. The coefficients obtained for the time variable (two separate functional forms were tried) were not statistically significant.[84]

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83. Donald, Lowenstein and Simon, op. cit., pp. 126–35.

84. The two functions attempted were

$$\log_e W_t = a - \frac{b}{Y_t} + \frac{bt}{Y_t}$$

and $$\log_e W_t = a - \frac{b}{Y_t} + \frac{bt}{Y_t} + \frac{bt^2}{Y_t}$$

Table 9.3.3

RELATION BETWEEN WOOL AND STAPLE SYNTHETICS (EQUIVALENT) CONSUMPTION AND INCOME: 20 NON-TROPICAL COUNTRIES

Equation No.	Type of Equation (c)	Years	Constant	Coefficients of Independent Variables		Standard Error of Estimate	R^2
				Log Income	Reciprocal of Income		
9.3.14	Semi-log	1953	-3.21	0.757 (0.116)		0.32	0.70
9.3.15	"	1956	-3.13	0.927 (0.147)		0.40	0.69
9.3.16	"	1959	-4.25	0.961 (0.177)		0.48	0.62
9.3.17	Log-inverse	1953	0.94		-253.52 (31.47)	0.22	0.78
9.3.18	"	1956	1.10		-295.36 (33.61)	0.20	0.81
9.3.19	"	1959	1.20		-318.62 (45.12)	0.23	0.74
9.3.20	Log-log-inverse	1953	1.08	-0.020 (0.321)	-261.45 (128.26)	0.23	0.78
9.3.21	"	1956	0.10	-0.014 (0.332)	-289.06 (152.32)	0.20	0.81
9.3.22	"	1959	3.36	-0.292 (0.426)	-464.89 (217.30)	0.23	0.74

Sources: See Table 9.3.2.

What is the order of magnitude of the income elasticities implied by these equations and how do they compare with income elasticities estimated by other research workers? A number of comparisons can be made.

(a) The first relates to the income elasticity for wool in Japan which was estimated at 0.86 at the 1960 level of income in the BAE publication Wool in Japan.[85] Equation (9.3.10) gives an income elasticity of 0.68 (± 0.14) for this income level, whilst equation (9.3.19) — i.e., for "wool type fibres" — gives an elasticity of 0.81 (± 0.12).

(b) For selected countries in Western Europe (at an average 1952-59 income) our two equations give income elasticities of 0.35 (± 0.07) and 0.41 (± 0.06) respectively compared with a BAE cross-country elasticity of 0.44.[86]

(c) For the U.S. (at average 1950-60 incomes) our equations give income elasticities of 0.16 (±0.03) and 0.18 (±0.03) respectively. This is very much lower than the income elasticity obtained by Donald, Lowenstein, and Simon [87] [0.34 (± 0.09) and 0.86 (± 0.10) for apparel and carpet wools respectively]. However, in the light of actual movements in per capita wool consumption in the United States and other high income countries (Canada, Australia, New Zealand, Sweden, and Switzerland) over this period, our elasticity appears more plausible.

In terms of incomes of other countries, equation (9.3.10) implies an income elasticity of demand for wool of unity at a per capita income level of U. S. $269 (at constant 1955 prices) — about the 1960 per capita income level of Greece ($278); an income elasticity of 0.54 for an income level of $500 (Italy's per capita income in 1960 was $524), or an income elasticity of 0.27 at $1000 (French income was $960 in 1960 and West German income was $1078).[88] The income elasticities obtained agree fairly closely with those obtained by Swan using similar cross-country data.[89]

4. PROJECTING WOOL'S MARKET SHARE — THE INFLUENCE OF SYNTHETICS

In three papers by Polasek and Powell (one of which included Burley as a third joint author)[90], a market share concept for non-cellulosic synthetic staples was defined as $y_t = s_t/(s_t + w_t)$ where s_t and w_t are consumption, in pounds weight, of staple synthetics and virgin wool respectively.

The authors then fitted a logistic growth curve of the form $y_t = K/\{1 + e^{-(a+bt)}\}$ to the data, where y_t is defined as the trend value of the staple synthetics' share of the

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where W_t is per capita wool consumption (or wool plus synthetics equivalent consumption) in kg.
Y_t is per capita income (in 1955 U. S. dollars)
t is time (1953 = 53).

85. Equation (9.3.4) above.

86. cf. Table 9.3.1.

87. Equations (9.3.1) and (9.3.2) above.

88. Using equation (9.3.19) – i. e. for "wool type fibres" – would give income elasticites which are $8\frac{1}{2}\%$ higher than those given for wool above.

89. Neil Swan, "Export Prospects for Australian Wool," Economic Papers, The Economic Society of Australia and New Zealand. N. S. W. Branch (Sydney, August 1964), pp. 36–64.

90. A. Powell, M. Polasek and H. T. Burley. "Synthetic Fibres in the Wool Textile Industry: A Study of the Role of Price of Technological Adjustment", Australian Journal of Agricultural Economics, Vol. 17, No. 2 (December 1963), pp. 107–120.

M. Polasek and A. Powell, "Wool and Synthetics: A Statistical Analysis of Fibre Substitution in the U. S. ", Australian Journal of Agricultural Economics, Vol. 8, No. 1 (June 1964), pp. 11–27.

M. Polasek and A. Powell, "Wool Versus Synthetics: An International Review of Competition in the Fibre Market", Australian Economic Papers, Vol. 3, No. 1 (July 1964), pp. 49–64.

market, K is the value of the upper limit approached by the series over time, "a" is a coefficient locating the logistic on the time scale and "b" determines the speed of approach towards the asymptote K. Following Griliches, Polasek and Powell referred to parameters K and b as the ceiling and rate of adoption respectively.[91]

This method of fitting a growth curve makes the synthetics' share of the market solely a function of time; however it gave a very good statistical fit for 5 of the 6 countries where it was tried.[92] The countries for which the logistic was fitted were: The United Kingdom, France, Western Germany, Japan, the United States and Italy. The only country with a relatively poor fit was Italy, where — according to the authors — conditions differed in other respects as well. Thus the Italian wool textile industry consumed a relatively large proportion of non-virgin wool; it was also the only country where the ratio of wool-to-synthetics consumption seemed to respond to price stimuli. In their first paper, dealing solely with the U. S. market, Powell, Polasek, and Burley attempted to introduce prices as an explanatory variable with conspicuous lack of success.

It was our original intention to utilise this technique to forecast future trends in wool's share of the market. Before doing so, we examined Polasek and Powell's predictions in the light of later data which have become available. They based predictions (of staple synthetics' share of the market) on data for 1954-1961. Since then wool consumption data to 1964 have become available. Polasek and Powell used staple synthetic consumption data compiled by F.A.O. These estimates make adjustments for foreign trade in staple synthetics; they are now available for 2 more years, 1962 and 1963.[93] In addition Textile Organon has recently published staple synthetics production for 1955-64 for the countries concerned; for 1964 then, synthetics data are available which are not adjusted for foreign trade.[94] However, as shown in Table A9.4.1, the trends shown by the adjusted data do not usually differ significantly from those shown by the unadjusted data for the set of years where we can make this comparison.[95]

Table A9.4.1 gives the estimates of both wool and staple synthetics consumption used by Polasek and Powell, the Textile Organon staple synthetics production figures for the 6 countries, and the ratio used by the authors and their predictions for 1962-64 inclusive. To focus attention more specifically on a comparison of the Polasek-Powell projections and the later data which have become available, Table 9.4.1 gives

91. Zvi Griliches, "Hybrid Corn: An Exploration in the Economics of Technological Change", Econometrica, Vol. 25, No. 4 (October 1957) pp. 501 – 522. Griliches was very successful in explaining trends in the proportion of total corn acreage sown with hybrids by means of the logistic.

92. Polasek and Powell used two measures of "goodness of fit"; firstly the conventional proportion of sums of squares "explained" (which is not strictly applicable to non-linear models; hence they labelled it "Quasi-R^2"); and a method of inequality analysis due to Theil. According to both methods, the logistic gave a very good fit for the data for all countries excepting Italy. cf. Polasek and Powell, Australian Economic Papers, op. cit., Tables I and II, pp. 57 - 58.

93. F. A. O., Monthly Bulletin of Agricultural Economics and Statistics, Vol. 13, No. 4 (April 1964), pp. 1–33; World Apparel Fibre Consumption 1961 - 63 (Rome, August 1965).

94. Textile Organon, Vol. 36, No. 6 (June 1965).

95. There are some obvious differences between the F. A. O. and the Textile Organon estimates, most of these are not major and can be explained (either wholly or partly) by foreign trade in staple synthetics. Thus the F. A. O. estimates for the U. S. are consistently lower than the one given by Textile Organon largely because the U. S. is a net exporter of staple synthetics; for the U. K. which has tended to be a net importer, the F. A. O. estimates are higher (until 1962) than the Textile Organon figures. On the other hand the discrepancy for France in 1961 and 1962 is much larger than can be accounted for by foreign trade.

Table 9.4.1.
SYNTHETICS' MARKET SHARES 1962-1964:
PROJECTIONS AND SUBSEQUENT DATA
(percent)

Year	United Kingdom		France		West Germany	
	A	B	A	B	A	B
1962	14.3	13.1	13.0	16.1	25.0	33.0
1963	16.9	15.4*	14.6	20.3	25.8	30.0*
1964	19.5	(21-22)	16.0	(23-27)	26.3	(34-41)
	Italy		Japan		U.S.A.	
	A	B	A	B	A	B
1962	11.0	17.6	42.8	43.6	36.4	44.1
1963	11.3	21.7*	46.1	47.5**	36.6	51.2
1964	11.6	(31-33)	48.9	(50-55)	36.8	(60-61)

Column A: Polasek-Powell projections. Column B: Market shares for 1962 and 1963 based on later F.A.O. data; for 1964, based on later Textile Organon data which are only approximately adjusted for foreign trade in staple synthetics.

* For 1963 F.A.O. data are available only for "discontinuous" fibres which does not entirely correspond to the category "staple" used earlier; these figures have been adjusted to be as nearly comparable as possible with earlier years.

** Japanese wool consumption for earlier years exclude consumption by commission combers; an adjustment was necessary to make them comparable.

this comparison only, leaving out the basic data (and their numerous revisions) which are given in the Appendix Table (A9.4.1).

For the United Kingdom and Japan, the forecasts are reasonably close to the estimates made available later. The Polasek-Powell projections overestimated the United Kingdom staple synthetics' share by 1-1½% in 1962 and 1963, and underestimated it by about 1½- 2½% in 1964. The projections underestimated Japanese synthetics' share by a small margin in 1962 and 1963 and possibly by a larger margin in 1964. In the case of Germany, the U.S., and Italy the projections seriously underestimated the gains which were in fact made by synthetics for all 3 years. The projection for France was also seriously underestimated, but this was partly the result of wrong figures (for synthetics consumption) used for 1960.

This raises the question of why the Polasek-Powell projections underestimated the rise in the synthetics' share of the market — especially since, as mentioned earlier, they achieved a good statistical fit for the years 1954-1961. The following possible explanations deserve some discussion:

(a) It might be argued that during the period examined by Polasek and Powell plant capacity was the major factor limiting the use of synthetics, whilst after 1961 such limitations may have been less important. This would apply less strongly to the U.S., where the gap between projection and subsequent performance is greatest, robbing this explanation of much of its cogency.

(b) There may have been some other "structural" change in the market after 1961; however, labelling a change "structural" does not explain it, and some further description is necessary as to why one would expect a structural change. Two possible candidates present themselves:

(i) there may have been some quality improvement of synthetics which enabled them to capture a larger share of the market. As far as we could ascertain, there have been no dramatic improvements in quality which could account for this marked change. There have, of course, been quality improvements for the various synthetics, but there have also been important improvements in wool's versatility as a textile fibre and little evidence of any great relative gain in quality by synthetics.

(ii) The second factor which might be regarded as "structural" refers to the relative price changes of wool and synthetics over this period. The U.S. prices for three of the major synthetic staples competing with wool and the price for one representative type of U.S. wool are given in Table 9.4.2. As shown, there has been a marked price movement in favour of synthetics since 1961. Thus in 1961 the list prices of Dacron, Orlon, and Acrilan were about 20-25% higher (per lb) than the price of good French combing wool (3/8 blood), whilst by 1964 the same grade of wool cost 20-30% more than these synthetics.

If we are going to regard prices as an important factor and some experienced observers have concluded that it was the chief factor in the decline of wool's share, we have to consider why relative price movements did not provide a significant explanation previously.[96] Three considerations could explain this apparent contrast: Relative price changes after 1961 were greater than before; synthetics prices were progressively lowered and thus moved out of the range considered from 1954 to 1961; and lastly Powell, Polasek, and Burley considered only a lag of 3 months as an explanatory variable, whilst the most effective lag is probably longer.

(c) It seems likely that staple synthetics are being increasingly substituted for fibres other than wool. This obviously affects the usefulness of Polasek and Powell's market share concept. Polasek and Powell were aware of the difficulties associated with their market share concept, so they pointed out that "there is at present only a very rough basis for deciding what quantities of non-cellulosics enter into the process of wool textile manufacture. Non-cellulosics appear on the market as continuous filament or staple; the latter are produced by cutting continuous filament into lengths corresponding to those found in various natural fibres. It is in this form that synthetics can be spun into yarn in the same manner as wool.... Filaments on the other hand are best suited in end uses where they can be woven in the same way as cotton, linen and silk".[97] They also point out that "in recent years synthetic <u>filaments</u> have been of declining importance"[98] (our emphasis) in the U. S. However, what appears to have happened recently is that an increasing proportion of staple synthetics now compete with fibres other than wool particularly cotton and rayon. This also helps to explain why the consumption of "wool plus staple synthetics" rose so much faster in recent years than

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96. Powell, Polasek, Burley, op. cit. p. 119.

97. Polasek and Powell, Australian Economic Papers, op. cit., p. 50.

98. ibid. p. 51.

Table 9.4.2

PRICE OF WOOL AND SYNTHETICS:
1954-1964
(U.S. prices — cents per lb.)

Year	Graded Fleece 3/8 Blood Clean Basis 1	Dacron 2	Orlon 3	Acrilan 4
1954	117.1	161.7	152.5	140.0
1955	107.5	157.9	147.9	135.3
1956	107.7	135.5	125.3	112.0
1957	121.9	141.0	128.0	113.0
1958	90.0	140.6	128.0	116.0
1959	102.1	136.0	128.0	118.0
1960	107.0	136.0	128.0	118.0
1961	103.2	127.0	126.0	120.7
1962	109.0	114.8	116.0	116.7
1963	117.5	114.0	106.0	110.0
1964	128.7	99.3	106.0	110.0
1965	117.0*			

* First quarter only.

Sources: Column 1 — Survey of Current Business and Business Statistics, U.S. Department of Commerce, Office of Business Economics.
Columns 2-4 — Wool Statistics and Related Data, 1920-1964. Statistical Bulletin No. 363, July 1965.

one would expect total "wool-type" fibres consumption to expand, on the basis of the growth of income and population which has occurred.

This suggests that it is becoming increasingly difficult to examine the market for "wool-type" fibres alone. Ideally projections for the wool market should be made by constructing an economic model of the fibre market as a whole and considering the scope for competition among all the different fibres. Such a detailed investigation is beyond the scope of our limited resources. Instead, we shall project the likely per capita changes for wool and "wool-type" fibres separately on the basis of the inter-country comparisons made earlier (equations 9.3.10 and 9.3.19 above). For tropical countries and for centrally planned economies, we shall use projections of other research workers.

Our two equations will give us an implicit projection of the demand for "wool-type" synthetics which can be adjusted in the light of the most recent growth rates of wool-type synthetics and the most likely future growth rates for such synthetics. Whilst this approach lacks the mathematical precision obtained by extrapolating growth curves, at least one previous attempt to project synthetics production on this basis was reasonably successful. A commercial study, assuming a crude 25-percent annual increase in world non-cellulosic fibre production, forecast the actual growth in synthetics production reasonably closely.[99]

5. PROJECTING THE DEMAND FOR WOOL

(a) The Developed non-Communist Countries

Using equations (9.3.10) and (9.3.19), we can estimate future wool consumption in the developed, non-Communist countries, using the assumed growth rates of population and of per capita incomes given in Tables 8.1.1 and 8.1.3. Equation (9.3.10) provides a projection for wool consumption, whilst (9.3.19) provides a similar projection for "wool-type fibres." Table 9.5.1 gives the consumption projections for major countries or regions, whilst Table A9.5.1 gives the projections for the individual countries excluded from Table 9.5.1.

The average annual compound percentage growth rates for the different regions (or major countries) implied by these projections agree reasonably well with those obtained by other research workers. A research study by the Committee of Economic Development of Australia summed up the concensus in the following terms: "It is to be expected that wool consumption will grow more rapidly in North America and Japan than it will in Europe, since the former areas are expected to have a faster growth of population in the sixties than Europe. Projections of the demand for imported wool suggest that wool consumption and imports in North America may rise at up to 2 percent per annum, that of Japan at about 4-5 percent per annum ..... The rate of growth for Continental Europe is likely to be about 2 percent per annum and for Britain it will probably remain at under 1 percent per annum."[100]

The projections in Table 9.5.1 imply average annual compound growth rates for wool consumption of 0.9 to 1.1 percent for the United Kingdom (for 1960-1970); 3.6 to 4.7 percent for Japan; 1.7 to 2.0 percent for North America; and 1.9 to 2.3 percent for Continental Europe. Our projections agree broadly with Balassa's estimate of an average annual growth rate for wool consumption for all developed countries of 1.7 to 2.2 percent (Table 9.5.1 implies a growth rate for all developed countries of 1.9-2.3 percent).

Unfortunately, the most recent data available suggest that all these projections considerably overstated wool consumption in the developed countries during the first half of the sixties. F.A.O. wool consumption estimates for developed countries as a group show a 0.7 percent rise between 1961 and 1962 and again between 1962 and 1963. Estimates for later years relate to mill consumption by the wool textile industries in consuming countries. These differ from wool consumption in each country because: (a) they exclude consumption on cotton and other spinning systems — a relatively minor factor, and (b) they are unadjusted for foregin trade in tops and wool textiles; hence they can be misleading for individual countries. But since most foreign trade in wool products is between developed countries, this should not affect the year-to-year

99. "Wool's Role in the Sixties", Lempriere (Aust) Wool Futures Pty. Ltd.; Forecasts of non-cellulosic production are given below (with actual production from the August 1965 issue of Textile Organon in brackets). 1960 - 1,585 million lbs (actual 1548); 1961 - 1,981 (1,830); 1962 - 2,476 (2,380); 1963 - 3,095 (2,936); 1964 - 3,869 (3,722).

100. Australia's Export Potential, published by the Committee for Economic Development of Australia, July 1964, p. 22.

Table 9.5.1

CONSUMPTION PROJECTIONS FOR WOOD AND "WOOL-TYPE" FIBRES USING INTER-COUNTRY INCOME COEFFICIENTS

	Base Period Consumption Average 1959-61	Projected Consumption (a)							
		1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
	(Millions lbs.)								
United Kingdom									
Wool	285.9	301.2	304.7	313.9	319.7	326.3	334.0	338.0	348.1
Wool-type	410.3	434.1	440.0	454.2	464.1	473.8	474.7	492.5	509.9
E.E.C.									
Wool	600.5	654.1	663.6	698.4	714.1	740.5	760.6	779.6	805.3
Wool-type	886.5	974.7	991.2	1048.1	1077.2	1116.4	1157.2	1184.3	1232.4
Other Non-Communist Europe									
Wool	290.6	333.3	345.7	381.0	405.9	429.9	466.5	483.9	535.7
Wool-type	343.7	399.9	417.1	462.1	497.1	528.2	580.5	600.5	674.0
Japan									
Wool	247.4	301.6	312.4	351.4	372.6	395.7	420.2	443.6	469.6
Wool-type	614.0	772.5	805.6	918.9	981.9	1049.4	1127.4	1178.4	1265.7
U.S.A. and Canada									
Wool	541.0	592.6	596.8	638.9	656.5	692.0	704.8	757.1	773.4
Wool-type	1121.7	1230.8	1240.5	1328.5	1349.4	1440.5	1445.6	1577.4	1617.3
New Zealand									
Wool	16.3	18.5	18.7	20.9	21.4	23.6	24.3	26.9	27.8
Wool-type	20.9	24.0	24.3	26.9	27.6	30.6	31.5	34.8	36.2
Australia									
Wool	57.5	65.0	65.9	72.1	73.6	80.2	82.5	89.1	92.2
Wool-type	86.2	97.9	99.4	108.5	111.6	121.3	125.4	134.9	140.2
Total — Developed Countries									
Wool	2039.2	2266.3	2307.8	2476.6	2563.8	2688.2	2792.9	2918.2	3052.1
Wool-type	3483.3	3933.9	4018.1	4347.2	4508.9	4760.2	4942.3	5202.8	5475.7

(a) "Low" and "High" refer to the income growth assumption.

Sources: (for base period consumption)
F.A.O., "Per Caput Fibre Consumption Levels", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 11, No. 1 (January 1962), pp. 1-28;
F.A.O., "World Apparel Fibre Consumption, 1960 to 1962", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 13, No. 4 (April 1964, pp. 1-33).
(for projections)
Equations (9.3.10) for wool and (9.3.19) for "wool-type fibres", and the population and per capita income growth rates used in Tables 8.1.1 and 8.1.3.

Table 9.5.2

CONSUMPTION OF MATERIALS BY THE WOOL TEXTILE INDUSTRIES IN SEVEN MAJOR COUNTRIES
(million lb.)

	United Kingdom	United States	Japan	France	West Germany	Italy	Belgium	Total	Total Expressed as Relatives (1959-61 = 100)
1959-61 Average									
Virgin wool*	487	382	268	284	154	186	83	1,844	100.0
Non-virgin wool	105	145	67	44	28	168	14	571	100.0
Man-made fibres	78	151	28	63	46	42	11	419	100.0
Other	36	33	17	64	51	69	4	274	100.0
Total	706	711	380	455	279	465	112	3,108	100.0
1962									
Virgin wool*	448	394	304	273	150	199	102	1,870	101.4
Non-virgin wool	96	154	71	44	24	185	11	585	102.5
Man-made fibres	87	194	30	73	48	44	15	491	117.2
Other	30	32	16	75	54	67	5	279	101.8
Total	661	774	421	465	276	495	133	3,225	103.8
1963									
Virgin wool*	458	371	302	278	151	191	97	1,848	100.2
Non-virgin wool	102	149	77	51	25	199	13	616	107.9
Man-made fibres	108	248	32	88	49	40	19	584	139.4
Other	32	34	20	86	60	68	6	306	111.7
Total	700	802	431	503	285	498	135	3,354	107.9
1964									
Virgin wool*	440	362	318	249	173	180	97	1,819	98.6
Non-virgin wool	103	114	75	47	25	168	13	545	95.4
Man-made fibres	135	333	40	97	57	47	21	730	174.2
Other	5	34	15	91	26	72	7	250	91.2
Total	683	843	448	484	281	467	138	3,344	107.6
1965									
Virgin wool*	425	396	334	241	179	184	100	1,859	100.8
Non-virgin wool	97	114	77	37	21	142	9	497	87.0
Man-made fibres	134	389	50	86	62	56	19	796	190.0
Other	4	34	10	87	40	71	9	255	93.1
Total	660	933	471	451	302	453	137	3,407	109.6

* Virgin wool includes fine hair.

Source: International Wool Textile Organization, "Wool Statistics" (Table 7A, Bulletin from 1959-60 to 1965-66).
[With the exception of 1965, figures for each year were collected from the Wool Statistics Bulletin of the succeeding year, thus providing revised statistics].

changes in wool consumption for developed countries as a group.

The mill consumption figures suggest that there has been virtually no change (perhaps a 1 percent increase) in wool consumption in all developed countries between our base period and 1965. This compares with an expected increase of about 11 percent on the basis of the estimated income elasticities (Table 9.5.1). Nor are price changes likely to be responsible for the stagnation in consumption. If the London price of 64's is regarded as representative for consumers, the 1965 price of 92.1 pence (sterling) can be compared with a 1959-61 base price of 89.7 pence.[1] It seems unlikely that a 2.7 percent price rise would depress consumption by 10 percent.

Table 9.5.2 gives the consumption of virgin wool and other materials by the wool textile industries in seven major wool-using countries (U.K., U.S.A., Japan, France, West Germany, Italy, and Belgium).[2] These figures show the trends in consumption after 1963 and also the quantitative importance of other fibres used in conjunction with virgin wool.[3]

1. It is true that prices rose higher in the interim – thus in January 1964, London 64's reached 119 pence sterling. This undoubtedly affected consumption. On the other hand, wool consumption in 1965 was raised by abnormal military demands.

2. These seven countries accounted for 77 percent of the wool consumption in all developed countries. But the mill consumption in the seven countries represents a somewhat larger share of the developed countries' total wool consumption (87%) since they are – as a group – net exporters of wool textiles (both to other developed countries and to the rest of the world).

3. On the other hand, the statistics understate the competition wool suffers from synthetic fibres since some proportion of synthetic fibre production is converted directly from man-made tow to top without combing and some textiles made entirely from synthetics do not pass through the wool textile industry even though they compete directly with products of the wool textile industry.

Before presenting our tentative revised judgements — for this is all that can be given — of the likely future trend in wool consumption in the developed countries, it seems desirable to make some explicit comment about the possible and probable effects of the increased expenditures on wool research, promotion, and development which have been authorised by the wool-growers of Australia, New Zealand and South Africa in recent years.

Research and Promotion

To counteract the growing threat from synthetics, wool interests are fighting back in two directions: Increased research, to make wool a more versatile fibre, and increased promotion, to reduce the present imbalance of expenditure.

It is difficult to judge how effective these means towards raising wool consumption will be. However, there are reasons for doubting that the likely future trends in these areas will be "product-neutral" — instead they seem more likely, on balance, to favour synthetics. This should not be construed as an argument against maintaining or increasing expenditure on either research or promotion by wool interests. On the contrary, we believe wool interests should explore every possible avenue to increase the demand for wool and reduce the cost of wool marketing and processing. What is attempted here is an assessment of the most likely future trends.

(i) Research

The major disadvantage of wool — as compared with synthetics — are that: wool is a relatively weak fibre and variable in strength and quality, it shrinks and is frequently not machine-washable, it yellows, some consumers find that it irritates their skin, it tends to wrinkle, and is often not mothproofed. The amount of research directed towards eliminating these faults varies considerably; a good deal of effort has been directed towards counteracting yellowing and shrinking, but very little towards the problem of skin irritation.

The question which arises is how effective research programmes designed to overcome these shortcomings of wool can be. Each of the improvements considered — machine-washability, increasing wool's strength, etc. — involves some increased cost during the yarn or cloth manufacturing process, and therefore some increase in the retail prices of the final product. Against the potential increase in demand resulting from the adoption of these improvements, one must therefore set the reduction in demand resulting from the increased processing costs. According to one careful study of the possibilities, the net expansion in demand which can be expected from the addition of these properties to wool garments may be around 5 percent — and possibly slightly lower.

It seems that research on synthetics is likely to allow manufacturers to undertake basic reconstruction of their fibres at an earlier stage in manufacturing and at lower additional cost. There is evidence to show that synthetics' manufacturers are actively working on modifications to their fibres to allow them to compete more effectively with wool. "Conjugate fibres are now being developed, either acrylic alone or with nylon, in which two components with different heat shrinkages are spun into one fibre which is then shaped into coils (5-10 per cm) by heat treatment. The fibre has bulkiness and elasticity inherent in it, and is much closer to wool than ordinary acrylic fibre".[4] Four Japanese firms and possibly manufacturers in other countries are working on this development.

4. Kayser Sung and R. H. Leary (eds.), Asian Textile Biannual, 1965–66 (Far Eastern Economic Review Ltd., Hongkong 1965), p. 44.

There are other textile developments which are likely to benefit synthetics at the expense of wool in the next 10 to 15 years. Two of these should be mentioned specifically.

First, the growth of non-woven fabrics and foam backs could have a serious impact on wool use in heavy overcoats and similar garments. In foam backs a thin sheet of plastic foam is combined with a lightweight face fabric. "The resulting product remains light in weight, but acquires both the additional stability and the insulating properties of a much heavier weight of knitted cloth".[5] There are still disadvantages and problems associated with these new products but they have improved considerably in recent years.

Second, the use of higher speed textile machinery and the possibilities being explored of different techniques of knitting and weaving are also likely to benefit the stronger and more uniform synthetic fibres at the expense of wool.

All this is not to deny that there are many other areas where research could benefit wool's competitive position. Thus research designed to reduce the costs of processing operations peculiar to wool (e.g., scouring) or research designed to reduce the costs of marketing and to provide processors with a product of a more uniform quality could have significant beneficial results on the demand for wool. On the other hand, these avenues of research are also open to synthetic fibre producers and doubtless energetic research aimed at improving the competitive position of synthetic fibres in these areas is also under way. On balance, it seems probable to us that research will benefit non-wool fibres and textiles more than it will benefit wool.

5. F. A. O., The State of Food and Agriculture 1964 (Rome 1964), p. 173.

(ii) Promotion

The world wide agency charged with promoting wool products — the International Wool Secretariat — is unusual in that it does not sell any of the products that it attempts to promote. Synthetic fibre producers, on the other hand, sell the product which they promote. They therefore can make some judgement as to whether their promotional expenditure achieved the desired effect — by examining changes in their sales before, during, and after a promotion campaign. We do not suggest that synthetic producers do not use more sophisticated techniques of judging the effectiveness of their promotion expenditure, but only that the data available to them to test its efficacy is very much better than that available to those charged with promoting wool. The International Wool Secretariat started, some years ago, to test the effectiveness of its promotional work, but up to mid-1965, it had not succeeded in measuring or quantitatively estimating the effectiveness of its promotion expenditure in terms of increases in wool consumption or price. It seems to us that the inherently greater difficulty in testing the effectiveness of wool promotion makes it likely that such promotion will not be as effective, dollar for dollar, as promotion undertaken by synthetics interests.[6]

Summing up Likely Future Trends

Balancing all the various factors which have to be taken into account, it seems to us most reasonable to project the demand for wool (at constant base-period prices) on the following assumptions: (i) Total materials used by the wool textile industries in all developed countries, for consumption within these countries will rise by 10-12½ percent during each 5-year period, or 1.9 to 2.4 percent per annum compound. This is somewhat higher than the rate achieved during the 5-year period 1959-61 to 1965, but equivalent to the growth rate implied by our projections based on inter-country income coefficients. (ii) The average annual growth rate of man-made fibre usage in the wool textile industries will slow down from 13.7 percent yearly during 1959-61 to 1965 to 7½-10 percent in 1965-70; 5-7½ percent in 1970-75; 2½-5 percent yearly in the last 5 year period which concerns us here. (iii) For the low projection, the demand for fibres (other than man-made) will be split between virgin wool and other fibres (non-virgin wool, cotton, etc.) in the proportion of 67/33. For the high projection we assume a rising trend — 73 percent in 1970, 75 percent in 1975, and 77 percent in 1980. This assumption was made to allow for the increasing emphasis put on the promotion of pure wool garments by the International Wool Secretariat. It was felt that this was more likely to affect the proportion of fibres other than man-made ones. (In the seven countries given in Table 9.5.2 the share of virgin wool varied between 66.7 and 71.2 percent between 1960 and 1965).

The results obtained from these assumptions are given in Table 9.5.3, which also gives estimates for the base year (1959-61) and for 1965.[7] The assumptions imply a slight (3%) decline in "most likely" wool consumption between 1965 and 1970; a further 0.9 percent decline between 1970 and 1975, followed by a 6 percent increase in wool consumption between 1975 and 1980 as the growth in man-made fibre use tapers off. Since, as pointed out above, other projections have arrived at much more optimistic conclusions, we stress two points: (i) the assumptions used here are not particularly pessimistic as far as wool is concerned. In particular the increase

6. It may be necessary to stress again that we are not attempting to praise or blame but solely to judge likely future trends.

7. The base period figures differ from those given in Table 9.5.2. The reasons are given in a footnote to Table 9.5.3.

in the usage of total materials is somewhat more optimistic than immediate past trends and some decline in the rate of growth of man-made fibre usage is postulated. (ii) It might be argued that, as the stagnation in wool consumption during 1959-61 to 1965 was accompanied by a substantial change in the relative prices of wool and synthetics, the experience of this quinquennium is unlikely to be repeated in the next 5 years. However, we are setting out at present to project likely wool use on the basis of constant base-period wool prices. Synthetics prices have been declining substantially in the last 5 years; as shown in Table 9.4.2. U.S. list prices of Dacron and Orlon were reduced substantially.[8] Between 1960 and 1964 Dacron prices were cut 28 percent; they have since been cut further. Orlon list prices were only reduced by 17 percent, but demand for acrylic fibres seems very strong and a substantially greater expansion in capacity was planned in 1965 than in any of the preceding 4 years. Further substantial reductions in synthetics prices are likely, partly from progressive reductions in raw material prices and in manufacturing costs, and partly from an expected reduction in profit margins. These are likely to be cut by the end of oligopolistic control of production for many non-cellulosic fibres (particularly the polyamides and polyesters) and increasing competition between synthetic fibre manufacturers. According to one synthetics manufacturer, acrylics prices may drop to about half their present level within the next 10 years. Our projections in Table 9.5.3 are based on an average price decline for all synthetics of about 25 percent over the next 10 years, and the maintenance of wool prices at base-period level.

(b) The Under-developed Countries

Projection of demand in under-developed countries presents more formidable difficulties. Because statistics of both real income and wool consumption are less reliable, estimation of income elasticities of demand for wool for these countries is likely to be less useful than for developed countries. Nor is it easy to judge the future importance of competition from other fibres.

In most under-developed countries per capita wool consumption is very low — partly for climatic reasons. Wool is pre-eminently a fibre used to shield the wearer against cold, hence there is less need for wool clothing in hot countries. However, there are large areas in the under-developed world where wool would be a desirable clothing fibre, but the mass of the population can only afford garments made from cheaper fibres. As a result we would expect the income elasticity of demand for wool to be relatively high in under-developed countries. Swan, on the basis of a very limited number of observations for Latin America, suggests that they are likely to be between 1.0 and 2.0.[9]

The under-developed countries have been grouped in three broad regions in our earlier tables (Tables 9.1.3 and 9.1.4), namely "Other East and South and South East Asia" (except Japan),[10] "Other Americas" (except Canada and the United

8. It is difficult to ascertain how realistic list prices of synthetics are. There have been persistent reports that price discounts are available; however there seems little doubt that the decline in list prices in the United States has been paralleled by a decline in the actual prices paid by textile manufacturers, though the timing of these reductions may have been different than suggested by the reduction in list prices.

9. Neil Swan, op. cit., p. 50.

10. This region is identical with the countries labelled "Far East (excluding Japan)" in the F. A. O. 's latest summary of wool consumption statistics; Monthly Bulletin of Agricultural Economics and Statistics, Vol. 14 Nos. 7/8 (July/August 1965) pp. 16-18.

Table 9.5.3

CONSTANT PRICE PROJECTIONS FOR WOOL (AND OTHER MATERIALS)
ALL DEVELOPED COUNTRIES — FIRST REVISION[a]

Type of Fibre	Based Period (1959-61)	1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
	in million lb. (clean wool)								
Virgin Wool	2,156	2,150	2,200	2,012	2,209	2,058	2,203	2,231	2,284
Man-made Fibres	490	900	950	1,287	1,530	1,647	2,188	1,861	2,800
Other Fibres	988	850	900	991	817	1,014	734	1,099	682
Total Fibre weight	3,634	3,900	4,050	4,290	4,556	4,719	5,125	5,191	5,766

(a) At constant base-period (1959-61) prices.

Sources: Base period virgin wool consumption from Table 9.1.3. This differs from base-period figures in Table 9.5.1 which summed totals for all developed countries, whilst the figure here is the world total minus Communist countries and underdeveloped countries. The discrepancy was noted in Table 9.1.3. Base-period consumption of man-made and other fibres from Table 9.5.2. 1965 consumption of all fibres estimated from Table 9.5.2.

States) and "Rest of the World", which includes Africa, the Near East, and Western Asian countries such as Iran and Afghanistan. Within each of these regions we can identify the major wool consuming countries. India accounted for about half the Asian region's wool consumption in the base period, 1959-61; the next largest wool consuming nation was South Korea (about 20% of the regional total). In both these countries shortage of foreign exchange limited wool consumption in the past and is likely to do so in the future.[11] In spite of this dampening factor, consumption in the Far East region as a whole has been rising fairly steadily in the post-war period, with an increase of over 85% during 1953-1963.[12] For this region, we estimated 1965 consumption on the basis of the latest obtainable import and consumption figures for India and South Korea. For later years we have made the following assumptions:

(a) For our "low" projection we assumed constant per capita wool consumption, but made allowance for the projected increase in population (Chapter 8, Table 8.1.2).
(b) For our "high" projection we assumed an income elasticity of demand for wool of 0.5, assuming that synthetics will replace an amount of wool equivalent to the difference between 0.5 and the "true" income elasticity for wool-type fibres of around 1.0-2.0. The growth of per capita income assumed is the "high" level of Table 8.1.4.

In contrast, the consumption of wool in the Latin American region remained remarkably constant at around 152-163 million lbs. between 1952 and 1960; in the next 3 years consumption dropped about 20%. The major consuming countries were Argentina and Brazil, each accounting for slightly more than a quarter of the wool consumed in Latin America in the base period, and Chile and Mexico (about 10% each). The decline in Latin American consumption in 1962 and 1963 was largely the result of a precipitous drop in Argentinian consumption during a period of currency instability and generally depressed economic conditions. Estimates of wool consumption by the Argentinian wool textile industry for later years suggest that Argentinian consumption has returned to its pre-1962 levels and perhaps exceeded them. Of the other major wool-consuming nations — Brazil, Chile and Mexico — only the last-named has shown a persistent long-run growth in wool usage; consumption more than doubled in the decade ending in 1962. Chilean consumption has remained relatively static, but subject to short-term fluctuations. A slight long-term upward

11. In India "manufacturers have stated that the reason for the non-achievement of the target for cloth in 1960-61 was the restrictions on imports of raw wool and tops made necessary by India's balance of payments position. Without these restrictions it is probable that consumption of wool in India may have been significantly higher in recent years" G. E. Seeber, "Wool in India", Quarterly Review of Agricultural Economics, Vol. 15, No. 3 (July 1962), p. 128. Since then restrictions on the import of raw wool have remained the major limitation on an expansion of output; the industry was more profitable than any other branch of the textile industry in India and yet was only working at 35-40% of capacity (cf. Asian Textile Bi-Annual 1965-66, op. cit., p. 116).

In South Korea, wool consumption has been falling since 1960 because wool imports have been reduced to husband scarce foreign exchange resources. At the same time man-made fibre production capacity is being expanded in an effort to save foreign exchange. Currently South Korea's worsted woolen textile industry consumes 60 lbs of wool for every 40 lbs of acrylics and polyesters. The authorities are attempting to reverse this ratio "to an eventual 30:70 proportion in favour of the chemical fibres. The lever for effecting this thorough structural change is the building of chemical fibre plants" (ibid. p. 191).

12. On the other hand Indian consumption in 1963 was probably exceptionally large because the Indian wool textile industry was geared to defence needs and given a special additional foreign exchange allocation for raw material imports. However the decade 1952-62 shows a rise of 66% in consumption in this region.

trend in Brazilian consumption is also noticeable.

An important factor of long-run significance has been the gains made by synthetics in wool's traditional markets. The International Wool Secretariat's mission to Latin America in 1964 reported to have found the penetration of synthetic fibres since 1961 to have been "wide and deep."[13]

In the light of past trends we made the following assumptions for our projections of wool consumption in Latin America: (a) For our "low" projection we assumed that yearly wool consumption will remain constant at 158 million lb. — the level of consumption in the base period. (b) For our "high" consumption we assumed that per capita consumption will remain constant, thus allowing for an increase in consumption as population grows. Since most wool consumption takes place in the four countries listed above, whose population growth is expected to be less than for Latin America as a whole, we have not used the population projections of Table 8.1.2 for Latin America as a whole; instead we have used population projections for the six most important wool-using nations in Latin America: Argentina, Brazil, Chile, Mexico, Uruguay and Peru.[14]

Our region "Rest of the World" is a rather mixed bag; apart from South Africa, the major wool-consuming nations in this group of countries are in the Near East and Northern Africa: Iran, Afghanistan, Morocco, United Arab Republic, Algeria, Irag, Lebanon, and Syria — in descending order of importance. The listed countries accounted for 55% of wool consumption in the base period. We have little information about factors influencing consumption in these countries and likely future trends. Consumption in this group of countries has been expanding by about 40% over the decade 1953-63. In the absence of adequate information we made the same assumptions for projections as for the Far East region (excluding Japan): for the "low" projection, that consumption per capita will remain constant and for the "high" projection that consumption per person will increase with projected incomes rising at the "high" level given in Table 8.1.4, and income elasticities assumed to be 0.5. The "low" projections give percentage increases in wool consumption which are slightly less than those experienced in the past decade, though the actual numerical increase in consumption is very similar to that actually realised between 1953 and 1963.

Our projections for all under-developed countries are given in Table 9.5.4.

(c) The Communists Countries

For our purposes these fall naturally under three headings: The Soviet Union; the Eastern European countries (excluding Yugoslavia), and mainland China and Asian Communist countries.

As shown in Table 9.1.3, wool consumption in Communist Europe rose substantially in practically every year between 1948 and 1961; the yearly increase averaged 9 percent. Per capita consumption also doubled in the fifties. By 1960, per capita consumption was some 30 percent below that of the Common Market countries (compared to 1950 when per capita consumption in Communist Europe was only one-third of that in the E.E.C. countries).[15]

13. Statement by Mr. B. D. Von Bibra at a press conference in Melbourne 26.1.65 upon his return from South America as a member of the I. W. S. Mission.

14. The population projections used were those found in Economic Commission for Latin America, Economic Bulletin for Latin America, Vol. 8, No. 2 (October 1963), p. 193, Table H. Each country was weighted by base period wool consumption.

15. There seems to be little difference in average per capita consumption between the Soviet Union and the remaining European communist countries as a group.

Table 9.5.4

CONSTANT PRICE CONSUMPTION PROJECTIONS OF WOOL — UNDERDEVELOPED COUNTRIES

Region	Base Period Consumption	Projected Consumption							
		1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
	in million lb. (clean wool)								
Other East, South and South-East Asia	65.9	77	88	86	106	97	128	110	154
Other Americas	157.5	158	179	158	201	158	226	158	254
Rest of World	123.8	139	150	157	183	179	227	203	284
Total	347.2	374	417	401	490	434	581	471	692

Sources: (for base period consumption) — F.A.O., "Per Caput Fibre Consumption Levels", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 11, No. 1 (January 1962), pp. 1-28; F.A.O., "World Apparel Fibre Consumption, 1960 to 1962", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 13, No. 4 (April 1964), pp. 1-33.

Table 9.5.5

TRADE IN RAW WOOL OF THE SOVIET UNION AND EASTERN EUROPE
('000 metric tons) (a)

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
IMPORTS										
Soviet Union	46.0	48.1	57.0	54.7	56.6	61.0	54.7	48.1	42.2	44.0
Czechoslovakia	16.0	18.0	19.0	19.0	24.0	25.0	22.0	20.0)		
Poland	16.3	14.5	19.0	19.4	20.7	18.7	17.6	18.5)	64.0	67.1
Other Eastern Europe	15.6	14.8	18.1	21.0	23.7	28.1	29.9	25.1)		
Total Soviet bloc	93.9	95.4	113.1	114.1	125.0	132.8	124.2	111.7	106.2	111.1
EXPORTS										
Total Soviet bloc	15.2	14.2	14.6	18.2	19.5	20.4	29.6	25.4	(not available)	

(a) This is a "mixed" weight basis. Statistics for Bulgaria, Czechoslovakia, East Germany, Hungary, Roumania and the Soviet Union are all either "clean", "scoured", or "washed", while those for Albania and Poland are on an "actual weight" basis.

Sources: Commonwealth Economic Committee, World Trade in Wool Textiles 1952-1962, p.119 (Figures 1955 to 1962).
Bureau of Agricultural Economics, The Wool Outlook (Mid-Year Supplement) July 1965, p.20.

Table 9.5.6

TRADE OF THE SINO-SOVIET GROUP IN RAW WOOL WITH COUNTRIES OUTSIDE THE GROUP
('000 metric tons)*

	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
IMPORTS													
Soviet Union	16.3	18.6	36.7	19.0	23.0	33.1	34.3	35.0	40.6	38.5	34.1	29.9	31.7
Czechoslovakia	6.8	11.0	12.0	11.0	13.0	15.0	14.0	19.0	20.0	18.0	15.0	15.0	
Poland	11.2a	10.8a	14.3a	16.3a	14.3	18.6	19.4	20.4	18.2	16.7	18.1	14.9	15.7
Other Eastern Europe	12.3b	13.3b	13.5b	9.5b	9.1	9.4	12.9d	13.8d	16.6d	8.3d	9.0d		
Total of Above	46.6	53.7	76.5	55.8	59.4	76.2	80.6	88.2	95.4	81.5	76.2		
China	0.3	0.7	1.2	1.2	1.2	3.0	5.2	10.2	23.2	11.3	14.4	16.4	19.1
Total of Sino-Soviet Group	46.9	54.4	77.7	57.0	60.6	79.2	85.8	98.4	118.6	92.8	90.6		
EXPORTS													
Soviet bloc (c)				4.3	3.9	2.9	5.8	5.8	4.9	4.6	3.9		
China				0.9	2.2	2.7	2.6	3.1	4.6	2.6	4.8		
Total Sino-Soviet bloc				5.2	6.1	5.6	8.4	8.9	9.5	7.2	8.7		

* "Mixed" weight basis.
(a) Total imports/exports.
(b) Total imports/exports for East Germany, Hungary and Bulgaria.
(c) Total includes Soviet Union, Roumania, Hungary, Bulgaria and Albania.
(d) Total imports/exports for Roumania.

Sources: Commonwealth Economic Committee, World Trade in Wool and Wool Textiles 1952-1963, p. 120, p. 141 (figures 1952 to 1962).
Commonwealth Economic Committee, Wool Intelligence November 1965 (for 1963 and 1964 Soviet Union imports).
Department of Primary Industry (Canberra) Wool Notes Nos. 65/8, 65/34, 65/50 (for Czech, Polish and Chinese 1963 and 1964 imports).

Table 9.5.7

CONSTANT PRICE CONSUMPTION AND IMPORT PROJECTIONS FOR WOOL — ALL COUNTRIES

Region	Base Period Consumption	Projected Consumption							
		1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
	million lb. (clean wool)								
Developed Countries	2156	2150	2200	2012	2209	2058	2203	2231	2284
Under-developed Countries	347	374	417	401	490	434	581	471	692
Communist Countries (net imports)	187	187	231	154	276	132	309	110	342
Total	2690	2711	2848	2567	2975	2624	3093	2812	3318

Sources: (for base period consumption) Tables 9.5.3 and 9.5.4; for Communist countries Tables 9.5.6 and Commonwealth Economic Committee, World Trade in Wool and Wool Textiles 1952-1963, Appendix 3, p. 171.

In our base period (1959-61), annual consumption averaged 682 million lbs (or about 310,000 metric tons), with the Soviet Union accounting for about two-thirds of this total. Table 9.5.5 gives the total foreign trade in raw wool of the Soviet Union and Eastern Europe. Much of this trade takes place between Communist countries — e.g., exports of wool from Mongolia and China to the Soviet Union, which normally exports some wool to East European countries — so it is of some interest therefore to estimate the quantity of raw wool which the Communist bloc has bought from non-Communist sources. This has been estimated by the Commonwealth Economic Committee and is reproduced in Table 9.5.6. While these imports are given on a "mixed weight basis" (for some countries they are clean weights, in others the actual weights of imports), a clean-content weight for total Sino-Soviet imports has been calculated by the Committee which makes it possible to estimate net Soviet-East European imports on a basis comparable to the F.A.O. consumption estimates mentioned above.[16] On the basis of these series of estimates, it seems that about 166 million lbs (or 75,000 metric tons) of the wool supplies available in Communist Europe in the base period were imported from outside the Sino-Soviet bloc; i. e., approximately 25 percent of the wool supplies available in Communist Europe in the base period were imported from outside the Sino-Soviet bloc.

Since 1961 wool consumption in Communist Europe appears to have declined slightly. As shown in Table 9.5.5, imports declined by some 20 percent between 1960 and 1963. In 1964 imports showed some rise, whilst the export figures of the five principal exporting countries show a substantial (20%) rise between 1963-64 and 1964-65.[17] This was probably the result of the decline in Soviet wool production, which has fallen by some 15 percent since 1963; sheep numbers have been reduced, as a result of drought and feed shortage, from a record high of 140 million in 1963 to 125 million in 1965. Future trends in net imports of wool to the Soviet Union and Eastern Europe will depend mainly on three inter-related factors:

1. Trends in the level of demand for wool-type fibres,
2. Likely trends in wool production in the Soviet Union and East European countries,
3. The expansion of synthetic fibre production.

In view of past trends and the general improvement in living standards in both the Soviet Union and East European countries, it seems reasonable to suppose that further increases in per capita consumption of wool-type fibres will take place. This conclusion is reinforced by two considerations:

(a) the greater emphasis placed on the development of light industries, and
(b) the further scope which exists for increases in wool consumption before these countries "catch up" with West European levels.

While there have been plans to increase the production of both wool and synthetic fibres substantially in the Soviet Union in recent years, actual production figures have fallen short of the targets aimed for by the planning authorities. Thus wool produced in the U.S.S.R. was supposed to rise by 17 percent between 1960 and 1965; actual production declined by 5 percent.[18]

16. Commonwealth Economic Committee, World Trade in Wool and Wool Textiles 1952–1963 (London, 1965), Appendix 3, p. 171.

17. Bureau of Agricultural Economics, Wool Outlook, December 1965 (Canberra) Table 4, p. 6. The 5 countries are Australia, New Zealand, and South Africa (using a June–July trade year) and Argentina and Uruguay (using an October–September trade year).

18. Planned production is given in The State of Food and Agriculture 1965, Food and Agriculture Organization (Rome).

Again, production of synthetic fibres, whilst rising rapidly, has fallen short of the target set by the planning authorities. Gosplan, the Soviet planning institute, has cut back projected output targets in the light of the (relatively) slow expansion of the chemical industry. "Gosplan's intention to cut back production of man-made fibres over the next few years will also have widespread ramifications: it is estimated that as a result of this reduction it will be necessary to double the acreage devoted to cotton as well as to considerably increase sheep stock. This could involve investment three times greater than would be necessary if the shortfall were made good by the chemical fibres industry."[19]

Less information is available about current trends in wool production and consumption in mainland China. As shown in Table 9.5.6, Chinese imports of wool rose rapidly until 1960, and dropped very substantially in 1961. This has been attributed to the use of scarce foreign exchange for the large purchases of grains from 1960 onwards. However, after 1961 imports of wool rose again, and by 1964, they had almost regained the 1960 level.

For the purposes of our projections we will attempt to estimate the future trends in the clean weight of net imports of the Sino-Soviet bloc as a whole. As pointed out earlier, on the basis of the figures in Table 9.5.6 and the clean weight estimates published by the Commonwealth Economic Committee, the clean weight of net imports into the Sino-Soviet bloc was estimated at 85,000 tons or 187 million lbs. in the base period. Net imports appear to have risen to about 95,000 tons or 209 million lb. in 1965. Allowing for the fragmentary nature of the information available to us, 1965 imports are given as a range — between 187 and 231 million lbs.

In assessing future trends, the possibility of a net decline in future imports by the Sino-Soviet bloc exists — if the attempts succeed to raise both wool and synthetic fibre production substantially. In our "low" projections we therefore allowed for a decline in net imports. On the other hand, if the planning authority's intentions are not fulfilled and foreign exchange is available, there is considerable scope for further expansion of imports and our "high" projections make some (arbitrary) allowance for this. Our high and low projections of imports by Communist countries and consumption in both developed and underdeveloped countries are consolidated in Table 9.5.7.

6. PROJECTIONS OF WOOL SUPPLY

Changes in the wool supply can be conveniently broken down into changes in sheep numbers and in average wool cut per sheep. As pointed out above, changes in sheep numbers were responsible for about two-thirds of the increase in world wool production in the post-war period.[20] The decline in the growth rate of world wool production after 1956-57 has been the result of the slower rate of growth of sheep numbers; world sheep numbers (and the total number of sheep in non-Communist countries) have remained virtually static since 1959-60, with increases in some

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Table VIII−4, p. 129. Actual production figures are taken from Bureau of Agricultural Economics, The Wool Outlook, December 1965 (Canberra) Appendix Table II, p. 30. Actual production in 1960 was already considerably below production planned for 1960; by 1965 sheep numbers were supposed to have reached 200 million [cf. B. A. E. Wool Economic Research Report No. 1 Wool in Communist Countries (Canberra, June 1960) Table 6, p. 14]. Actual sheep numbers in 1965 have been estimated at 125 million.

19. The Economist Intelligence Unit, Quarterly Economic Review, U. S. S. R. October 1965 (London) pp. 5−6. In spite of this cut back Soviet man-made fibre production is rising rapidly, having increased by over 70 percent between 1960 and 1964. From 1965 to 1970 a further 50 percent increase in output is planned.

20. cf. p. 337 above.

years being counterbalanced by declines in others. On the other hand, average wool cut per sheep has maintained an irregular, long-term upward trend. As Swan has pointed out "the difference in the behaviour of sheep numbers and sheep productivity is important for it suggests that the former is determined by rather different forces from the latter."[21]

Regression analyses by both Swan and Lowenstein have been unsuccessful in explaining changes of sheep numbers as a function of wool or lamb prices.[22] But it seems plausible that this break in trend in 1956-57 was caused by the sharp drop in world wool prices after 1956-57. Between 1949 and 1957 the average world export price for wool was $U.S. 1,626 per metric ton and the lowest value $U.S.1,357 in 1955. In the following 6 years, export prices averaged $U.S. 1,165 and never rose as high in 1955.[23]

Table 9.6.1 gives the mean annual percentage change in sheep numbers for major wool-producing countries for two post-war periods — 1949-50 to 1956-57 and 1957-58 to 1963-64. It shows that the decline in the growth rate of sheep populations took place in most of the important wool producing countries, except Argentina. The lack of expansion of sheep numbers in Argentina in the first period is probably the result of the export price policies pursued by President Peron until his replacement in 1955.

Table 9.6.1 also records sheep and lamb slaughterings as a proportion of total sheep numbers for the different countries for which this information is available. If the declines in the rates of growth are the result of economic factors (as opposed, for instance, to increased deaths from drought or disease), one would expect an increased proportion of sheep and lambs to be slaughtered.[24] As shown in the last two columns of Table 9.6.1, this is what has happened. Slightly corroborative evidence that changes in sheep numbers are responsive to wool prices is provided by the recent (1963-64) increase in wool prices which led to above-average increases in sheep numbers in both Australia and New Zealand in the following financial year.

For our projections we took account primarily of movements in sheep numbers since 1957, because since then wool prices have been fluctuating around the lower level at which we want to make our constant price projections. From the viewpoint of making trend projections this is not a long period; also, for most of the countries (or groups of countries) for which we wish to project sheep numbers, regressions of number of sheep on time do not provide a satisfactory fit. The procedure which was adopted for making projections varied from country to country according to the fit of trend estimates in the recent past and the additional information we have obtained from other sources. The regressions of sheep numbers on time obtained are given in Table A9.6.2. The projections of sheep numbers for the individual countries and/or regions are given in Table 9.6.2. The reasons for the adoption of the particular values used are given below.

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21. Swan, op. cit., p. 54.

22. Swan, op. cit., p. 55; F. Lowenstein, Wool, Trends and Prospects, Report No. EC-109, International Bank for Reconstruction and Development (August 30, 1962), p. 11.

23. F.A.O., The State of Food and Agriculture, 1965 (Rome 1965), Annex Table 14, p. 257.

24. But this is only a necessary, not a sufficient condition. It is possible that increased slaughtering percentages reflect mainly increased lambing percentages. For Australia – the only country for which we had detailed information – the increase in the lambing percentage would only have boosted slaughterings from 15.6 to 16.3 percent.

Table 9.6.1

CHANGES IN SHEEP NUMBERS AND SHEEP SLAUGHTERINGS: SELECTED COUNTRIES

Countries	Mean Annual Percentage Changes in Sheep Numbers		Average Sheep and Lamb Slaughterings as Percentage of Sheep Numbers	
	1949-50 to 1956-57	1957-58 to 1963-64	1949-50 to 1956-57	1957-58 to 1963-64
	percentages			
Australia	+4.1	+1.4	15.6	20.0
New Zealand	+3.3	+2.8	48.8	52.3
South Africa	+3.6	+1.3	10.6*	13.6*
Argentina	-0.6	+0.7	19.8	19.5
Uruguay	+0.2	-0.8	n. a.	n. a.
United States	0.0	-1.3	47.4	51.5
United Kingdom	+4.0	+2.9	34.8	40.6
Other-non Communist Countries	+0.6	+0.2	n. a.	n. a.
Communist Countries	+6.8	+2.4	n. a.	n. a.
World Total	+2.5	+1.1	n. a.	n. a.

* Abbatoir slaugherings only.

Sources of data: (for sheep numbers)
Bureau of Agricultural Economics, Statistical Handbook of the Sheep and Wool Industry, Third Edition 1961, pp. 5-6. Supplement to the Statistical Handbook of the Sheep and Wool Industry 1964, pp. 6-7. The Wool Outlook, Various Issues. Wool in Communist Countries (1960), p. 89.
(for sheep and lamb slaughterings)
Commonwealth Economic Committee, Meat (H. M. S. O., London, annual issues 1952 to 1965).

Table 9.6.2

PROJECTION OF WOOLLED SHEEP NUMBERS FOR NON-COMMUNIST COUNTRIES

Region	Base Period 1959-60	Projected Sheep Numbers							
		1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
	in million head								
Australia	154.6	154.0		164.6	171.7	167.9	175.1	169.7	173.3
New Zealand	47.9	51.3	53.4	55.1	58.3	58.8	63.3	61.9	68.9
South Africa	34.5	30	33	32	36	32	36	32	36
Argentina	46.9	48	50	48	53	48	57	48	60
Uruguay	21.5	21	23	21	25	21	27	21	29
United States	32.5	26.7		23.6	25.5	22	25.5	20.5	25.5
United Kingdom	28.5	29.2	32.8	31.0	36.6	32.7	40.5	33.4	45.5
Other Non-Communist Countries	310.8	303.5	318.0	303.5	318.0	303.5	318.0	303.5	318.0
Total Non-Communist Countries	677.2	663.7	690.9	678.8	724.1	685.9	742.4	690.0	756.2

Sources: (for base period) see Table 9.6.1.

For Australia our projection estimates are taken from Chapter VII.[25] For New Zealand the projection estimates are based on the regression equation

$$(9.6.1) \quad Y_t = 44.943 + \underset{(0.057)}{0.871}\,T \qquad R^2 = 0.979$$

where

Y_t = New Zealand sheep numbers in year t (in millions),

T = time (1957-58 = 1).

The high and low projections made are two standard deviations above and below the mean relationship.[26]

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25. In Chapter VII we projected the number of sheep shorn. This differs from the number of sheep at the census date (31 March), hence the figures given here for number of sheep shorn and wool cut per head differ from those in Chapter VII. For the sake of uniformity the definition used here for both sheep numbers and average cut per head for Australia conforms with that used for other countries even though it differs from that in Chapter VII. This will, of course, not affect projections of Australia's wool production.

26. A more detailed discussion of this measure is given in P. H. Karmel, Applied Statistics for Economists, 2nd edn. (Pitman, Melbourne 1963), pp. 194-200. The ranges indicated above were forecast using the formula

$$Y_F \pm t\hat{\sigma}_u \left\{ 1 + \frac{1}{n} + \frac{\sqrt{(x_0 - \bar{x})^2}}{\Sigma x^2} \right\}$$

where Y_F is the forecast value of Y (sheep numbers) given by the calculated regression equation;

t is the tabular t value corresponding to the chosen level of significance (in our case we adopted a 95 percent level of significance i.e. $t_{.025}$) at n − 2 degrees of freedom;

n is the size of the sample from which the regression equation being used was derived;

X_o is the value of the regressor (in our case, time with 1957-58 = 1) in the year for which the forecast is desired;

$\bar{x}$ is the arithmetic mean of the regressor (time) from which the regression equation was derived;

x^2 is the sum of squared deviations of observations employed in calculating the estimating relationship from the arithmetic mean $\bar{x}$;

$\hat{\sigma}_u$ is the simple standard error and is equal to

$\hat{\sigma}_{\hat{\beta}} \sqrt{\Sigma x^2}$ where $\hat{\sigma}_{\hat{\beta}}$ is the standard error of the regression coefficient.

This measure is employed in preference to the simple standard error because it takes into account the influence that a) the size of the sample (n), and b) the distance from the arithmetic mean $\bar{x}$ can have upon the accuracy of the estimates made.

For South Africa, regression of sheep numbers on time since 1957-58 gives a very poor fit (R^2 = .014). Since 1957-58, sheep numbers in South Africa fluctuated between a high of 35.8 million (1961-62) and a low of 33.8 million (1960-61) and there is no evidence of any pronounced upward or downward trend. Sheep numbers in South Africa were affected by a serious drought in 1964-65; our estimates for 1965 therefore ranged from 30 to 33 million. For succeeding years we project some recovery in sheep numbers back to the average levels ruling since 1957-58. In the case of Argentina, trend regressions on time since 1957-58 again give very poor results (R^2 = .07). Sheep numbers in Argentina fell from 48 million in 1957-58 and 1958-59 to 45 million in 1961-62. Since then they have regained the 1958-59 level. For our low projections we used the 1964 average. Since there is considerable scope for an expansion in sheep numbers in Argentina, provided its economic problems can be overcome, the high projection allows for a rise similar to that which took place over the last 3 years — an increase in sheep numbers of 3 to 4 million over each 5 year period. In Uruguay, sheep numbers since 1957-58 have again been static at a level of 21 to 22 million. For our low projections we are adopting this static level; on the other hand, as in the case of Argentina, there is considerable scope for an expansion in sheep populations, so our high projections allow for a possible increase of 2 million sheep every 5 years.

For the United States, sheep numbers declined approximately 600,000 each year since 1957-58. This decline has been particularly marked since 1960-61. A regression of sheep numbers on time for U.S. gave the following results:

$$(9.6.2) \quad Y_t = 33.800 - \underset{(0.274)}{0.621}\, T \qquad R^2 = 0.507$$

where Y_t = U.S. sheep numbers in year t (in millions),
T = time (1957-58 = 1).

For our projections we made the following assumptions. The low projection is based on a continued yearly decline of 621,000 sheep until 1970; after 1970 for the low projection we assumed arbitrarily that the decline will be half the previous absolute annual amount of decline. For our high projection we assumed that the decline will level off in 2 years and will stay at this value in the future.

In the United Kingdom, sheep numbers have risen steadily since 1957-58. Regressing sheep numbers on time gives the following relationship.

$$(9.6.3) \quad Y_t = 26.186 + \underset{(0.097)}{0.564}\, T \qquad R^2 = 0.871$$

where Y_t = U.K. sheep numbers in year t (in millions),
T = time (1957-58 = 1).

In the case of projections for the United Kingdom we used the same procedure as for New Zealand — given high and low projections which are two standard deviations from the mean.

For Other Non-Communist Countries there was little movement in sheep numbers. Regression of sheep numbers on time provides a very poor fit (R^2 = .037) Sheep numbers rose from 308 million in 1957-58 to 317 million in 1960-61; since then they have declined again to 308 million. In the absence of any marked long-term trend, the projection was based on the arithmetic mean of sheep numbers between 1957-58 and 1963-64. For the high and low projections, limits of two standard deviations have been set — giving a low value of $303\frac{1}{2}$ million and a high value of 318 million for all future years.

To obtain projections of wool production, given our projections of sheep numbers, it was necessary to estimate future trends in wool cuts per sheep. In most wool producing countries, productivity per sheep has tended to increase irregularly and fairly slowly since World War II. This trend is probably largely the result of genetic improvements and of better levels of nutrition. Neither factor is likely to be responsive to changes in wool prices.[27] There has been no evidence of any change in trend over the period.

Table 9.6.3 gives the regressions of wool cut per sheep for the major wool-producing countries (or groups of countries). For most countries the regressions were based upon figures for 1947-48 to 1963-64.[28] These were used to estimate future fleece weights per sheep for the projection period and are shown in Table 9.6.4 (which also gives 95 percent confidence limits).

Wool production figures are normally given on a greasy basis; however, to compare our supply estimates with the demand projections (which are given on a clean weight basis), it was necessary to apply clean yield factors to the quantities expressed on a greasy weight basis. Clean

27. On the other hand it is possible that an improvement in sheep meat prices (relative to wool prices) will induce farmers to keep animals with inherently lower wool producing potential – e.g., a higher proportion of breeding ewes. However, so far there has been no evidence of such a change.

28. For "Other Non-Communist", "Total Non-Communist" and "World" however regressions have been derived from statistics for 1955–56 to 1963–64. This is because woolled sheep number figures cannot be obtained separately for these groups of countries until 1955–56. Available statistics before 1955-56 include "non-wooled" sheep and these are irrelevant to the calculation of wool cut per sheep.

Table 9.6.3

SUMMARY OF REGRESSIONS OF WOOL CUT PER SHEEP UPON TIME (a)

Country/Region	Constant	Coefficient Independent Variable	Standard Error of Estimate	R^2
Australia	9.515	0.071 (0.017)	0.0360	0.544
New Zealand	11.059	0.057 (0.016)	0.0275	0.449
Scuth Africa	8.782	0.039 (0.012)	0.0149	0.413
Argentina	8.454	0.017 (0.017)	0.0236	0.061
Uruguay	7.114	0.102 (0.023)	0.0624	0.574
United States	9.274	0.040 (0.025)	0.0526	0.144
United Kingdom	4.229	0.010 (0.006)	0.0031	0.148
Other Non-Communist	2.947	-0.012 (0.007)	0.0012	0.283
Total Non-Communist	6.303	0.048 (0.014)	0.0069	0.631
U.S.S.R.	4.087	0.115 (0.006)	0.0144	0.962
Mainland China	3.093	-0.052 (0.014)	0.0209	0.488
Eastern Europe	3.438	0.121 (0.007)	0.0176	0.957
Total Communist Bloc	3.823	0.056 (0.007)	0.0088	0.804
World Total	5.145	0.065 (0.009)	0.0045	0.763

(a) For all countries and groupings time is the independent variable and wool cut per sheep the dependent variable. 1947-48 = 1 for all countries and groupings except "Other Non-Communist", "Total Non-Communist" and "World" where 1955-56 = 1.

Source: Tables A9.6.1 and 9.1.1.

Table 9.6.4

PROJECTED FLEECE WEIGHT, GREASY BASIS
(Pounds per sheep)

	Base Period: 1959-61			1965		1970		1975		1980	
	Actual Value	Estimated Value	95% Confidence Limits	Projected Value	95% Confidence Limits	Projected Value	95% Confidence Limits	Projected Value	95% Confidence Limits	Projected Value	95% Confidence Limits
Australia	10.7	10.5	± .8	10.8	± .9	11.2	± 1.0	11.5	± 1.1	11.9	± 1.3
New Zealand	11.7	11.8	± .8	12.1	± .8	12.4	± .9	12.7	± 1.1	13.0	± 1.2
South Africa	9.3	9.3	± .9	10.2	±1.0	11.1	± 1.1	12.0	± 1.3	12.9	± 1.4
Argentina	9.0	8.7	± .8	8.8	± .9	8.9	± 1.0	8.9	± 1.1	9.0	± 1.3
Uruguay	8.2	8.5	±1.1	9.0	±1.2	9.5	± 1.4	10.0	± 1.5	10.5	± 1.7
United States	9.9	9.8	±1.2	10.0	±1.3	10.2	± 1.5	10.4	± 1.7	10.6	± 1.9
United Kingdom	4.3	4.4	± .3	4.4	± .3	4.5	± .4	4.5	± .4	4.6	± .4
Other Non-Communist	2.9	2.9	± .4	3.0	± .4	3.2	± .5	3.3	± .5	3.5	± .6
Total Non-Communist	6.6	6.5	± .5	6.9	± .6	7.3	± .6	7.7	± .7	8.1	± .8
U. S. S. R.	5.7	5.7	± .3	6.2	± .3	6.8	± .4	7.4	± .4	7.9	± .4
Mainland China	2.5	2.4	± .7	2.1	± .7	1.9	± .8	1.6	± .9	1.4	± 1.0
Eastern Europe	5.1	5.1	± .3	5.7	± .4	6.3	± .4	6.9	± .5	7.5	± .5
Total Communist Bloc	4.6	4.6	± .3	4.9	± .4	5.1	± .4	5.4	± .5	5.7	± .5
World	6.1	6.0	± .4	6.3	± .5	6.7	± .5	7.0	± .6	7.3	± .7

Source: Table 9.6.3
Confidence limits obtained using formula given in footnote 26 in this chapter.

Table 9.6.5

CONSTANT PRICE PROJECTIONS OF WOOL PRODUCTION FOR NON-COMMUNIST COUNTRIES[(a)]

(Million lbs.)

Country	Base Period Av. 1958-59 to 1961-62	Projected Wool Production							
		1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
Australia	940 (1649)	981 (1706)		965 (1679)	1205 (2095)	1004 (1746)	1268 (2206)	1034 (1799)	1315 (2287)
New Zealand	395 (573)	400 (580)	475 (689)	437 (634)	535 (775)	471 (682)	603 (874)	504 (730)	675 (978)
South Africa	164 (322)	141 (276)	189 (370)	163 (320)	224 (439)	174 (342)	244 (479)	188 (368)	263 (515)
Argentina	241 (422)	216 (379)	276 (485)	216 (379)	299 (525)	213 (374)	325 (570)	211 (370)	352 (618)
Uruguay	109 (175)	102 (164)	146 (235)	105 (170)	169 (273)	98 (158)	193 (311)	115 (185)	219 (354)
United States	140 (314)	103 (232)	134 (302)	91 (205)	133 (298)	85 (191)	138 (309)	79 (178)	142 (319)
United Kingdom	83 (124)	80 (120)	103 (154)	85 (127)	120 (179)	90 (134)	133 (198)	94 (140)	153 (228)
Other Non-Communist	582 (895)	513 (789)	703 (1081)	532 (819)	765 (1177)	553 (850)	785 (1208)	572 (880)	848 (1304)
Total Non-Communist	2659 (4469)	2536 (4246)	3007 (5022)	2594 (4333)	3450 (5761)	2688 (4477)	3689 (6155)	2797 (4650)	3967 (6603)

(a) Clean basis. Corresponding greasy basis figures are given in brackets below the clean basis figures.

Sources: Base period: Table 9.1.1.
Projections: Tables 9.6.2 and 9.6.4.

Table 9.6.6

WOOL PRODUCTION AND CONSUMPTION
PROJECTIONS AT CONSTANT PRICES

	Production*	Consumption*
	(in million lbs clean wool)	
Base Period	2,659	2,690
1965	2,771.5 (±235.5)	2,779.5 (± 68.5)
1970	3,022 (±428)	2,771 (± 204)
1975	3,188.5 (± 500.5)	2,858.5 (±234.5)
1980	3,382 (± 585)	3,065 (±253)

* Production is for non-Communist countries; Consumption includes Sino-Soviet net imports from non-Communist countries

Source: Table 9.6.5 for Production.
Table 9.5.7 for Consumption.

yield factors were obtained from a variety of sources; in the main from explicit or implicit estimates published by the Commonwealth Economic Committee.[29] The clean yield factors used represent average clean yields for the 7-year period 1957-58 to 1963-64.[30]

Greasy and clean wool projections for the non-Communist countries are given

29. For Australia, New Zealand, South Africa, Argentina and the United Kingdom clean yield conversion factors were obtained from Commonwealth Economic Committee, Wool Intelligence (London, April issues, 1959 to 1965). For Uruguay, C.E.C. published clean conversion figures separately for merino and crossbred wools. An average for all Uruguayan wool was obtained, using F.A.O. estimates of the proportion of merino and crossbred wools (F.A.O. Monthly Bulletin of Agricultural Economics and Statistics, Vol. 10, No. 2, February 1961, p. 14). For the United States average clean yields were taken from the United States Department of Agriculture, Agricultural Statistics 1963, pp. 349-352. For "other non-communist countries" clean yields were estimated indirectly from the "total world" clean yield conversion factors implicit in the Commonwealth Economic Committee's estimates of the world clean and greasy wool production (published annually in Industrial Fibres - London), the Communist countries' clean yield conversion factors published in C.E.C. World Trade in Wool and Wool Textiles, 1952-63, and the clean conversion figures for the other countries given above.

30. For Argentina and "other non-Communist countries" this information could only be obtained for 4 years. A possible source of bias is introduced by the assumption that clean yields will not increase. In Australia, New Zealand and the United States there was a slight upward trend in clean yields (1% over 7 years for Australia and the United States, 1½% for New Zealand). In Argentina and the United Kingdom there has been a slight downward movement.

in Table 9.6.5 and may be compared with our consumption and import projections (at constant 1965 prices) in Table 9.5.7.

A comparison of the "most likely" production and consumption figures — at constant base-period prices — is given in Table 9.6.6. The table shows practically no misclosure between production and consumption estimates in either the base period or 1965. From 1965 on, our "most likely" constant price consumption projections fall short of the "most likely" constant price production projections; hence we would expect some downward pressure on wool prices to develop between 1965 and 1975. However, all projections of production and consumption are well within the "high" and "low" limits which were specified earlier, so we cannot be dogmatic about such downward pressure on prices. The "most likely" equilibrium price levels which would eliminate the divergence in consumption and production estimates will be examined in the next chapter.

Chapter X

FINAL EXPORT-IMPORT PROJECTIONS FOR THE SELECTED PRODUCTS

1. ESTIMATING LIKELY PRICE CHANGES FOR PASTORAL, CEREAL, AND DAIRY PRODUCTS

In this chapter the final export-import projections for the selected products are given. Before it is possible to make these, some comment is necessary about the constant price projections in Chapters VIII and IX. It is obvious from the range of possible demand and supply imbalances under constant prices that we cannot be certain of our ability to predict correctly the direction of the likely future movement in prices for Australia's major exports — let alone the extent of such a movement. One easy way out would therefore be to stick to the constant base-period prices for projection purposes. However, while these constitute a possible course of future prices, it does seem that a more likely set can be selected. We intend, primarily on the basis of Chapters VIII and IX, to formulate judgements about the "most likely" long term trends in prices — without having overmuch faith in the particular price paths selected. Ideally it would be desirable to fix on "low" and "high" prices — but the number of possible combinations of low and high prices for our 6-sector supply model (64) makes this procedure too ambitious to be attempted here. Instead we will select one "most likely" price path for each of the six major products. Our final projections will therefore be restricted to this set of prices; the "high" and "low" projections of production which would be obtained from the various combinations of plausible price paths would display very much wider bounds than those recorded here.

(i) Wool

As shown in Table 9.6.6 the "confidence limits" for our wool production and consumption projections are such that neither upward nor downward movements in the price of wool can be ruled out, though a downward movement appears more likely. To assess the possible size of this downward movement we made various assumptions about the sizes of the respective elasticities of demand and supply and about the relation between producer and consumer prices. In particular, we assumed the world demand elasticity to vary from a "low" of -0.75, through a "most likely" level of -1.5 to a "high" of -3.0; the world supply elasticity to range from a "low" of 0.1 through a "most likely" level of 0.25 to a "high" of 0.75. Lastly we assumed that the relationship between consumer and producer prices could be approximated by the following regression:

$$(10.1.1)\quad P_{Ut} = \underset{(4.83)}{10.31} + \underset{(0.081)}{1.846}\, P_{At} \quad (R^2 = 0.972)$$

where P_{Ut} = U.K. price of 64's clean wool in pence sterling in year t;
P_{At} = Australian price of greasy wool in pence Australian in year t;
and the period of the regression is from 1948-49 to 1964-65.

On the basis of these assumptions Table 10.1.1 shows the percentage price declines from the base-period level necessary to eliminate the imbalances in the "most likely" constant price production and consumption projections (Table 9.6.6).

As shown in Table 10.1.1 our projected price declines may be as low as 3 percent—or as much as $28\frac{1}{2}$ percent. In addition, we had to allow for the boost given to wool consumption as a result of the abnormally high level of military expenditure at the present time (September 1966). We assumed that, because of the high level of employment and output in the United States and in some other major wool consuming countries, the Australian wool price (strictly, its mathematical expectation) may rise to 52 cents (Australian) in 1966-67. After this we assume an average fall of 1 cent a year to 1970-71, followed by an average annual fall of $\frac{1}{2}$ cent per lb (greasy) until the end of our projection period. These are, of course, only average figures, the actual price paths being generated by the Monte Carlo procedure outlined in Chapter VII.[31]

31. In Chapter VII, it was pointed out that even under constant product prices, for a majority of products valuations per decision unit rise over time because of autonomous gains in productivity (i.e., wool cut per head increases secularly). If commodity prices are allowed to change linearly as well as productivity per decision unit, valuation per decision unit no longer follows a linear path over time but a quadratic trend. Fortunately, these quadratic trends are very shallow in all cases considered here; thus they may be approximated very closely by a linear trend. The method of approximation followed is outlined in the second section of the Appendix to Chapter X.

(ii) Wheat

The price Australian farmers receive for their wheat depends partly on the level of international wheat prices and partly on the operations of the Australian wheat stabilisation system. Australian consumers are charged a fixed home consumption price (which may differ from export parity), while the surplus is exported on whatever terms can be obtained by the central wheat marketing authority — the Australian Wheat Board. The price growers receive equals the average net receipts per bushel obtained by the Wheat Board from sales to all consumers, subject to two provisos: (a) If export prices fall below "cost of production" (at present, 153 cents Australian per bushel), growers receive at least this amount for all wheat sold for consumption in Australia and for the first 150 million bushels exported,[32] (b) there are certain provisions for payments into a stabilisation fund if export prices rise above the guaranteed return (at present 153 cents Australian).

The price Australian wheat growers obtain will depend therefore on future movements in the assessed cost of production and on the price received for Australian wheat on world markets. Cost of production has tended to move upwards over time — thus over the 7-year period 1954-55 to 1962-63 it rose by 25 percent, or about $3\frac{1}{2}$ percent per annum; there was a reduction of 9 percent in 1963-64. Since then assessed cost of production has again drifted upwards. Against this, our "most likely" projection for world trade in wheat (Table 8.5.5) suggests a downward trend in world wheat prices, though we would expect that the major exporters would (if necessary) restrict output in an attempt to minimise the decline in world prices.

32. Any difference is made up either by payments from the Treasury or from the stabilisation fund.

Table 10.1.1

WOOL PRICE MOVEMENT NECESSARY TO RECONCILE PRODUCTION AND CONSUMPTION PROJECTIONS†

Elasticity Assumptions*	1970	1975	1980
	(all figures in percentages)		
Pessimistic	-11.5 (-17.0)	-14.6 (-25.6)	-13.1 (-28.5)
"Most Likely"	-5.6 (-8.2)	-7.1 (-12.3)	-6.3 (-13.7)
Optimistic	-2.6 (-3.8)	-3.3 (-5.7)	-2.9 (-6.3)

† The underlined figures refer to the percentage declines necessary to eliminate the "most likely" production/consumption imbalances in Table 9.6.6; the figures in parentheses relate to an alternative constant-price supply projection which embodies trend in the Australian wool supply projection. This alternative model is discussed in the succeeding section: constant-price projections based upon it are given in Appendix Table A10.2.1.

* Demand and Supply Elasticity Assumptions: Pessimistic: -0.75 and 0.1 respectively; "Most Likely": - 1.5 and 0.25 respectively; Optimistic: -3.0 and 0.75 respectively.

For our wheat price projection we assumed a constant average price of 150 cents (Australian) a bushel — this could come about as a result of the home consumption price rising to 160 cents (Australian) over 10 years whilst the export price declines to 140 cents, with half the output sold at the guaranteed home consumption price; or by a proportionately greater rise in cost of production and a more severe fall in export prices. (The price received for Australian wheat on world markets was about 150 cents (Australian) a bushel in 1965-66 — though no official figures are yet available).

(iii) Coarse Grains

According to the projections in Table 8.5.6, world coarse grain prices may be expected to decline over the projection period. On the other hand, most Australian coarse grain production is consumed locally and exports consist mainly of barley and oats, whilst most world trade in coarse grains consists of maize. For our projections we assumed constant average prices of $A1.20 per bushel for barley and $A0.90 for oats.

(iv) Beef and Veal

The constant price projections in Table 8.4.6 summarised in Table 1.2 suggest that beef prices may rise over the projection period. They have already risen substantially since the base period. Thus our indirect estimate of the average auction price of beef was $A468 per ton carcass weight for 1965-66, compared with a base-period estimate (derived by the same estimation technique) of $A406.[33]

For our projections we assumed a starting price of $A460 a ton for 1965-66, rising by an average of $A4 a ton annually. (Because of the nature of the supply simulation projection model, it is difficult to use price regimes which are stable for

33. To arrive at these estimates we used an unpublished weighted index of prices received for beef and saleyard prices at the principal auction markets.

34. The actual estimate of $A468 for 1965-66 was used as data in the projection procedure: the figure of $A460 refers to the "intercept" for generating simulated prices from the assumed trend. The distinction is explained more fully in Chapter VII.

short periods only; otherwise it might have been preferable to use a price of $A465-470 a ton for 2 to 3 years, followed by a rising trend).

(v) Lamb and Mutton

In the case of lamb prices, our international price projections again suggest the likelihood of prices remaining above base-period values. Prices have risen from a base-period level of $A509 per ton carcass weight to an estimated $A647 in 1964-65 and $A734 in 1965-66. Some reduction in prices from this very high level seems likely; we regarded the 1964-65 price as a more reliable indicator of the price to be expected in the long-run than the 1965-66 estimate. Our long-term projections begin with a starting price of $A650 in 1965-66, rising slightly by an average of $A2 a ton (carcass weight) per annum.

Although our mutton supply projections do not depend on expected future mutton price movements, some judgment needs to be made about mutton prices to derive revised meat consumption projections. The average auction price has risen from an estimated base period level of $325 per ton (carcass weight) to an estimated $A415 for the average of 1964-65 and 1965-66. Our projections will be based on the assumption that mutton prices will continue to rise — to $A425 in 1970, $A435 in 1975 and $A450 in 1980.

(vi) Dairy Products

The milk price used in the supply projection model corresponds to the Commonwealth Statistician's gross unit value of milk produced for all purposes: this price was $A0.238 per gallon in the base period and $A0.25 in 1964-65. It is a blended price which does not, except by accident, correspond to the price actually received by any Austrlian dairy farmer. Producers for the whole milk market received considerably more than this price ($0.42 per gallon in 1964-65) whilst butter producers received only about 19 cents. In addition, for that portion of their output sold overseas, butter producers received in effect only about $A0.13 per gallon. To secure an internally consistent projection of the expected milk price, we considered likely movements in (a) local consumption of dairy products, and (b) export prices for dairy products.

Our constant price projections in Chapter VII suggested that production of dairy products would rise by 28.7 percent over the next 15 years (cf. Table 7.3.3). If consumption of milk (including milk consumed as butter, cheese, etc.) rises by less than this proportion, our constant price projection would be internally inconsistent.[35] Our consumption projections (cf. Table 5.3.4) give a rise in consumption of 25.6 percent by 1980 — if table margarine quotas are retained at their present level. However, if quotas are completely abolished, a 5-percent decline in total Australian milk usage (for butter, cheese and liquid milk) between 1965 and 1980 is forecast. At this stage, some further judgments about likely future levels of butter consumption are necessary. In view of the likely growth of Australian vegetable-oil production (and indeed of the expansion already apparent), it seems more reasonable to assume that there will be some liberalisation of present quota restrictions on table margarine production than that quotas will remain fixed at their current levels. In particular we assumed that per capita butter consumption will decline from the 1964-65 level of 22.8 lbs to 19.5 lb in 1970, 17 lb in 1975, and 16 lb in 1980. This would imply that total milk consumption (for butter, cheese, and whole milk, etc.) will

35. Unless overseas butter prices are expected to rise sufficiently to compensate for the declining proportion sold on the home market – an unlikely eventuality.

Table 10.1.2

PAST AND EXPECTED FUTURE PRICES FOR MAJOR PRODUCTS*
(in $ Australian)

Product	Unit	Historical†		Hypothetical Mean Prices Used for Projections**			
		Base Period	1965	1965-66	1970	1975	1980
Wool	Average Auction price per lb. of greasy wool	0.44	0.49	0.53	0.487	0.462	0.437
Wheat	Average return for bulk wheat at principal Eastern ports (per bushel)	1.367	1.42	1.50	1.50	1.50	1.50
Barley	Unit gross value of production (per bushel)	1.005	1.13	1.20	1.20	1.20	1.20
Oats	" " "	0.725	0.764	0.90	0.90	0.90	0.90
Beef and Veal	Indirect estimate of average auction price per ton of carcass weight	406	440	460	476	496	516
Lamb	" " "	509	691	650	659	669	679
Mutton	" " "	325	415	415	425	435	450
Dairy Products	Unit gross value of production (per gallon)	0.24	0.25 ††	0.25	0.227	0.202	0.177

* For historical price series on products other than mutton, see Alan A. Powell and F.H. Gruen, "Problems in Aggregate Supply Analysis, I: The Construction of Time Series for Analysis", Review of Marketing and Agricultural Economics, Vol. 34, No. 3 (September 1966) [in press]. For historical data on mutton prices see Table 6.4.1. The price index there should be multiplied by a factor of 2.385 to convert it to $A per ton carcass weight.

** For the years 1970, 1975 and 1980 the mean prices are the averages for the fiscal years 1969-70 and 1970-71; 1974-75 and 1975-76; 1979-80 and 1980-1981 respectively.

† Base Period is average for the years 1958-59 to 1961-62. 1965 figures are averages for the years 1964-65 and 1965-66.

†† 1964-65 estimate.

rise from 1,025 million gallons in 1965 to only 1,083 million gallons by 1980 (cf. Table 9.3.4. In addition, some slight downward movement in overseas butter prices may be expected (cf. Table 8.3.4). In practice the problem of dairy surpluses may manifest itself, not so much in a decline in butter prices, but in an inability to find any markets for butter: the world's largest importer, the United Kingdom, introduced a quota system for butter imports in 1962.

For our "equilibrium" price projections we assumed that the gross unit value of milk will decline from the 1965-66 level of \$A0.25 per gallon by a yearly average of \$A0.005 (by ½ cent Australian) over the projection period

***

In summary, our price assumptions for wool, sheep meats, beef, wheat, coarse grains, and dairy products are given in Table 10.1.2. For comparison, estimates of the actual prices ruling in the base period and 1965 are also given.

2. "EQUILIBRIUM" PROJECTIONS FROM 6-SECTOR SUPPLY MODEL: PASTORAL, CEREALS, DAIRYING

In Chapter VI the apparent lack of cross responsiveness between the wool and beef supplies was noted with some reservation. We mentioned the potential need for ad hoc surgery to the simultaneous supply system should substantial movements in the beef/wool price ratio be predicted. We are forecasting a substantial change in the price of beef relative to wool over the projection period. To allow for some transformation of potential wool output into beef production over the period to 1980 — a period during which we forecast secularly declining wool prices, but secularly increasing beef prices — we superimposed a 'judgement estimate' of the elasticity of transformation between beef and wool upon the supply model reported in Chapter VI. Not wishing to flout completely the historical evidence, we took a rather low value for our guess about the partial transformation elasticity between wool and beef: -0.05. This is numerically equal to the lowest estimated transformation elasticity elsewhere in the system. The adoption of this partial transformation elasticity meant that the coefficients of expected prices given in Table 6.3.6 needed revision in the case of the supply equations for wool and beef and veal. For these two products the expected price coefficients actually used in the first of two sets of projections documented below were as follows (see table below).

A second reservation about the suitability of our system for projection came from our

Product	Coefficient(a) with Respect to the Expected Price of					
	Wool	Lamb	Wheat	Coarse Grains	Beef and Veal(b)	Dairying
Wool	+2.983477	-0.002994	-0.514417	0	-0.010582	0
Beef and Veal	-0.010582	0	0	0	+0.001001	-0.002926

(a) Zero entries indicate coefficient constrained as such.
(b) Short run price. For coefficient of long run price, see Table 6.3.2.
All other parameters of the model which we will below label "trend-free" are as recorded in Chapter VI.

inability to come directly to grips with the investment function. The Nerlovian interpretation of our supply system implicitly recognizes the importance of investment in that potential output for year t depends on actual output in year t-1, which itself reflects the cumulative impact of prices (and of profitability) over several earlier years. Nevertheless, we felt somewhat uneasy about our treatment, particularly because the residuals from certain equations tended to exhibit autocorrelation that suggested neglected trends.[36] Moreover, even though we made rather painstaking attempts to pre-filter our output series of autonomous technological influences,[37] we were by no means confident that this attempt was successful; thus we were concerned lest insufficient scope for improvements in technology had been left within our model. Considerations of this led us to fit a second supply model, identical to that reported in Chapter VI, save that to every supply curve time was added as an additional shift variable.[38] The coefficients of this model are tabulated in the first section of the Appendix to Chapter X.

Projections — With and Without Trends

Our prior expectations were that the projections incorporating trends would be uniformly higher than the trend-free projections. In fact, the trend-based projections were indeed higher over all years projected, with the lone exception of beef. In the case of this product, the inclusion of trend so altered the coefficients of the opening inventory of non-breeding beef cattle and of the long-run expected price for beef that, for the latter decade of the projection period, the trend-based projections of beef output were slightly below the trend-free projections. As mentioned in Chapter VI, the inclusion of trends had a dramatic impact on the projected supply of cereals (Table 10.2.1), where the trend-free and trend-based projections are contrasted.[39] In view of the impact of trends on cereals, we questioned whether the acreages postulated by the trend-based projections were plausible or whether ceilings on grain acreages might be imposed by the availability of suitable crop land.

Potential Grain Acreage

Wheat: No reliable study of the potential area which can be sown to wheat and other cereals exists. The highest post-war acreage sown to wheat (for grain) was 18 million acres in 1964-65 in these States: New South Wales 5¾m acres, Victoria 3¼m acres, Queensland 1m acres, S. Australia 2¾m acres, and W. Australia 5.2m acres. The most careful study known to us concluded that "It is expected that in 1963-64 the Australian wheat acreage will be about 16.5 million acres. Indications are that, given satisfactory seasons, the acreage may rise to 18.0 million acres, but expansion beyond this level, in the short term, is unlikely."[40] In fact the area sown to wheat in the current year (1966-67) has been estimated at around 20½ million acres — suggesting that there were still substantial

36. See Powell and Gruen, "Problems in Agricultural Supply Analysis, II", op. cit.

37. "Problems in Agricultural Supply Analysis, I", op. cit.

38. As already noted, the model including trends was introduced as a hedge against underestimation of future output. In the case of the trend-based model, no attempt was made to superimpose a judgement estimate of the partial transformation elasticity between wool and beef: our experience with the trend-free model had indicated that this superimposition would have reduced our wool projections considerably without having much positive impact upon beef supplies.

39. Constant price projections based on the supply model including trends are given in Appendix Table 10A.3.1: these may be compared with Table 7.3.3.

40. L. W. McLennan, "Recent Wheat Acreage Changes in Australian States and Likely Future Movements", Quarterly Review of Agricultural Economics, Vol. XVI, No. 3 (July 1963), p. 144.

additional areas which could be sown to wheat. In making our estimates of the future potential acreage of wheat we took into account:

1. The large-scale clearing developments in the West Australian wheat belt — where approximately one-half to three-quarter million acres are being cleared annually (and there appears to be scope for a continuation of this process for a further 15 years or so). From this total area around 150,000 to 200,000 additional acres could be sown to wheat annually. This would account for an expansion of $2\frac{1}{4}$ to 3 m acres in 15 years.
2. It seems likely that the application of nitrogenous fertilisers will become more economic — partly because of the reduction in the price of nitrogen and partly because of the recent rise in wheat prices (which we believe will remain high during the projection period). The use of nitrogen is likely to reduce the need for the long pasture phase which has been a feature of much of Australian wheat growing in recent years. This will likely allow farmers to raise the proportion of their farm area sown to wheat fairly substantially. According to one estimate, it may double the proportion of the area devoted to grain production[41] on many farms in Western Australia.

Our own estimates allow for an increase of about 45 percent in the potential proportion of the national arable area sown to wheat. The reason that our estimate is considerably lower than the 100-percent increase forecast for Western Australia is that in the drier parts of the wheat belt, rainfall is generally the greatest factor limiting wheat yields; in such areas further expansion of acreage is unlikely to be profitable. Our estimates of potential wheat acreages are then as follows:

1965 — 20 m. acres, increasing by 800,000 acres annually to a potential of 32 m. acres by 1980.

Coarse Grains: In pragmatic fashion, we assumed that ceiling acreages for coarse grain aggregates would increase equiproportionately with those of wheat.[42] The postulated ceilings are:

1965 — 6.647 m. acres, increasing by 266,000 acres annually to a potential of 10.637 m. acres in 1980.

Equilibrium Supply Projections: A Synthesis

The reader will have become aware by now that these authors are in something of a dilemma about (if not positively schizoid in respect to) the question of inclusion versus exclusion of trends from the basis of our supply projections. On the one hand, time by itself is an explanator of very little power, and there seems little justification for arbitrarily assuming that supply schedules shift rightwards through time. This argument is strengthened by the fact that several of our output indicators — number of acres, number of livestock — are not of a kind that are overtly subject to increase as a result of improvements in technology. Yet it would be impossible to maintain that our trend-free treatment of Chapter VI fully recognises technological improvements or the feed-back of prices upon investment. The post-war sample period (1947-48 through 1964-65) was characterised by high levels of investment and some dramatic improvements of a technological variety. The use for projections

41. F.J. Roberts, E.N. Fitzpatrick, W.J. Toms, E.A.N. Greenwood, and G. Oliver, "The Prospects for Nitrogen Fertilizers in Western Australia", Journal of the Australian Institute of Agricultural Science, Vol. 32, No. 2 (June 1966), p. 79.

42. The base for these comparisons was taken as the average of 1964-65 and 1965-66 acreages.

to 1980 of estimated trend coefficients derived from data for this period would seem to us to be somewhat over-optimistic; the complete disregard of these trends, however, is also unpalatable because it would suggest that — apart from the long-term yield increases embodied in our model — there are no technological factors shifting the production frontier outward. In an entirely pragmatic spirit, we have come to a compromise by taking a weighted average of the two sets of conditional projections given in Table 10.2.1. Because of the caution with which we view projecting for long periods on the basis of trend, we have given two-thirds of the weight in the average to the trend-free projections, and one-third to the projections including trend. Again, we must stress that this 'mix' is based entirely on our hunches, and that we would not (indeed, could not) defend the choice of these proportions against any other set which might be proposed. A synthesis of projections along these lines is given in Table 10.2.2. In the case of wheat, the projections based upon the model incorporating trends gave implausibly high acreages; in these instances, our judgement estimate of the ceiling was substituted for the trend-based projected acreage when computing our synthetic weighted average.[43]

Conversion from decision to commodity units was made along the lines adopted in section 3 of Chapter VII. Perhaps one problem needing some additional description is the disaggregation of coarse grains. In order to compute an aggregate price index of values per acre for coarse grains — a prerequisite to the projections made here — acreage weights had to be assigned to the three grains barley, oats and maize. For the purposes of constructing such an index we assumed weights 0.43, 0.54 and 0.03 respectively: these figures were derived from acreages in the base period, 1958-59 through 1961-62. Now it is a feature of our system that these weights are endogenously determined [equations (7.3.1) and (7.3.2)]: thus they cannot, strictly speaking, be given ex ante, nor would they be constant (except by chance). In fact in disaggregating coarse grains we did not use constant proportions, but instead:

	1970	1975	1980
Barley:	.4200	.4310	.4465
Oats:	.5570	.5490	.5440

These figures are a compromise between results which would have been obtained from the trend-free model and those which have been obtained from the model including trends in output indicators. Whilst we recognise the internal inconsistency, its potential impact on our results is very slight.

Table 10.2.3 gives, in commodity units, the projections corresponding to the synthesis attempted in Table 10.2.2. In Table 10.2.4, the projected wholemilk supply is disaggregated into domestic consumption of liquid milk, plus supplies of butter, cheese and condensary products. The rationale differs from Chapter VII, section 3. The existence of the equalisation machinery for suppliers to butter and cheese factories ensures that these farmers obtain a return averaged over sales from the higher-priced local market and the (normally) lower-priced export market. Over the projection period we expect local consumption of (whole milk) condensery products and cheese to rise, whilst the consumption of butter is likely to remain stationary — or at best rise relatively less rapidly that that of condensery products and cheese. If butter manufacture were to take an unchanged proportion of the total milk supplies available for processing, the equalised return of suppliers to butter

43. Unfortunately, no allowance for feedback from wheat into potential output of other products could be made in the case of the trend-based projections which overshot ceiling acreages.

Table 10.2.1

TWO APPROACHES TO "EQUILIBRIUM" PROJECTIONS OF AUSTRALIAN SUPPLIES: PASTORAL, CEREALS, DAIRYING (DECISION UNIT BASIS)*

Year	Beef and Veal		Wool		Wheat			Coarse Grains			Lamb		Dairying	
	(a)	(b)	(a)	(b)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(a)	(b)
	(mil. tons carcass weight)		(mil. adult sheep shorn)		(mil. acres)						(mil. tons carcass weight)		(mil. dairy cows)	
Base Period Values:														
Average 1958-59 through 1961-62	.770		138.1		12.4			5.9			.203		3.230	
1965-66 (estimate)**	.949		141.7		17.5			5.9			.210		3.230	
1970 High	1.044	1.035	148.810	166.540	20.454	24.592		5.684	7.492		.238	.277	3.123	3.277
1970 "Most Likely"	.965	.955	145.919	163.649	19.632	23.770	24	5.321	7.129	7.977	.210	.249	3.010	3.163
1970 Low	.885	.876	143.028	160.758	18.810	22.948		4.959	6.767		.181	.220	2.896	3.050
1975 High	1.203	1.182	146.847	185.468	23.078	31.887		5.420	8.368		.247	.314	2.959	3.168
1975 "Most Likely"	1.117	1.097	142.986	181.607	22.091	30.900	28	5.068	8.016	9.307	.216	.283	2.849	3.058
1975 Low	1.032	1.011	139.125	177.746	21.104	29.913		4.716	7.664		.185	.252	2.739	2.948
1980 High	1.299	1.269	140.892	201.158	25.663	38.592		5.482	9.449		.284	.366	2.788	3.093
1980 "Most Likely"	1.215	1.176	136.444	196.710	24.521	37.450	32	5.020	8.987	10.637	.236	.318	2.683	2.988
1980 Low	1.131	1.083	131.996	192.262	23.379	36.308		4.558	8.525		.188	.270	2.578	2.883

* Based on sample means of Monte-Carlo experiment over 60 replicates. For commodity price assumptions, see section 1 of text. "Most likely" values for 1970 and 1975 are averages of projections for 1969-70 and 1970-71, and for 1974-75 and 1975-76, respectively. "Most likely" value for 1980 has been taken as projected value for 1979-80 (1980-81 was not projected). Limits were established by adding and subtracting one estimated sampling standard deviation.

** Latest estimate available of actual value achieved in 1965-66.

(a) Based on trend-free model.

(b) Based on model including trends.

(c) Judgement estimate of maximum acreage which could be planted in year shown.

Table 10.2.2

A SYNTHETIC APPROACH TO "EQUILIBRIUM" PROJECTIONS OF AUSTRLIAN SUPPLIES: PASTORAL, CEREALS, DAIRYING (DECISION UNIT BASIS)*

Year	Beef and Veal (m. tons carcass weight)	Wool (millions of adult sheep shorn)	Wheat (millions of acres)	Coarse Grains (millions of acres)	Lamb (m. tons carcass weight)	Dairying (millions of dairy cows)
Base Period Values: Average 1958-59 through 1961-62	.770	138.1	12.4	5.9	.203	3.230
1965-66 (estimate)**	.949	141.7	17.5	5.9	.210	3.230
1970 High	.985	158.698	22.270	6.647	.257	3.150
1970 "Most Likely"	.935	150.863	20.540	5.803	.219	3.023
1970 Low	.885	143.028	18.810	4.959	.181	2.896
1975 High	1.132	170.021	25.698	7.150	.271	3.025
1975 "Most Likely"	1.082	154.573	23.401	5.933	.228	2.882
1975 Low	1.032	139.125	21.104	4.716	.185	2.739
1980 High	1.223	178.090	29.127	7.820	.306	2.922
1980 "Most Likely"	1.177	155.043	26.253	6.189	.247	2.750
1980 Low	1.131	131.996	23.379	4.558	.188	2.578

* Based on Table 10.2.1. "Most likely" value is a weighted average of the 'low' value for the trend-free projection and the 'high' value of the trend-based projection with weights 2/3 and 1/3 respectively. The exceptions to this rule have been the grains where, in the weighted average referred to above, instead of the 'high' value of the trend-based projection we have used either that value or our judgement estimate of the ceiling acreage, whichever was the less. 'Low' value in this table is the 'low' value for the trend-free projection of Table 10.2.1; the 'high' value is placed symmetrically above the "most likely".

** Latest estimate of actual achieved in 1965—66.

Table 10.2.3

"EQUILIBRIUM" PROJECTIONS FOR SUPPLIES OF WOOL, BEEF AND VEAL, LAMB, CEREALS AND WHOLE MILK: NATURAL COMMODITY UNIT BASIS*

Year	Wool	Beef and Veal	Lamb	Wheat	Barley	Oats	Whole milk
	(m. lbs greasy)	(millions of tons carcass weight)		(millions of bushels)			(m. gallons)
Base Period Values: Average 1958-59 through 1961-62	1,648.7	.770	.203	233.6	51.7	66.2	1,390
Average of 2 Fiscal Years centred on: 1965 (estimate)**	1,706.0	.949	.210	313.4	44.6	64.0	1,512
1970 High	2,195.7	.985	.257	512.5	99.6	114.8	1,540.7
1970 "Most Likely"	1,919.1	.935	.219	415.1	57.1	70.2	1,474.9
1970 Low	1,658.6	.885	.181	327.4	23.4	34.3	1,409.5
1975 High	2,417.5	1.132	.271	623.5	115.2	130.8	1,573.3
1975 "Most Likely"	2,022.5	1.082	.228	501.3	63.0	77.0	1,495.5
1975 Low	1,660.7	1.032	.185	392.1	24.2	36.2	1,418.0
1980 High	2,613.9	1.223	.306	740.2	135.8	150.7	1,610.3
1980 "Most Likely"	2,092.2	1.177	.247	591.0	71.0	85.4	1,512.2
1980 Low	1,622.2	1.131	.188	458.4	25.5	38.1	1,414.5

* For price assumptions, see section 1 of text. Based on Tables 10.2.2 and 7.3.1.

** Based on Bureau of Agricultural Economics, Trends in Australian Rural Production and Exports, No. 38 (Canberra, June 1966) [Mimeo].

Table 10.2.4

"EQUILIBRIUM" PROJECTIONS OF SUPPLIES OF LIQUID MILK, BUTTER, CHEESE AND CONDENSERY PRODUCTS*

Years	Whole milk Equivalent (Total) (a) 1	Domestic Liquid (b) Milk Consumption 2	Supplies Available for Processing (c) 3	Projected Supply of: Butter (d) 4	Cheese (e) 5	Condensary Products (f) 6
	(millions of gallons)			(thousand tons)		(m. gallons whole milk equivalent)
Base Period Values: Average 1958-59 (g) through 1961-62	1,390	313	1,077	192.9	47.7	79.6
Average of 2 Fiscal Years Centred on 1965 (estimate) (h)	1,519	349	1,170	204	59.5	96
1970 High	1,541	377	1,196	198.9	70.8	113.6
1970 "Most Likely"	1,475	360	1,115	185.4	66.0	105.9
1970 Low	1,410	345	1,033	171.8	61.1	98.14
1975 High	1,573	428	1,194	189.6	83.2	127.8
1975 "Most Likely"	1,496	400	1,096	174.0	76.4	117.3
1975 Low	1,418	379	990	157.2	69.0	105.9
1980 High	1,610	485	1,194	184.1	92.6	133.1
1980 "Most Likely"	1,512	450	1,062	163.7	82.3	118.4
1980 Low	1,415	416	930	143.4	72.1	103.7

* For price assumptions, see Section 1 of text.

Sources and Notes:

(a) Table 10.2.3.

(b) Projections from Table 5.3.4.

(c) Difference between preceding two columns: High = high of column (1) minus low of column (2); low = low of column (1) minus high of column (2); Most likely = "most likely" of column (1) minus "most likely" of column (2).

(d) Conversion factor 1 ton of butter = 4,666.6 gals of whole milk. For 1970: 77.6% of column (3); for 1975: 74.1% of column (3); for 1980: 71.95% of column (3).

(e) Conversion factor 1 ton of cheese = 2,180.3 gals of whole milk. For 1970: 12.9% of column (3); for 1975: 15.2% of column (3); for 1980: 16.9% of column (3).

(f) 9.5, 10.7 and 11.15 percent of column (3) for 1970, 1975 and 1980 respectively.

(g) Commonwealth Bureau of Census and Statistics, Rural Industries, Bulletin No. 1, 1962-63 (Canberra, 1965).

(h) Based on Bureau of Agricultural Economics, Trends in Australian Rural Production and Exports, No. 39 (Canberra, September 1966) [Mimeo].

factories would decline, relative to the returns obtained by farm suppliers to cheese or processed milk factories. We therefore assumed that the proportion of milk for processing which is manufactured into butter, cheese, and condensery milk products will be equal to the proportions of total milk (for processing) consumed as those products.[44]

3. FINAL EXPORT-IMPORT PROJECTIONS FOR THE SELECTED PRODUCTS

In this section the final export-import projections will be given — both in terms of quantities and values. In all cases we will restrict ourselves to "most likely" magnitudes.

(i) Wool

Table 10.3.1 gives projections of Australian wool production and exports. Export figures are for all forms including yarns.[45] To obtain the value of wool exports, allowance was made for the difference between the average auction price of greasy wool and (a) the average f. o. b. export value of greasy wool, and (b) for the extra value added when wool is exported at a later stage of processing (scoured wool or tops, etc.). During 5 recent years (1958-59 to 1961-62 and 1964-65), unit export values were, on average, 4.9 cents Australian higher than the auction price for greasy wool.[46] For Table 10.3.1, we used an average addition of 5 cents Australian to cover the gap between unit export values and the expected average auction prices for greasy wool given in Table 10.1.2.

Our projections of wool exports can be compared with projections made by the Bureau of Agricultural Economics for the Vernon Committee.[47] For 1974-75, the Bureau projected wool exports at 1,885 million lbs (greasy equivalent), compared with our 1975 projection of 1,950 million lbs. However, our projection includes exports of tops and yarn, whilst the B. A. E. projections appear not to include these items — which accounted for 35 to 37 million lbs (greasy equivalent) in the base period and 1964-65. Our estimates are approximately 30 million lbs or $1\frac{1}{2}$ percent higher.

(ii) Meat

Before we could obtain export projections, some reconsideration of our meat consumption projections was necessary. Our original meat consumption projections in Chapter V used a base period equal to the average of the normal 1960 base period and 1964-65. Since we expect a further rise in meat prices during our projection period, some reduction in projections of per capita consumption seems called for. We originally intended to use

44. In 1964-65 the proportions of milk (for processing) channelled into butter, cheese and condensery product manufacture were 80.5, 11.7, and 7.8 percent respectively, whilst the proportions of total milk (for processing) consumed as butter, cheese and condensery products were: 80.9, 11.1 and 8.1 percent respectively.

45. In particular, it includes wool exported in its greasy state; slipe, scoured and carbonised wool; wool exported on skins; wool exported as tops and as woollen and worsted yarn.

46. The gross value of wool exported in the various forms given in footnote 45 above, was divided by the Statistician's estimate of 'Total' Australian Wool Exports - Greasy Basis (cf. Commonwealth Bureau of Census and Statistics, Wool Production and Utilization, Vol. 13, 1964-65 and earlier volumes, Table 1). This unit export value was subtracted from the average auction price each year. The excess ranged from a minimum of 1.4 cents Australian in 1960-61 to 8.7 cents Australian in 1959-60. The large annual differences would reflect, primarily, differences in wool prices over time periods covered in the auction series and the export statistics respectively - e. g., a considerable proportion of wool sold in 1959-60 may not be shipped until 1960-61.

47. Vernon Report, op. cit., Vol. II, p. 1012.

Table 10.3.1

PROJECTIONS OF WOOL EXPORTS, AUSTRALIA: 1960 TO 1980
(Quantities and Values; "most likely" estimates)

	Unit	Base Period†	1965	1970	1975	1980
Production*	million lbs; greasy basis	1,649	1,706	1,919	2,022	2,092
Total Exports††	million lbs; greasy basis	1,594	1,644	1,850	1,950	2,020
Value of Exports	$ A million	739.5	857.2	994	999	985

† Base period is average for years 1958–59 to 1961–62. All other years are averages of the two fiscal years entering on the calendar year; e.g. 1974–75 and 1975–76 for 1975.

* Includes wool exported on skins.

†† Includes wool exported on skins, greasy, slipe, scoured and carbonised wool; wool exported as tops and as woollen and worsted yarns.

Source of Data:

Production: Table 10.2.3.
Exports: (for base period and 1964-65) Commonwealth Bureau of Census and Statistics, Wool Production and Utilization, Vol. 13, 1964-65 and earlier volumes, Table 1; for 1965-66 our estimates. For later years some small growth in Australian consumption of locally produced wool assumed.
Value of Exports: (for base period and 1965) Commonwealth Bureau of Census and Statistics, Overseas Trade, Vol. 62, 1964-65 and earlier volumes, Table 14, Wool, greasy, scoured or washed, carbonised, tops, noils and waste, sheep and lambskins; for later years quantity exported multiplied by projected average gross unit export values (=average projected auction prices from Table 10.1.1 plus 5 cents Australian).

the demand equations in Chapter IV to estimate per capita consumption; however, these equations use "real" retail prices as explanatory variables, while our projection model on the supply side relies on auction prices. The only major econometric study of meat marketing margins was of little use to us, since it examined changes in quarterly data.[48] Short run changes in auction prices tend, in large measure, to be absorbed by retailers, rather than being passed on to the consumer. However, it is doubtful whether these results can be extended to a situation where a long-term upward trend in auction prices is forecast.

Instead we made some arbitrary revisions in our per capita consumption projections. Because of the expected rise in the price of beef and lamb, consumption projections for beef and lamb were reduced. Since pork consumption evidently responds to changes in the retail price of other meats, pork consumption projections were raised. Mutton consumption projections were not changed, since the simultaneous rise of beef and mutton prices may leave mutton consumption unaffected [cf. equation (4.4.3)].

Our revised per capita meat consumption projections are given in Table 10.3.2. For comparison, the original "most likely" projections from Table 5.4.1 are given in brackets.

We can now discuss the derivation of our export projections for beef, lamb and mutton (Table 10.3.3). Beef and lamb production projections were taken from our final equilibrium six-sector supply projections (Table 10.2.3). Mutton production projections were made by using equation (6.4.1) which estimates mutton production as a function of (a) the number of adult sheep shorn, (b) the change in the number of sheep shorn between the present and the past year, and (c) a drought mortality index. For projecting mutton production, we used the projection of adult sheep shorn in Table 10.2.2 and assumed an average drought mortality of 6.3 percent. Using the "most likely" sheep numbers from Table 10.2.2 gave "most likely" mutton production projections of 385,000, 400,000, and 404,000 tons for 1970, 1975, and 1980 respectively. Since we are forecasting a rise in the mutton/wool price ratio it seemed reasonable to allow for some slight production response to this change in relative prices.[49] We therefore arbitrarily raised our "most likely" mutton production projections by $2\frac{1}{2}$, 5, and $7\frac{1}{2}$ percent for 1970, 1975, and 1980 respectively.

To obtain projections of meat exports, the quantity of meat consumed in Australia was deducted. Total Australian consumption projections were obtained by multiplying the per capita consumption projections of individual meats (Table 3.1.1). For beef and mutton, an allowance for meat used for canning was made as well. It was assumed that the quantity of beef and mutton used for canning would remain at the estimated average levels for 1964-65 and 1965-66.

Our export projections can again be compared with those made by the Bureau of Agricultural Economics for the Vernon Committee. B. A. E.'s projections are in terms of export product weight, whilst our projections are in terms of carcass weight equivalent. Hence, some conversions are necessary before a comparison can be made. Using the conversion ratio ruling for exports in 1961-62, B. A. E.'s 1974-75 projection of mutton exports (in terms of

48. Ian W. Marceau, "Quarterly Estimates of the Demand and Price Structure for Meat in New South Wales", Australian Journal of Agricultural Economics (forthcoming).

49. One way in which such a price response might be attained is by an increase in the proportion of breeding ewes in the national sheep flock.

Table 10.3.2.

REVISED "MOST LIKELY" PER CAPITA CONSUMPTION PROJECTIONS FOR CARCASS MEATS, AUSTRALIA, 1960 to 1980

Type of Meat	Base Period*	1965	1970	1975	1980
	lb/head carcass equivalent weight				
Beef and Veal	98.7	95.3	94 (101)**	92 (105)	90 (107)
Lamb	38.0	37.8	39 (41)	41 (44)	43 (47)
Mutton	59.4	45.0	49	46	43
Pork	11.5	13.0	15 (13)	17 (15)	19 (16.5)

* Base period is the average for years 1958—59 to 1961—62. All other years are averages of the two fiscal years centering on the calender year; e.g. 1975 = average of 1974—75 and 1975—76.

** Original "most likely" projections given in Table 5.4.1. (p. 5—19). (1965 consumption figures here differ from those in Table 5.4.1. —the latter being compiled before 1965—66 consumption estimates became available).

Sources of data:

Base Period: Commonwealth Bureau of Census and Statistics, Report on Food Production and the Apparent Consumption of Foodstuffs and Nutrients in Australia, No. 20, 1964-65 (Canberra).
1964-65 and 1965-66: Commonwealth Bureau of Census and Statistics, Statistical Bulletin: The Meat Industry, Australia — June 1966 (roneod) Table 13. (1965-66 estimates are subject to revision).

Table 10.3.3

PROJECTIONS OF MEAT EXPORTS, AUSTRALIA 1960 TO 1980
(Quantities and Values; "most likely" estimate)

Type of Meat	Unit	Base Period*	1965	1970	1975	1980
Beef and Veal †						
Production	) '000 tons	770	949	935	1,082	1,177
Consumption	) '000 tons	451	484	524	573	621
Use for Canning	) '000 tons	56	60	60	60	60
Exports — quantity	) '000 tons	262	405	347	449	496
— value	$A million	105	198	167	225	258
Mutton †						
Production	) '000 tons	354	369	395	420	434
Consumption	) '000 tons	272	229	275	287	299
Use for Canning	) '000 tons	22	10	10	10	10
Exports — quantity	) '000 tons	60	120 ††	110	123	125
— value	$A million	13	33	31	36	38
Lamb †						
Production	) '000 tons	203	210	219	228	247
Consumption	) '000 tons	175	192	219	255	297
Trade — quantity	) '000 tons	28	20 ††	-	-27	-50
Value of exports	$A million	10	9.5			
Canned Meat ‡						
Production	) '000 tons	63	50	50	50	50
Consumption	) '000 tons	20	24	33	38	43
Exports — quantity	) '000 tons	42	26	17	12	7
— value	$A million	24	15	11	8	5
Other Exports						
Beef Offals	) $A million	5.2	9.3	)		
Pigmeats	) $A million	0.6	0.6	)		
Poultry	) $A million	0.2	0.4	)		
Rabbit and Hare	) $A million	5.4	4.0	) 40	45	50
Meat Extracts, Sausage Casings and "Other"	) $A million	9.4	16.7	)		
Total Value of Meat and Meat Product Exports	$A million	173	287	249	314	351

* Base period is the average for years 1958-59 to 1961-62. All other years are averages of the two fiscal years centering on the calendar year; e.g. 1975 = average of 1974-75 and 1975-76.
† All quantity figures for these products are in terms of carcass weight equivalents.
†† Production minus consumption, canning and exports do not add up to zero because 1965 figures are only preliminary estimates from different sources and because of stock changes.
‡ Quantity figures in terms of canned weight.

Sources of data:

Base Period Production, Consumption and Exports (quantity) Commonwealth Bureau of Census and Statistics, Rural Industries, 1962-63, Bulletin 1 (Canberra, 1965).
1965 Production: Bureau of Agricultural Economics, Trends in Australian Rural Production and Exports, No. 39 (Canberra, September 1966) [Mimeo].
Projections of beef and lamb production: Table 10.2.3. Projection of mutton production — see text. Projections of Consumption: Per capita consumption estimates from Tables 10.3.2 and (for canned meat) Table 5.4.1, multiplied by "most likely" Australian population projections from Table 3.1.1. Base Period and 1965 export values from Table 8.4.1. Unit export values for projections — see text.

carcass weight equivalent) amounts to 123,900 tons, compared with our 1975 projection of 123,000 tons.[50] For lamb, B. A. E. projects a 1975 export surplus of 35,000 tons, whilst our projections give a net import figure of 27,000 tons. Whether Australia will allow imports of lamb is doubtful — our projections suggest that the Australian export surplus of lamb could disappear within 5 years.[51] Exports have become a very much less important outlet for Australian lamb producers in recent years. Overseas markets took over 40 percent of Australia's lamb production immediately after the war (1946-47); this fell to 27 percent by the mid-fifties (average for 1954-55 and 1955-56). By 1964-65 export markets took only $11\frac{1}{2}$ percent of Australian lamb.

For beef our 1975 export projection is 449,000 tons — compared with the B.A.E.'s 1974-75 projection of 469,000 tons (carcass weight equivalent; using 1961-62 export conversion ratios). This difference is too small to deserve comment — especially in the light of the very wide low-high margins which should be attached to all our trade projections.

Nevertheless some comment should be made about our beef projections — if only because the B. A. E. beef projections were generally regarded as being unduly conservative at the time of their publication and our projections are marginally lower. Our beef supply projections are based in part on the supply equations in Chapter VI and in part on our estimates of future prices. The supply equation accounts fairly adequately for past changes in beef production — 89 percent of the observed variation in beef supply (over the period 1947-48 to 1964-65) being accounted for by movements in opening herd inventory, relative prices, and drought mortality. But it may well be that we are on the threshold of major technological improvements in the beef industry which will make any projection based on past experience hopelessly conservative.

According to one estimate made for us by a senior C.S.I.R.O scientist who has been closely associated with the development of tropical pasture plants for Northern Australia, beef production in Queensland may rise by 40,000 tons between 1965 and 1970, by a further 110,000 tons between 1970 and 1975 and yet again by 150,000 between 1975 and 1980.[52] This compares with our projected total increase of 228,000 tons for the whole of Australia during 1965 to 1980, We are unable to assess the likelihood of such production increases being achieved. There is evidence that many land holders — both in Queensland and in the Northern Territory — are intensely interested in new pasture improvement techniques. On the other hand, Donald, among others, pointed out "past experience in Australia indicates a long lag between the earliest steps in pasture development and the general adoption of the practice over a region."[53]

In addition, recently established meat works in Katherine (in the Northern Territory) and the general development of roads for transport of the cattle in Northern

50. However the B. A. E. assumes that canned meat products will rise whilst we have not assumed this – hence the close correspondence does not extend to the individual components of the projections.

51. Attention should also be drawn to the possibility that exports may take place during some months whilst imports may occur in other months when production is at its lowest seasonal level.

52. Private communication, dated 9.6.1965 from J. Griffiths Davies, Chief of Division of Tropical Pastures, C. S. I. R. O.

53. C. M Donald, "The Progress of Australian Agriculture and the Role of Pastures in Environmental Change", Australian Journal of Science, Vol. 27, No. 7 (January 1965), p. 194.

Australia may lead to a substancial increase in the proportion of cattle turned off annually — from the same basic breeding herd. These technological improvements could lead to substantial growth in total beef production.

We prefer to restrict our projections to those situations where we have some prospect of estimating possible future supply reactions and merely draw attention to the opinion of those who know much more about the possibilities than we. Far too little study has been undertaken on the likely benefits and costs of tropical pasture improvement to enable us to judge the rate at which such pastures might be established.[54]

To obtain gross unit values for exports of the various meats we used the following formula:

$$E_t = \frac{P_t}{P_{Bt}} \cdot E_{Bt}$$

where E = export unit value
P = average auction price (cf. Table 10.1.2)

and the subscripts t and Bt refer to the projection period and the base period respectively.[55] Average f. o. b. export prices for the base period were obtained from a B. A. E. publication.[56]

Canned meat production in Australia declined from 62.6 thousand tons (product weight basis = 78,000 tons carcass weight) in our base period to 50,100 tons in 1965 (average of 1964-65 and 1965-66). Over this period, canned meat exports declined from 42,200 to 25,900 tons. As Australian meat prices rose, it proved less profitable to export meat in canned form, so we have projected a continued decline in canned meat exports — since we are basing our projections on a further rise in the price of beef and mutton (Table 10.3.3). Export values were assumed to rise at the same rate as beef prices, since beef is the major Australian canned meat.

Table 10.3.3 also gives the value of exports of other meat products in the base period and for 1965. Of these, the most important are beef offal, sausage casings, and rabbit and hare. Neither pigmeat nor poultry exports have been significant in recent years. We made some arbitrary assumptions about the future growth of exports for this whole group of meat products.

(iii) Grains

Table 10.3.4 gives projections of production, Australian consumption and exports for wheat, barley, oats, and rice. Wheat, barley, and oat production projections have been taken from Table 10.2.3. To obtain the quantity available for export, local requirements for seed, human consumption, and feed were deducted. Base-period use of these three grains for seed, feed, and human consumption were taken from official estimates.[57] 1965 figures represent our estimates based on the latest available figures from B.A.E or the Commonwealth Statistician. Projections for 1970 and later years for the quantities of wheat, barley, and oats for human consumption are taken from Table 5.5.1 and

54. J. Griffiths Davies' estimated that 5 million acres will be sown to improved pasture in Queensland by 1970, 10 million acres by 1975, and 17 million acres by 1980 (private communication dated 9.6.65).

55. Thus, in the case of Beef the 1975 gross unit export value was obtained in the following way:

$$E_t = \frac{496}{406} \cdot 411 = 502 \text{ (all figures in \$A per ton carcass weight).}$$

56. Quarterly Review of Agricultural Economics, Vol. 19, No. 3 (July 1966), p. 166.

57. Commonwealth Bureau of Census and Statistics, Rural Industries 1962–63 (Canberra), Tables 49, 46 and 48 respectively.

Table 10.3.4

PROJECTIONS OF GRAIN EXPORTS, AUSTRALIA 1960 TO 1980
(Quantities and Values; "most likely" estimates)

Type of Grain	Unit	Base Period	1965	1970	1975	1980
Wheat						
Production	)	233.6	313.4	415	501	591
Use for: Seed	)	13.5	19	21	24	27
Human Consumption	) million bushels	42.7	45	47	50	53
Feed	)	19.1	34	28	30	33
Exports — quantity	)	160.8	220.0	319	397	478
— value	$A million	204.9	312.2	447	556	669
Barley						
Production		51.7	44.6	57.1	63.0	71.0
Use for: Seed	)	3.1	2.6	3.1	3.2	3.5
Human Consumption	) million bushels	9.2	9.6	10.4	11.5	12.6
Feed	)	9.0	17.0	19.8	23.3	27.4
Exports — quantity	)	30.1	13.1	23.8	25.0	27.5
— value	$A million	28.9	14.8	26	28	30
Oats						
Production	)	66.2	64.0	70.2	77.0	85.4
Use for: Seed	)	8.6	9.5	10.0	10.5	11.0
Human Consumption	) million bushels	1.7	1.9	2.1	2.3	2.6
Feed	)	38.4	41.0	44.0	48.0	53.0
Exports — quantity	) $A million	16.9	16.7	14.1	16.2	18.8
— value		12.9	13.5	13	15	17
Rice						
Production	)					
(minus seed requirements)	) in '000 long tons	86	114	106	121	139
Consumption	) milled equivalent	28	39	37	41	46
Exports — quantity	)	54.3	63.4	69	80	93
— value	$A million	6.2	8	9	10	12

Sources and Notes

Base Period is the average for the years 1958-59 to 1961-62. All other years are averages for the two fiscal years centering on the calendar year; e.g. 1975 = the average of 1974-75 and 1975-76.

Wheat, Barley and Oats: Base period consumption data are from: Commonwealth Bureau of Census and Statistics, Rural Industries 1962-63 (Canberra), Tables 46, 48 and 49; production projections are from Table 10.2.3; projections of human consumption for 1970 and later years are the average of the high and low projections from Table 5.1.1; projections of grain used for seed assume seed requirements of one bushel per acre for wheat and barley and one and a half for oats; the areas sown to each grain from Table 10.2.2 plus some arbitrary allowance for areas sown to wheat, oats and barley for green feed, hay etc.; projections of grain used for feed are the average of the high and low projections from Table 5.5.3, adjusted on two counts: (i) oat consumption was reduced by 1 million bushels to allow for the revision in our projections of dairy cow numbers and pigmeat production; and (ii) wheat consumption was increased by 5 million bushels to allow for wheat kept on the farm and used for purposes other than seed: exports are valued at a $A 1.40 per bushel for wheat, $A 1.10 for barley and $A 0.90 for oats.

Rice: Production projections are based on Tables 7.7.4 and 8.5.7; projections of rice consumption are from Table 5.5.1 and are slightly higher than the average of the high and low projections contained in that table; exports are valued at $A 126 per ton (milled equivalent).

represent the arithmetic average of the low and high projections given there. Projections of the quantities used for seed are based on the projected acreage for each product and the normal seeding rate estimates used by the Commonwealth Statistician.[58] In making projections of the quantities to be used for seed we made an allowance for the area sown to each grain which was not harvested for grain — wheat sown for green feed or hay, etc. Only a relatively small allowance had to be made for wheat, but for barley and especially oats, the area sown as green feed has been rising fairly rapidly in recent years and an arbitrary allowance was made for further increases.

The estimates of the quantity of each grain used for feed in the base period were again taken from official sources.[59] 1965 figures again represent our estimates. Projections of feed use for 1970 and later years are based on Table 5.5.3, subject to an adjustment to allow for new "equilibrium" projections of dairy cow numbers and pig production. This had little effect on wheat and barley food consumption, but reduced oat consumption by about 1 million bushels.[60]

For the base period and for 1965, production estimates minus consumption in Australia and exports do not necessarily add to zero, because of changes in stocks, and the quantity exported is related to the financial year which does not coincide with crop years.

Rice projections of production are based on Table 7.7.4 and on the expected overseas markets for Australian rice given in Table 8.5.7. It appears that production will be limited by the markets which can be found for Australian rice. Our "most likely" production estimates were revised downwards from the figures originally given in Table 7.7.4. Estimates of rice consumption are taken from Table 5.5.1. In view of the large quantity of rice which was apparently consumed in Australia in 1965, the "most likely" Australian consumption has been fixed at a somewhat higher level than the average given there.

Unit export values were based on past relationships between the average unit gross value of exports and Australian prices. Wheat exports were valued at $ 1.40 per bushel, barley at $1.10 per bushel, oats at $ 90 per bushel, and rice at $126 per ton (milled equivalent).

Our projections can again be compared with those made by B. A. E. This time some fairly substantial differences in projections appear; B. A. E. projected wheat exports at 275 million bushels, compared with our projections for 1975 of almost 400 million bushels. This difference is probably largely the result of our higher estimate of the possible wheat acreage in Australia, Our barley projection for 1975 is 25 m. bushels, compared with a B. A. E. projection of 27 m. bushels, whilst our oat projection of 16.2 m. bushels compares with a B. A. E. projection of 22 m. bushels. Our projections for rice are again more conservative than those of B. A. E. Their projection is 110,000 tons compared with our projection of 80,000 tons.[61]

58. These are one bushel per acre for wheat and barley and 1½ bushels per acre for oats.

59. Rural Industries 1962-63, op. cit.

60. In the case of wheat an allowance of 5 million bushels was added for wheat which is normally retained on farms for purposes other than seed use. This was not included in the original estimate of feed grain consumption in Table 5.5.3.

61. Since our rice projections have been generally more conservative than those of the B. A. E., we have based our "most likely" projection of exports on the "high" level of projected exports given in Table 8.5.7.

(iv) Dairy Products

Export projections for dairy products are given in Table 10.3.5. Total milk production projections were obtained from the six-sector supply model. The method of disaggregating the projected whole milk supply as between liquid milk, butter, cheese, and preserved milk products was discussed briefly above. Our projections of exports of individual dairy products are obviously subject to even greater uncertainty than projections for total dairy product exports. While the method of disaggregation has some support from the current proportions of milk channelled to butter, cheese, and preserved milk products manufacture, changes in dairy product pricing methods could affect the distribution among these products.[62]

For projecting consumption of the different dairy products within Australia, we relied on the estimates prepared earlier in Table 5.3.4 and the per capita butter consumption projections given above. Using these consumption projections and our method of apportioning milk between the different end uses, we obtain a substantial drop in expected butter exports over the projection period. For 1975 our projected level of butter exports is 68,000 tons — a decline of 23,000 tons from the average 1965 level. B. A. E. 1974-75 projections for 1974-75 are 80,000 tons. On the other hand, our cheese export projections at 30,000 tons are somewhat higher than the B. A. E.'s estimate of 23,500 tons.

Our export projections for preserved milk products (made from whole milk) have been formulated in terms of gallons of whole milk equivalent. Since production of the different preserved milk products can be shifted relatively easily from one type of processed milk product to another, this seemed the most convenient method of projection.

Projections of exports of skim milk products — mainly casein and dried skim milk powder — has been largely on past trends. Account was also taken of B. A. E. projections, though our projections appear to be somewhat higher.

To convert our projections of export quantities into values, we have made some arbitrary allowance for the expected surplus of dairy products disclosed by the discussion in Chapter VIII.[63]

For 1975, the projected total value of exports of the dairy products listed is $ 99 million — compared with a B. A. E. projection of $97.4 million; though the distribution of exports as between different end products is very different.

(v) Fruits

(a) Canned Fruit

Our first round constant-price production projections for canned fruit were given in Chapter VII, section 5, whilst consumption projections were given in Table 5.6.1. From these two sets of projections, we obtained constant-price estimates of the quantities of exportable supplies available. These can then be compared with the projections made in Chapter VIII of the likely demand for Australian exports of

62. Substantial changes in the relative export prices for different types of dairy products could also affect the distribution of milk between different end products.

63. For butter assumed export f. o. b. values were 1970 – $A650 per ton, 1975 – $A625 per ton, 1980 – $A600 per ton. This compares with a base period average of $A640 per ton and a 1965 average of $A689 per ton. For cheese we used the following values: 1970 – $A530 per ton, 1975 – $A520 per ton, 1980 – $A510 per ton. Actual export values for the base period were $A522 per ton and for 1965 $A532. For processed whole milk, skim milk powder and casein we used 1965 values for the projection period. These were $A0.45 per gallon, $A263 per ton and $A453 respectively.

Table 10.3.5

PROJECTIONS OF EXPORTS OF DAIRY PRODUCTS, AUSTRALIA 1960 TO 1980
(Quantities and Values; "most likely" estimates)

Type of Product	Unit	Base Product	1965	1970	1975	1980
Butter						
Production	)	193	204	185	174	164
Consumption	) '000 tons	116	113	110	106	110
Exports — quantity	)	75	91	76	68	53
— value	$A million	48	63	49	43	32
Cheese						
Production	)	47.7	59.5	66.0	76.4	82.3
Consumption	) ' 000 tons	28.1	33.2	38.9	46.4	55.6
Exports — quantity	)	18.4	26.1	27.1	30.0	26.7
— value	$A million	10	14	14	16	14
Processed Milk Products (excluding skim)						
Production	) million gallons	79.6	96	106	117	118
Consumption	) whole milk	45.3	52.7	63	72	80
Exports — quantity	) equivalent	34.3	43.3	43	46	39
— value	$A million	15.5	18.9	19	21	17
Dried Skim Milk						
Exports — quantity	'000 tons	19.2	22.8	24	26	28
— value	$A million	3.4	6.0	6	7	7
Casein						
Exports — quantity	'000 tons	9.4	17.9	24	27	30
— value	$A million	3.3	8.2	11	12	14
Value of exports of major dairy products	$A million	80	110	99	99	84

Sources and Notes

Base Period is the average for the years 1958-59 to 1961-62. All other years are averages for the two fiscal years centering on the calendar year; e.g., 1975 = the average of 1974-75 and 1975-76.

For butter, cheese, and condensery products production: Table 10.2.4.
For cheese and whole milk preserved products consumption: Table 5.3.4.
Butter consumption projections — 19.5 lbs per head in 1970; 17 lbs in 1975 and 16 lbs in 1980. These were multiplied by mean Australian population projections from Table 3.1.1.

All export quantity and value figures for the base period and 1965 from Commonwealth Bureau of Census and Statistics, Overseas Trade, 1965-66 and earlier years.

canned fruit at constant prices. A comparison of these two sets of projections is given below.

Table 10.3.6 suggests that the quantity of canned fruits available from Australia — at constant base-period prices — is considerably greater than the expansion of overseas demand which can be expected at the same constant prices. In other words, some reduction in export prices is to be expected. The average export price declined by about 5 percent between the base period and 1965, with a further slight decline apparently expected for 1966-67.[64]

It is difficult to estimate the likely extent of this price decline — or the effect it will have on the quantities of canned fruit available for export. There are a number of reasons for expecting the decline in price to be relatively moderate. Australia accounts for less than a quarter of U.K. imports of canned fruit — the principal overseas outlet for Australian canned fruit.[65] In addition, a decline in Australian export prices is likely to open up new markets. There is some evidence that this is already occurring.[66]

Because of these considerations we have assumed that the price declines necessary will be moderate. Our assumptions are given in Table 10.3.7 which also lists average gross unit export values for the base period and 1965. In making our assumptions of future price changes, allowance was made for the likely future trend in output for the different types of canned fruit.

Our export volume projections at constant prices are given by the averages of the low and high production and consumption projections referred to above.

To allow for the expected decline in export prices, the volume of exports was also adjusted downwards — by an arbitrary 11 percent for each type of canned fruit. With the expected decline in export prices, it seemed realistic to allow for some expansion in local consumption and some reduction in the proportion of the total fruit crop canned. Adjusted "most likely" export quantities and values are given in Table 10.3.8.[67] It is difficult to compare our projections here with those made by the Bureau of Agricultural Economics.[68]

(b) Dried Fruit

Export projections of dried vine fruit are given in Table 10.3.9. They are based on the projections of production (Table 7.5.5) and consumption (Table 5.6.2) respectively.[69] Until 1970, total dried

64. The B. A. E. forecast of 1966-67 export values and quantities given in Trends in Australian Rural Production and Exports, No. 39, September 1966 (mimeo) provides us with an implicit forecast of unit export values.

65. Australian Canned Fruits Board, Annual Report and Accounts 1965 (Canberra, May 1966), p. 24.

66. loc. cit., p. 13.

67. Estimates of base period and 1965 exports in Table 10.3.8 were taken from Commonwealth Bureau of Census and Statistics, Oversea Trade, rather than from our earlier Tables in Chapters V and VII. There are slight discrepancies in these two sets of estimates; our production estimates being based on Canned Fruit Board statistics which are in units of standard cartons. The conversion figures may possibly differ between different types of fruit. For total canned fruit, the discrepancy is less than 1 percent in both the base period and 1965. However, our canned pineapple and canned tropical fruit salad production estimates for 1965 in Table 7.5.4 appear to be wrong — tropical fruit salad being too high and pineapple production too low.

68. At one stage, B. A. E. suggests that "exports of Australian canned deciduous fruit are expected to increase sharply from the 112,600 tons shipped in 1963-64" (Vernon Report, volume II, p. 675); yet the actual projection on p. 1012 of the same publication gives a decline of 38.5 thousand tons.

69. Production and consumption projections for the individual vine fruit categories (sultanas, raisins, and currants) are given in Tables 7.5.5 and 5.6.2 respectively.

Table 10.3.6

CANNED FRUIT — PROJECTIONS OF SUPPLIES AND DEMAND

Year	Projected Exportable Surplus		Projected Overseas Demand	
	'000 long tons			
	Low	High	Low	High
1970	147.2	187.7	108.3	132.9
1975	180.5	205.4	123.0	153.5
1980	186.0	211.7	138.8	170.3

Sources of data: Projected Exportable Surplus: Production from Tables 7.5.1, 7.5.2, 7.5.3, and 7.5.4. Consumption from Table 5.6.1 (Consumption of "other" — berries, cherries, etc. excluded). Conversion ratio used was 1 standard case = 0.02009 long tons. To obtain low and high projections of exportable surpluses, low and high consumption projections were deducted from low and high production projections respectively. Projected overseas demand from Table 8.6.1.

Table 10.3.7

ACTUAL AND PROJECTED EXPORT PRICES
FOR CANNED FRUIT
(all figures $A per long ton)

Type of Product	Actual Base Period*	1965	1970	Projections 1975	1980
Apricots	266	270	270	270	270
Peaches	282	255	245	240	240
Pears	294	279	265	250	250
Mixed	318**	299**	285	270	270
Pineapples	256	276	270	270	270
Tropical Fruit Salad	323	339	310	300	300

* Base period is the average for the years 1958–59 to 1961–62. All other years are averages for the two fiscal years centering on the calendar year; e.g. 1975 = the average of 1974–75 and 1975–76.

** Average gross export values per ton for the following categories – Base period: "Fruit salad – other" and "other". For 1965: "Pears and Peaches combined" and "Fruit salad – other".

Source of Data (for base period and 1965) Commonwealth Bureau of Census and Statistics, Oversea Trade 1965-66 and earlier volumes.

Table 10.3.8

PROJECTIONS OF CANNED FRUIT EXPORTS — AUSTRALIA 1960 TO 1980
(Quantities and Values; "most likely" estimates)

Product	Unit	Base Period*	1965	1970	1975	1980
Quantities						
Apricots	'000 tons	5.0	4.7	2.1	3.2	3.1
Peaches	'000 tons	21.1	49.0	62.1	66.5	57.0
Pears	'000 tons	37.9	44.7	54.2	66.7	73.4
Mixed and Fruit Salad	'000 tons	2.7**	12.1**	13.8	15.8	16.5
Total Deciduous	'000 tons	66.7	110.5	132.2	152.3†	150.0
Pineapples	'000 tons	12.0	6.1	8.1	10.3	14.7
Tropical Fruit Salad	'000 tons	1.1	2.1	4.5	9.0	12.1
Other††	'000 tons	2.6	1.8	1.5	1.5	1.5
Total	'000 tons	82.2†	120.5	146.3	173.0†	178.3
Values						
Apricots	$A million	1.3	1.3	0.6	0.9	0.8
Peaches	$A million	6.0	12.5	15.2	16.0	13.7
Pears	$A million	11.1	12.5	14.4	16.7	18.3
Mixed and Fruit Salad	$A million	0.9**	3.6**	3.9	4.3	4.5
Total Deciduous	$A million	19.3	29.9	34.1	37.9	37.3
Pineapples	$A million	3.1	1.7	2.2	2.8	4.0
Tropical Fruit Salad	$A million	0.3	0.7	1.4	2.7	3.6
Other††	$A million	0.8	0.6	0.5	0.5	0.5
Total	$A million	23.5	32.9	38.2	43.9	45.4

* Base period is average for the years 1958-59 to 1961-62. All other years are averages for the two fiscal years centering on the calendar year; e.g. 1975 = the average of 1974-75 and 1975-76.

** For base period mixed and fruit salad includes: "Fruit salad - other than tropical" and "other" from the trade classfications. For 1965 it includes "Pears and Peaches combined" and "Fruit salad - other than tropical".

† Discrepancies due to rounding.

†† Berry fruits, apples, prunes and, for 1965, "other".

Source of data: (for base period and 1965) Commonwealth Bureau of Census and Statistics Oversea Trade 1965-66 and earlier volumes.

Table 10.3.9

PROJECTIONS OF DRIED FRUIT EXPORTS, AUSTRALIA 1960 TO 1980
(Quantities and Values; "most likely" estimates)

Product	Unit	Base Period*	1965	1970	1975	1980
Dried Vine Fruits.						
Production	) '000 tons	83.8	97.9	99.9	110	118
Exports — quantity	)	61.8	75.3	75	82	88
— value	$A million	19.2	24.1	25	27	30
Dried Tree Fruits						
Prunes — exports	)	0.9	2.4	1.6	1.6	1.6
Apricots — exports	) '000 tons	1.0	1.4	1.9	2.2	2.6
Other — exports	)	0.6	0.6	0.7	0.8	0.9
Total dried tree fruit exports	'000 tons	2.5	4.4	4.2	4.6	5.1
	$A million	1.4	2.0	2.2	2.4	2.8
Total value of dried fruit exports	$A million	20.6	26.1	27	29	33

* Base Period is average for the years 1958–59 to 1961–62. All other years are averages for the two fiscal years centering on the calendar year; e.g., 1975 = the average of 1974–75 and 1975–76.

Sources of Data: Base Period and 1965 export figures from Commonwealth Bureau of Census and Statistics, Oversea Trade, 1965-66 and earlier volumes. Projections of exports of dried vine fruits, prunes and apricots from production and consumption projections for these products given in Tables 7.5.5, 7.5.6, and 5.6.2, respectively. For projecting value of exports, unit gross export values used were: Dried Vine Fruits 1970: $A 330 per ton, 1975: $A 335, 1980: $A 340; for prunes a constant $A 275 per ton, apricots $A 750, for "other" (mainly peaches) $A 425 per ton.

vine fruit exports are expected to remain around the average 1965 level of 75,000 tons; in the following 10 years a modest (17%) expansion in exports is projected. Sultanas account for about 85 percent of the total volume of dried vine fruit exports; this proportion is not expected to change significantly. For 1975 our export projections, at 82,000 tons, are significantly higher than those made by B. A. E. for 1974-75 (61,000 tons).

Dried Tree fruit exports have risen substantially in the last 5 years — the quantity of dried tree fruits exported increasing by 75 percent, and the value by 40 percent. Apricots and prunes account for about 80 percent of the total value of dried tree fruit exported; exports of prunes are expected to fall slightly from the high 1965 levels, whilst dried apricot exports are expected to continue to increase.[70] These projections are based on the production projections of Table 7.5.6 and the consumption projections of Table 5.6.2. Other tree fruit exports (mainly peaches) are also expected to increase.

Our projections of exports are again given in Table 10.3.9.

(vi) Eggs

Our projections of egg exports are given in Table 10.3.10. They have been taken from Table 7.6.1.[71] Because of the introduction of a new Egg Marketing Plan in 1965, our projections provide for a substantial expansion of exports. The rationale for expecting such an expansion is given in Chapter VII. Exports of eggs in shell tend to be more profitable than exports of eggs in pulp and dried forms; however, it has become more difficult in recent years to find overseas markets for shell eggs; hence we have assumed that the increase in egg exports will be in the form of non-shell eggs. Gross export unit values for 1965 have been used to convert projections of the quantity of exports into projections of the value of exports.

Our projections of the quantity of egg exports are very much greater than those given by the B. A. E.; thus we project total egg exports to rise from 15.6 million dozen in 1965 to 37 million dozen by 1975. The 1974-75 projections of the Bureau of Agricultural Economics is given partly in million lbs of eggs not in shell. Applying the conversion factor which we have used suggests that the B. A. E. 1974-75 projection is about 18 million dozen eggs.

(vii) Miscellaneous Products

(a) Cotton

As pointed out in Chapter VII, the future level of Australian cotton production will depend very largely on the Federal Government's cotton bounty policy and on the final decision about the second stage of the Ord Irrigation scheme. Table 10.3.11 gives our "most likely" projections of Australian trade in raw cotton (including waste and linters). They are drawn up under two alternative assumptions (i) that the Ord scheme will not be proceeded with (this seems more likely at present) and (ii) that construction of the main Ord dam commences in 1967. As shown in Table 10.3.11, even if the Ord main dam is not constructed, Australian imports of cotton are likely to fall to about 40 percent of the 1965 (average of 1964-65 and 1965-66) level.

70. Production of "other tree fruits" in Table 7.5.6 falls short of consumption of "other tree fruits" in Table 5.6.2, in spite of Australian exports of other tree fruits (mainly peaches and apples). This discrepancy is accounted for by the imports of "other tree fruits" – mainly dates and figs.

71. Export estimates for the Base Period and 1965 in Table 10.3.10 differ from those in Table 7.6.1. The estimates in Table 10.3.10 come from the official Statistician's Oversea Trade publications, whilst the estimates in Table 7.6.1 come from the Australian Egg Board. We have been unable to reconcile the estimates from these two sources and, for purposes of uniform treatment throughout, have used the Statistician's estimates here.

Table 10.3.10

PROJECTIONS OF EGG EXPORTS, AUSTRALIA 1960 TO 1980
(Quantities and Values; "most likely" estimates)

Product	Unit	Base Period*	1965	1970	1975	1980
Exports — quantity						
Eggs in shell	million dozen	4.5	3.6	3.5	4	4
Eggs, pulped, dried, etc.	million dozen equivalent	15.2	12.0	26.0	33	39
Total egg exports — quantity	million dozen equivalent	19.2	15.6	29.5	37	43
Exports — value						
Eggs in shell	$A million	1.5	1.0	1.0	1.4	1.4
Eggs not in shell	"	4.7	3.7	7.3	9.2	10.9
Total egg exports — value	"	6.2	4.7	8.3	10.6	12.3

* Base period is average of the years 1958-59 to 1961-62. All other years are averages for the two fiscal years centering on the calendar year; e.g. 1975 = the average of 1974-75 and 1975-76.

Sources of data: For base period, 1964-65 and 1965-66. Commonwealth Bureau of Census and Statistics, Oversea Trade; 1965-66 and earlier volumes. For projections: averages of low and high quantity figures given in Table 7.6.1. Gross unit value of exports taken at $A 0.35 per dozen for shell eggs and $A 0.28 per dozen for eggs exported as pulp etc. For conversion of eggs exported in pulp and dried form, the conversion factors given in Commonwealth Economic Committee, Dairy Produce, 1966, p. iv have been used. For the major export classification — liquid eggs — this amounts to 1 dozen eggs = 0.753 lbs.

Table 10.3.11

PROJECTIONS OF AUSTRALIAN COTTON TRADE, 1960 TO 1980
(includes raw cotton, cotton linters and cotton waste,
"most likely" estimates)
All figures in million lbs.

	Base Period	1965	1970	1975	1980
Consumption	57.6	73.8	84	88	92
Production					
(i) Without main Ord Scheme	) 4.5	34	60	65	70
(ii) With main Ord Scheme	)		62	91	124
Imports					
(i) Without main Ord Scheme	) 54.0*	55.9*	24	23	22
(II) With main Ord Scheme	)		22	18**	20**
Exports					
With main Ord Scheme	Nil	Nil	Nil	21	52

* Production minus consumption does not equal imports, mainly because Australian production in year t is mostly consumed in year t+1. Cotton production increased very rapidly between 1963-64 and 1965-66. Imports in 1965-66 were considerably lower than in 1964-65.

** Allowance for imports of qualities and staple lengths of cotton which will not be produced in adequate quantities in Australia (and also for some cotton waste).

Sources of data: Production: Table 7.7.1 — with assumed yield for the Ord of 1,000 lbs of lint per acre. Consumption: Table 5.8.1. Imports in base period and 1965: Commonwealth Bureau of Census and Statistics, Oversea Trade 1965-66 and earlier volumes.

The construction of the Ord would not materially affect the level of Australian cotton production in 1970, the first year for which we are preparing projections. However, its impact in later years would be very substantial; by 1980, it could produce almost twice as much cotton as in the whole of Australia in 1965-66. In this case Australia would become a substantial net exporter of cotton, even though some imports of certain grades and staple lengths would still be necessary.

As the proportion of Australian consumption of locally grown cotton increases, problems of using the particular, locally produced, staple length and grade-mix cotton will arise. Most Australian imports of raw cotton are of medium staple length ($^5/_{16}$" to $1^3/_8$"). For most of these types, Australian-produced cotton should be readily substitutable. Even if Australian production of cotton exceeds consumption, some imports of raw cotton of short and extra-long staple lengths may still need to be imported, as would cotton waste. In the Ord River projection, some allowance for such imports has been made. This was based on discussions with industry organisations.[72]

(b) Tobacco

In the light of the most recent production figures for tobacco products, it seems that our previous "low" and "high" projections of tobacco requirements may have been too great. For our final projections we will therefore use the "low" requirements from Table 7.7.3. Our projections of Australian consumption of tobacco leaf and the quantities which will be imported are given in Table 10.3.12. The level of imports of manufactured tobacco products — cut tobacco, cigarettes, and cigars — is also given. To convert projections of the quantities of imports into values, 1965 average gross import values have been used.[73]

(c) Tallow

As pointed out in Chapter IV, Australian statistics of domestic consumption of edible and inedible tallow are difficult to reconcile with production and export statistics. For our projections, we assumed that, as in the past, most tallow exports will be in the form of inedible tallow. Projections of total tallow production have been made by applying the average tallow yields given in Chapter VII to the change in beef and mutton production which we are projecting.[74] These average yields are 0.161 tons per ton of beef (excluding veal) produced and 0.332 tons per ton of mutton produced (meat production in terms of carcass weights in each case).

Our consumption estimates are taken from Table 5.8.4 and represent the average of the high and low projections given there. Exports for the base period and 1965 (the average of 1964-65 and 1965-66) are taken from the Statistician's Overseas Trade bulletins. A comparison of our estimated production and export estimates for 1965 suggests that consumption (probably of inedible tallow) may have been some 20,000 tons higher than our consumption projections allow for. However, this may be the result of stock changes (about which we have no information).

Since there has been no evidence of any marked increase in inedible tallow consumption up to 1963-64 (the last year for which we have information — cf. Table A4.8.1), we have not revised our consumption projections.

72. This point is also discussed by Kerridge, op. cit., p. 64.

73. These are: $A 0.69 per lb for unmanufactured tobacco leaf, $A 1.10 per lb for manufactured cut tobacco, $A1.90 per lb for cigarettes and $A5.50 per lb for cigars.

74. For this purpose we have taken the actual tallow production for 1964–65 – the last year for which we have a Statistician's estimate of production – as the base period.

Table 10.3.12

PROJECTIONS OF TOBACCO IMPORTS, AUSTRALIA 1960 TO 1980
(Quantities and Values; "most likely" estimates)

Product	Unit	Base Period	1965	1970	1975	1980
Tobacco Leaf						
Australian Consumption	) in million	51.3	54	60.3	63.9	67.3
Australian Production	) lbs of un-	13.3	26	33.2	38.3	43.7
Australian Use of Imported Leaf	) stemmed leaf)	37.0*	28	27.1	25.6	23.6
Imports of Unmanufactured Tobacco	$A million	25.1*	19.3	18.7	17.7	16.3
Imports of Manufactured Tobacco — quantity						
Cut Tobacco	) in million	0.54	1.50	1.87	2.31	2.78
Cigarettes	) lbs product	0.87	1.37	2.00	3.25	4.60
Cigars	) weight	0.12	0.35	0.50	0.75	1.00
Imports of Unmanufactured Tobacco — value						
Cut Tobacco	)	0.61	1.65	2.06	2.54	3.06
Cigarettes	) $A million	1.51	2.57	3.80	6.18	8.74
Cigars	)	0.64	1.94	2.75	4.13	5.50
Total Value of Imports of Tobacco Products	$A million	27.8*	25.5	27.3	30.5	33.6

Base period is the average for years 1958–59 to 1961–62. All other years are averages of the two fiscal years centering on the calendar year; e.g. 1975 = average of 1974–75 and 1975–76.

* Imports of unmanufactured leaf in the Base Period equalled an average of 33.8 million lbs; however 37.0 million lbs of imported leaf was used by Australian manufacturers. The value of imports given is the quantity of imported leaf used by manufacturers in the base period from Commonwealth Bureau of Census and Statistics, Manufacturing Industries, 1962–63, No. 26 Tobacco, Cigars, Cigarettes, Table 5; multiplied by the average gross import value for imported leaf during the base period ($A0.678 per lb).

Sources: For base period consumption, production and use of imported leaf: Commonwealth Bureau of Census and Statistics, Manufacturing Industries 1962–63 op. cit., Table 5.
For 1965 consumption and production of tobacco leaf: our estimates.
For Base Period and 1965 Imports of manufactured tobacco products and 1965 imports of tobacco leaf: Commonwealth Bureau of Census and Statistics, Oversea Trade 1965-66 and earlier volumes. For projections of tobacco leaf: "Low" projections of Table 7.7.3. Assumptions of import percentages given there applied to the "low" projections of tobacco consumption in Table 7.7.2.

Table 10.3.13

PROJECTIONS OF TALLOW EXPORTS, AUSTRALIA 1960 to 1980
(Quantities and Values; "most likely" estimates)

Item	Unit	Base Period	1965	1970	1975	1980
Total Tallow — Production	)	172.9	243	244	272	287
Edible Tallow — Exports	) '000 tons	4.7	4.0	4	4	4
Inedible Tallow — Exports	)	67.2	77.2	96	109	143
Total Tallow — Exports	) $A million	9.2	13.3	18	20	25

xx
xx

Sources: Production: for base period — Table A4.8.1; 1965 and later years — our estimates based on beef and mutton production (see text). Exports: for base period and 1965 — Commonwealth Bureau of Census and Statistics, Oversea Trade, 1965-66 and earlier volumes. Export projections — production projections minus consumption projections from Table 5.8.4.

Projections of total tallow production and of exports of edible and inedible tallow are given in Table 10.13.13. To obtain export values we have used a gross unit value of $170 per ton for inedible tallow and $180 per ton for edible tallow.[75]

(d) Hides and Skins

Export projections of hides and skins are bedevilled by problems of inadequate statistics. No estimate is available of the total number of cattle, calf, sheep, and lamb skins actually produced. In addition, the Australian use of hides and skins in tanneries is quoted in terms of numbers, whilst, for cattle hides and calf skins export statistics are only available in terms of weight.[76]

For the production of hides and skins, we used our projections of beef, veal, mutton, and lamb production. These we converted into projections of the number of animals slaughtered by using the average meat production per animal over the years 1958-59 to 1965-66.[77] To allow for wastage (on farms and in abbatoirs), projections of hide and skin production are based on 98 percent of cattle and calf slaughterings (Chapter VI). Our projections of consumption are taken from Chapter V. Export projections are obtained by deducting the projections of consumption from those of production. For the base period and for 1965 it is possible to compare an estimate of exports (plus stock changes) derived in this way with the actual quantities

75. These are slightly higher than the average values ruling in 1965. However exports of mutton tallow are expected to increase proportionately more than exports of beef tallow, and the former normally sells for a significantly higher price.

76. Fortunately export statistics for cattle hides were given in terms of both weight and number for a limited period (from 1949–50 to 1952–53) and we have used the conversion rates ruling at that time for our projections.

77. These averages were: Beef: 0.201 tons carcass weight per animal; Veal: 0.0299 tons; Mutton: 0.0191 tons; Lamb: 0.0153 tons. Beef and Veal production projections were split between beef and veal by assuming that 94.5 percent of all beef and veal is beef – the average proportion in recent years.

Table 10.3.14

PROJECTIONS OF HIDES AND SKINS EXPORTS, AUSTRALIA 1960 TO 1980
(Quantities and Values; "most likely" estimates)

Product	Unit	Base Period	1965	1970	1975	1980
Cattle Hides						
Production	)	3,456	4,652	4,305	4,982	5,420
Consumption	) '000 hides	2,368	2,500	2,600	2,700	2,800
Production — Consumption	)	1,090	2,150	1,700	2,300	2,600
Exports — Dry and Dry Salted	) '000 lbs	7,972	7,930	8,000	8,000	8,000
— Wet salted	)	46,936	97,246	72,000	108,000	126,000
— "Other"	) '000 lbs	5,485*	8,546	6,000	6,000	6,000
Total Exports of Cattle Hides	'000 lbs	60,393*	113,722	86,000	122,000	144,000
Calf Skins						
Production	)	1,499	1,768	1,687	1,952	2,123
Consumption	) '000 skins	711	750	800	850	900
Production — Consumption	)	790	1,020	900	1,100	1,200
Exports	'000 lbs	3,898	6,669	4,500	5,500	6,000
Sheep and Lamb Skins						
Production	)	28,489	30,303	31,430	33,140	34,910
Consumption	) '000 skins	2,601	2,600	2,700	2,800	2,900
Production — Consumption	)	25,900	27,700	)		
Exports**	)	26,000	29,260	) 28,700	30,300	32,000
Value of Exports						
Cattle Hides	)	9.26	15.4	12.9	18.3	21.6
Calf Skins	) $A million	1.55	2.30	1.80	2.20	2.40
Sheep and Lamp Skins	)	42.4	63.2	46.8	49.4	52.2

Base period is the average for years 1958-59 to 1961-62. All other years are averages of the two fiscal years centering on the calendar year; e.g. 1975 = average of 1974-75 and 1975-76.

* Includes a small quantity of calf skins.

** Sheep and lambskins with and without wool; excludes exports of sheepskin and lambskin pieces.

Sources: Production: 98 percent of cattle and calf slaughterings; 90 percent of sheep and lamb slaughterings. Base period slaughterings: Table 4.8.5. Slaughtering projections — see text. Consumption: Table 5.8.5. Exports: Commonwealth Bureau of Census and Statistics, Oversea Trade 1965-66 and earlier volumes.

exported. Because of stock changes, complete correspondence between the two sets of estimates cannot be expected. For sheep and lamb skins, the base period figures (of exports and production minus consumption) correspond very closely; for 1965 exports are about 5.6 percent higher than the estimate obtained from production and consumption figures.[78] For cattle hides and calf skins, export statistics are given in terms of weight. Hence we can either compare movements between the base period and 1965, or convert export statistics into numbers by using the conversion ratios existing more than 10 years earlier.[79] Both types of comparisons suggest that our methods of estimation are reasonably accurate.

78. At the time of writing export figures for 1965-66 were only available in lbs weight; they were converted to the number of skins on the basis of 1964-65 conversion ratios.

79. cf. Footnote 76 above.

Our projections of hides and skin exports are given in Table 10.3.14. To convert export quantities into value terms, the average gross unit export values for the base period were used.[80] To obtain a projection of the gross value of exports for all the selected products, the value of exports of sheep and lamb skins should be excluded, since most of the value of exports of sheep and lamb skins is already counted in the export projections given for wool.[81]

Our sheep and lamb skin export figures exclude a small quantity of exports of skin pieces. These amounted to an annual average of $670,000 in the base period and to $A1,100,000 in 1965.

80. These were: $A0.15 per lb for cattle hides; $A0.40 per lb for calf skins and $A1.63 per sheep and lamb skin.

81. Sheep and lamb skins with wool on account for over 98 percent of the value of all sheep and lamb skins exported.

APPENDIX TO CHAPTER X

1. SIX SECTOR SUPPLY MODEL INCORPORATING TRENDS

The model differs from that reported in Chapter VI only in that time (t = 1 in 1947-48) was added to every equation as an additional argument of the linear shift functions Γ_{it}. As was to be expected, the effect of including trend was to lower the size of the estimated autoregressive coefficient in every case. A marginal improvement to R^2 was obtained for four products, whilst the goodness-of-fit of two (dairy and beef and veal) deteriorated slightly.

The apparent significance of the wool/wheat transformation elasticity became more tenuous in the new model, whilst the τ-value between wheat and coarse grains gained apparent significance under the new treatment. This coefficient's estimated value also increased considerably in absolute value. The previously apparently significant transformation elasticity between lamb and dairy halved in value under the new treatment, losing its apparent significance. The previously non-significant τ-value between lamb and wool fared no better in the trend model, though the estimated value of this coefficient doubled.

Finally the Durbin-Watson statistics for wheat and beef and veal rose, under the new treatment, from 1.07 and 1.67 to 1.86 and 1.68 respectively. For lamb, however, this statistic fell from 1.78 to 1.65, which resulted in the test for positive autocorrelation becoming inconclusive.

The principal results for the model incorporating trends are given below in Tables 10A.1.1 to 10A.1.3.

2. LINEAR APPROXIMATIONS TO TRENDS IN VALUATIONS PER DECISION UNIT UNDER CHANGING COMMODITY PRICES

Let commodity prices (natural unit basis) change linearly; that is

(A10.2.1) $p_t = p_o + a\,t$

where p_t is commodity price (e.g., dollars per bushel, or dollars per fleece) at time t;

p_o is the price level in the year immediately preceding the first for which the linear approximation technique is to be employed:

and a is the (linear) rate of change in commodity price.

Further, assume that yields per decision unit rise linearly as a result of autonomous technical change and/or investment. Thus, with q's as yields per decision unit (bushels per acre or lbs weight per fleece), one may write

(A10.2.2) $q_t = q_o + b_t$

We have that value per decision unit is

(A10.2.3) $v_t = p_t q_t$;

and hence that

(A10.2.4) $v_t = q_o p_o + (q_o a + p_o b)\,t + ab\,t^2$.

We want a suitable linear approximation to the above over t = 1, 2, ..., n (say). Adopting minimum sum of squared deviations as a criterion of suitability, and writing $f(t) = A + Bt$ as the linear approximating function, our aim becomes to minimise

$$\Phi = \sum_{t=1}^{n} (v_t - f(t))^2 \qquad \text{(A10.2.5)}$$

with respect to A and B.

Differentiating Φ with respect to A, setting to zero and solving, one obtains

$$\sum_{t=1}^{n} v_t - B \sum_{t=1}^{n} t = \sum_{t=1}^{n} A. \qquad \text{(A10.2.6)}$$

Before proceeding, we recall to mind that

$$\sum_{t=1}^{n} t \equiv n(n+1)/2 \ \{=nL, \text{ say}\}; \qquad \text{(A10.2.7)}$$

$$\sum_{t=1}^{n} t^2 \equiv n(n+1)(2n+1)/6 \ \{=nM, \text{ say}\}; \qquad \text{(A10.2.8)}$$

$$\sum_{t=1}^{n} t^3 \equiv [n(n+1)]^2/4 \ \{=hN, \text{ say}\} \qquad \text{(A10.2.9)}$$

Substituting from (A10.2.4) into (A10.2.6), one obtains

$$q_o p_o + (q_o a + p_o b) L + ab M - BL = A. \qquad \text{(A10.2.10)}$$

By differentiating Φ with respect to B, and setting to zero, one obtains

$$\sum_{t=1}^{n} (v_t - A - Bt)t = 0; \qquad \text{(A10.2.11)}$$

so that

$$\sum_{t=1}^{n} [q_o p_o + (q_o a + p_o b) t + abt^2 - A - Bt]$$

$$t = 0.$$

Thus

$$q_o p_o L + (q_o a + p_o b) M + ab N - BM = LA. \qquad \text{(A10.2.12)}$$

The simultaneous solution to (A10.2.10) and (A10.2.12) is obtained by solving

$$\begin{bmatrix} 1 & L \\ L & M \end{bmatrix} \begin{bmatrix} A \\ B \end{bmatrix} = \begin{bmatrix} q_o po + (q_o a + p_o b) L + abM \\ L \ q_o po + (q_o a + p_o b) M + abN \end{bmatrix} = \begin{bmatrix} 1 & L & M \\ L & M & N \end{bmatrix} \begin{bmatrix} p_o q_o \\ (q_o a + p_o b) \\ ab \end{bmatrix} \qquad \text{(A10.2.13)}$$

Whence

$$\begin{bmatrix} A \\ B \end{bmatrix} = \begin{bmatrix} 1, & 0, & (M^2 - LN)/(M - L^2) \\ 0, & 1, & (N - LM)/(M - L^2) \end{bmatrix} \begin{bmatrix} p_o q_o \\ q_o a + p_o b \\ ab \end{bmatrix} \qquad \text{(A10.2.14)}$$

From the viewpoint of computational ease, no useful purpose is served by further simplifying the above.

Appendix Table 10A.1.1

ESTIMATED CONSTANTS AND COEFFICIENTS OF SHIFT VARIABLES FOR SIX-EQUATION SUPPLY MODEL WITH AUTONOMOUS TRENDS IN PRODUCTIVITY

Equation for	Regression Constant	Variables Shifting Supply Curve		Estimated Coefficient of Adjustment (γ)	R^2
Wool[(a)]	24.9666 [1.462]	Drought Mortality Index (f) Lagged Output (a) Trend (h)	-0.2858 [0.459] .7357 [3.452] 1.0142 [1.187]	0.2643	.980
Lamb[(b)]	0.0467 [2.181]	Drought Mortality Index (f) Lagged Output (b) Trend (h)	-0.0080 [3.254] 0.5968 [3.191] 0.0024 [1.875]	0.4032	.919
Wheat[(c)]	0.3090 [0.294]	Lagged Output (c) Trend (h)	0.8993 [10.577] 0.1179 [3.362]	0.1007	.937
Coarse Grains[(c)]	1.7649 [2.796]	Lagged Output (c) Trend (h)	0.4206 [1.827] 0.1108 [2.078]	.5794	.879
Beef and Veal[(b)]	-0.1819 [0.406]	Drought Mortality Index (g) Long Run Beef Price* Opening Inventory of Non-Breeding Cattle (e) Trend (h)	-0.0165 [1.335] -0.0025 [2.434] 1.7792 [2.160] 0.0246 [1.586]	not estimated	.887
Dairy[(d)]	1.6636 [3.901]	Lagged Output (d) Trend (h)	0.4774 [3.442] 0.0042 [1.102]	0.5226	.823

* "Long-run" expected price of beef measured by distributed lags (with initial lag 6 months) on actual prices. Coefficient of expectations for beef was the value equivalent to a wool value of 0.6 and was obtained from Table 6.3.1.

Units are:
(a) millions of adult sheep shorn;
(b) millions of tons of carcass weight;
(c) millions of acres;
(d) millions of dairy cows;
(e) millions of animals;

(f) Deviation of crude annual percentage mortality rate about a " normal" value of 6.3 percent;

(g) Deviation of crude annual percentage mortalitay rate about a "normal" value of 4.3 percent;

(h) Time in years, 1947-48 = 1.

Appendix Table 10A.1.2

ESTIMATED PARTIAL TRANSFORMATION ELASTICITIES
(Autonomous Trend Model)

Partial Frontiers between:*	Estimated Elasticity (with Student's $\|t\|$-values in square brackets)
Wool/Wheat	-0.1307 [1.996]
Wheat/Coarse Grains	-0.3603 [2.013]
Beef/Dairy**	-0.2903 [4.723]
Lamb/Dairy	-0.1239 [0.890]
Wool/Lamb	-0.0953 [0.863]

* Partial transformation elasticities for all other pairs constrained to zero (for reasons discussed in text).

** Beef price is spot price, lagged six months.

Appendix Table 10A. 1.3

EXPECTED PRICE COEFFICIENTS FOR LINEAR SUPPLY EQUATIONS*
(Autonomous Trend Model)

Product[a]	Coefficient with Respect to the Expected Price[b] of					
	Wool	Lamb	Wheat	Coarse Grains	Beef and Veal[c]	Dairy
Wool	+2.301341	-0.005399	-0.436254	0	0	0
Lamb	-0.005399	+ .000122	0	0	0	-0.000383
Wheat	-0.436254	0	+0.211527	-0.119685	0	0
Coarse Grains	0	0	-0.119685	+0.135983	0	0
Beef and Veal	0	0	0	0	+0.000801	-0.002878
Dairy	0	-0.000383	0	0	-0.002878	+0.012609

* Zero entries indicate coefficient constrained as such.

(a) For units, see footnotes to Appendix Table A10.1.1.

(b) Units for expected prices are:
- (1) Wool: £ per fleece;
- (2) Lamb: £ per fleece;
- (3) Wheat: £ per acre per annum;
- (4) Coarse Grains: £ per acre per annum;
- (5) Beef and Veal: £ per ton of carcass weight;
- (6) Dairy: £ per cow per annum.

(c) Short Run Price. For coefficient of Long Run Price, see Appendix Table A10.1.1.

Table 10A.3.1

TREND-BASED* PROJECTIONS FOR SUPPLIES OF WOOL, BEEF AND VEAL, LAMB, CEREALS AND WHOLE MILK UNDER CONSTANT PRICES: NATURAL COMMODITY UNIT BASIS**

Year	Wool	Beef and Veal	Lamb	Wheat	Barley	Oats	Whole milk
	(m. lbs greasy)	(million tons carcass weight)		(million bushels)			(m. gallons)
Base Period Values:							
Average 1958-59 through 1961-62	1648.7	.770	.203	233.6	51.7	66.2	1390
Average of 2 Fiscal Years centered on:							
1965 (estimate) †	1706.0	.949	.210	313.4	44.6	64.0	1512
1970 High	2344.1	1.022	.267	563.9	124.1	129.9	1702.4
1970 "Most Likely"	2101.3	.942	.237	470.9	75.2	84.0	1658.9
1970 Low	1875.7	.862	.230	384.7	33.0	44.1	1610.5
1975 High	2691.3	.930	.298	754.6	157.7	150.6	1924.4
1975 "Most Likely"	2407.1	.842	.263	636.2	96.8	99.6	1868.0
1975 Low	2130.8	.754	.228	525.8	43.2	54.5	1812.0
1980 High	3023.3	.708	.328	940.3	190.6	170.0	2094.2
1980 "Most Likely"	2702.4	.625	.287	799.1	118.3	114.3	2034.6
1980 Low	2393.6	.542	.246	666.6	53.8	64.5	1975.3

* The Supply Model upon which these results are based is reported in the first section of the Appendix to Chapter X

** Constant prices, are, meats excepted, average commodity prices over the four year base period 1958—59 through 1961—62. In the case of meats, this average has been further averaged with commodity prices prevailing in 1964—65.

† Based on Bureau of Agricultural Economics, Trends in Australian Rural Production and Exports, No. 38 (Canberra, June 1966) [mimeo].

APPENDIX TO REPORT

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Table A3. 1. 1

PROJECTED POPULATION, AUSTRALIA, 1960 – 1980
(Thousands)

Year	Model 3.1 (a) no immigration			Model 3.1 (c) 100,000 immigrants per annum			Model 3.1 (d) 90,000 immigrants in 1960 – 61 falling to 50,000 per annum by 1964 – 65 and constant thereafter			Annual percentage rates of increase of total population		
	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons	Model 3.1 (a)	Model 3.1 (c)	Model 3.1 (d)
1960	5,195.6	5,083.0	10,278.6	5,195.6	5,083.0	10,278.6	5,195.6	5,083.0	10,278.6	—	—	—
1961	5,258.5	5,151.0	10,409.5	5,317.5	5,204.0	10,521.5	5,312.0	5,199.1	10,511.1	1.27	2.36	2.26
1962	5,321.6	5,219.1	10,540.7	5,441.4	5,326.8	10,768.2	5,424.7	5,311.9	10,736.6	1.26	2.34	2.15
1963	5,384.7	5,288.0	10,672.7	5,567.0	5,452.1	11,019.0	5,533.2	5,421.9	10,955.1	1.25	2.33	2.04
1964	5,453.5	5,356.5	10,810.0	5,699.8	5,578.4	11,278.1	5,642.9	5,527.5	11,170.4	1.29	2.35	1.97
1965	5,518.3	5,425.8	10,944.1	5,829.9	5,706.7	11,536.6	5,743.6	5,629.6	11,373.2	1.24	2.29	1.82
1966	5,587.7	5,496.0	11,083.8	5,965.4	5,836.9	11,802.2	5,848.9	5,732.6	11,581.5	1.28	2.30	1.83
1967	5,656.5	5,568.9	11,225.3	6,101.0	5,970.4	12,071.4	5,953.6	5,838.2	11,791.7	1.28	2.28	1.81
1968	5,727.5	5,644.8	11,372.3	6,239.8	6,107.9	12,347.7	5,060.7	5,946.9	12,007.6	1.31	2.29	1.83
1969	5,800.6	5,721.6	11,522.2	6,382.2	6,247.0	12,629.2	6,169.5	6,056.3	12,225.8	1.32	2.28	1.83
1970	5,876.1	5,801.6	11,677.7	6,526.4	6,388.7	12,915.2	6,280.5	6,168.9	12,449.4	1.35	2.21	1.83
1971	5,954.0	5,884.8	11,818.8	6,674.5	6,534.0	13,208.4	6,394.6	6,283.2	12,677.8	1.38	2.27	1.83
1972	6,034.3	5,968.3	12,002.5	6,826.2	6,682.7	13,508.9	6,511.6	6,400.4	12,912.0	1.38	2.27	1.85
1973	6,117.0	6,054.1	12,171.1	6.981.7	6,835.2	13,816.9	6,631.7	6,520.6	13,152.3	1.41	2.28	1.86
1974	6,201.7	6,142.0	12,343.7	7,140.9	6,990.9	14,131.9	6,754.5	6,643.4	13,397.9	1.42	2.28	1.87
1975	6,288.6	6,231.9	12,520.5	7,303.4	7,150.1	14,453.5	6,879.9	6,768.9	13,648.9	1.43	2.28	1.87
1976	6,379.5	6,327.2	12,706.8	7,471.9	7,312.4	14,784.3	7,009.8	6,896.7	13,906.5	1.49	2.29	1.89
1977	6,471.5	6,417.0	12,888.5	7,641.3	7,479.9	15,121.1	7,141.3	7,028.5	14,169.7	1.43	2.28	1.89
1978	6,565.5	6,514.0	13,079.5	7,814.2	7,647.7	15,461.9	7,277.5	7,162.1	14,439.7	1.48	2.25	1.90
1979	6,659.8	6,611.0	13,270.8	7,975.3	7,819.7	15,794.9	7,411.0	7,297.0	14,708.0	1.46	2.15	1.86
1980	6,755.5	6,709.5	13,465.0	8,143.2	7,992.8	16,136.0	7,548.5	7,434.1	14,982.6	1.46	2.16	1.87

Assumptions: (1) 1957 – 59. Mortality experience in all models;
(2) 1955 – 57. Fertiliry experience in Model 3. 1. (a); Models 3. 1. (c) and 3. 1 (d) have 1957 – 59 fertility experience discounted to give a Gross Reproduction Rate of 1.614 after 1970 (see footnote 2. p. 3 – 2).

Sources: (1) W. D. Borrie and Ruth Rodgers, Australian Population Projections 1960 – 75 (Australian National University Canberra 1961) Table 7, page 10.
(2) 1976 – 80: See Text.

Table A3.1.2

PROJECTED POPULATION, AUSTRALIA, 1960 — 1980 — BY AGE GROUP
(Thousands)

Model 3.1 (a)

Estimated Population Excluding Immigration
After June 1960
(1955 — 57 Fertility, 1957 — 59 Mortality Experience)

Age	1960	1965	1970	1975	1980
Total Persons					
0 — 14	3,091.7	3,212.2	3,408.3	3,699.7	4,123.6
15 — 24	1,433.6	1,738.1	1,985.8	2,091.1	2,170.1
25 — 34	1,401.0	1,311.6	1,420.2	1,721.2	1,962.4
35 — 44	1,418.0	1,493.2	1,376.1	1,288.7	1,395.6
45 — 54	1,209.2	1,282.8	1,368.1	1,434.3	1,320.0
55 — 64	852.7	955.9	1,089.9	1,154.8	1,233.8
65 and over	872.4	950.1	1,029.4	1,130.7	1,259.5
Total	10,278.6	10,944.1	11,677.7	12,520.5	13,465.0
Males					
0 — 14	1,582.5	1,642.0	1,741.5	1,888.1	2,106.5
15 — 24	736.2	888.0	1,013.3	1,066.2	1,105.8
25 — 34	733.6	679.5	727.5	876.7	996.5
35 — 44	723.9	776.3	717.7	665.0	712.1
45 — 54	621.5	649.1	694.5	738.8	682.6
55 — 64	421.2	481.2	543.3	566.1	607.4
65 and over	376.7	402.3	438.3	487.7	544.6
Total	5,195.6	5,518.3	5,876.1	6,288.6	6,755.5
Females					
0 — 14	1,509.2	1,570.2	1,666.7	1,811.7	2,017.1
15 — 24	697.4	850.2	972.5	1,024.9	1,064.3
25 — 34	667.4	632.1	692.7	844.5	965.9
35 — 44	694.1	717.0	658.3	623.7	683.6
45 — 54	587.7	633.7	673.7	695.5	637.4
55 — 59	227.0	259.0	301.4	303.4	339.3
60 and over	700.2	763.5	836.3	928.3	1,002.0
Total	5,083.0	5,425.8	5,801.6	6,231.9	6,709.5

Table A3. 1. 2 (Continued)

Model 3.1 (b) Population Derived From 100,000 Immigrants (1957—59 Fertility, 1957—59 Mortality Experience)

Age	1961*	1965	1970	1975	1980
Total Persons					
0—14	29.2	169.6	382.6	627.9	889.5
15—24	26.0	112.6	204.6	308.0	424.7
25—34	25.2	139.5	289.7	401.3	492.6
35—44	12.0	69.8	170.2	307.3	455.1
45—54	4.4	30.3	76.1	143.2	239.8
55—64	2.3	12.6	29.6	57.2	98.6
65 and over	1.3	7.7	18.0	31.5	49.1
Total	101.0	542.0	1,170.7	1,876.4	2,649.5
Males					
0—14	15.3	88.1	197.3	324.1	459.5
15—24	15.0	64.8	115.2	169.3	228.6
25—34	13.5	76.3	162.7	226.9	276.4
35—44	6.1	34.8	85.9	160.6	245.6
45—54	2.3	14.9	38.3	71.6	120.3
55—64	.8	4.6	11.8	25.0	45.5
65 and over	.5	2.4	5.6	9.8	15.9
Total	53.5	286.0	616.8	987.3	1,391.8
Females					
0—14	13.9	81.5	185.2	303.8	430.1
15—24	11.0	47.8	89.4	138.7	196.1
25—34	11.7	63.2	125.0	174.4	216.2
35—44	5.9	34.9	84.3	146.7	209.5
45—54	2.6	15.4	37.8	71.7	119.6
55—59	.8	4.4	10.1	19.1	31.4
60 and over	1.5	8.8	20.2	34.7	54.8
Total	47.5	255.9	553.9	889.1	1,257.7

* Population from 100,000 immigrants for the year ending 30th June, 1961 52,935 Male Immigrants and 47,065 Female Immigrants.

Table A3. 1. 2 (Continued)

Model 3. 1 (c) Estimated Population Assuming 100,000 Immigrants a Year, from June 1960

Age	1960	1965	1970	1975	1980
Total Persons					
0 — 14	3,091.7	3,432.3	3,857.6	4,384.2	5,005.7
15 — 24	1,433.6	1,850.8	2,190.3	2,399.1	2,644.8
25 — 34	1,401.0	1,451.2	1,709.8	2,122.5	2,455.0
35 — 44	1,418.0	1,563.0	1,546.3	1,596.0	1,850.8
45 — 54	1,209.2	1,313.1	1,444.2	1,577.5	1,537.5
55 — 64	852.7	968.5	1,119.5	1,212.0	1,332.3
65 and over	872.4	957.7	1,047.5	1,162.2	1,310.0
Total	10,278.6	11,536.7	12,915.2	14,453.5	16,136.0
Males					
0 — 14	1,582.5	1,755.6	1,972.4	2,239.7	2,558.6
15 — 24	736.2	952.8	1,128.4	1,235.5	1,359.7
25 — 34	733.6	755.8	890.2	1,103.6	1,272.0
35 — 44	723.9	811.1	803.7	825.6	957.6
45 — 54	621.5	664.0	732.8	810.4	780.5
55 — 64	421.2	485.8	555.1	591.1	652.9
65 and over	376.7	404.7	443.9	497.5	561.0
Total	5,195.6	5,829.9	6,526.4	7,303.4	8,143.2
Females					
0 — 14	1,509.2	1,676.7	1,885.2	2,144.5	2,447.1
15 — 24	697.4	897.9	1,061.9	1,163.6	1,285.1
25 — 34	667.4	695.4	819.7	1,018.9	1,182.1
35 — 44	694.1	751.9	742.6	770.4	893.1
45 — 54	587.7	650.1	711.4	767.1	756.9
55 — 59	227.0	263.4	311.5	322.5	370.7
60 and over	700.2	772.3	856.5	963.1	1,057.8
Total	5,083.0	5,707.7	6,388.7	7,150.1	7,992.8

Table A. 3. 1. 2 (Continued)

Model 3.1(d) Estimated Population Including Immigration, Assuming 90,000 Immigrants in 1960—61, Falling to 50,000 by 1965; Constant at 50,000 thereafter

(1957—59 Mortality Experience; Fertility Rising Slightly, Then Falling Slightly to 1970 to Give G. R. R. in 1970 of 1.614 Compared with 1.682 in 1960)

Age	1960	1965	1970	1975	1980
Total Persons					
0—14	3,091.7	3,379.2	3,701.0	4,110.8	4,609.5
15—24	1,433.6	1,815.3	2,105.7	2,265.3	2,453.4
25—34	1,401.0	1,410.6	1,594.6	1,942.7	2,226.0
35—44	1,418.0	1,543.1	1,482.8	1,471.1	1,652.2
45—54	1,209.2	1,304.6	1,416.2	1,520.5	1,460.7
55—64	852.7	964.9	1,108.4	1,189.3	1,292.0
65 and over	872.4	955.5	1,040.6	1,149.2	1,288.7
Total	10,278.6	11,373.2	12,449.4	13,648.9	14,982.6
Males					
0—14	1,582.5	1,728.0	1,891.6	2,099.1	2,355.3
15—24	736.1	932.3	1,080.1	1,161.1	1,256.1
25—34	733.6	733.8	825.7	1,001.7	1,143.7
35—44	723.9	801.1	771.9	761.1	851.1
45—54	621.5	659.8	718.8	781.9	753.4
55—64	421.2	484.5	550.8	581.5	634.7
65 and over	376.7	404.0	441.7	493.5	554.2
Total	5,195.6	5,743.6	6,280.5	6,880.0	7,548.5
Females					
0—14	1,509.2	1,651.2	1,809.4	2,011.6	2,254.2
15—24	697.4	883.0	1,025.6	1,104.2	1,197.3
25—34	667.4	676.8	769.1	940.9	1,082.3
35—44	694.1	742.0	710.9	710.0	801.1
45—54	587.7	644.7	697.4	738.6	707.3
55—59	227.0	262.1	307.7	314.8	357.7
60 and over	700.2	769.8	848.7	948.8	1,034.2
Total	5,083.0	5,629.6	6,168.9	6,768.9	7,434.1

Source: (1) 1960—75: W. D. Borrie and Ruth Rodgers, op. cit., Appendix Tables 1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 3c, 4a, 4b, 4c.
(2) 1980: See Text, Chapter III. 1.

Table A3.2.1

GROSS NATIONAL PRODUCT, TOTAL AND PER CAPITA
ANNUAL PERCENTAGE GROWTH, AUSTRALIA 1949 – 50 – 1963 – 64

	1949–50	1950–51	1951–52	1952–53	1953–54	1954–55	1955–56	1956–57	1957–58	1958–59	1959–60	1960–61	1961–62	1962–63	1963–64
CURRENT PRICES															
Gross National Product	17.46	32.62	7.30	13.44	9.23	6.62	8.22	8.88	2.04	6.94	8.83	7.82	1.94	7.10	9.10
Per Capita Gross National Product	13.88	28.48	3.23	12.08	7.19	4.39	5.68	6.37	–0.15	4.73	6.52	5.46	–0.13	5.07	8.32
AVERAGE 1953–54 PRICES															
Gross National Product	7.40	5.38	2.73	–0.65	6.05	5.71	5.32	2.31	1.24	8.87	3.68	(a)	(a)	(a)	(a)
Per Capita Gross National Product	4.08	2.09	0.01	–2.99	4.07	3.50	2.78	–0.04	–0.93	6.61	1.49	(a)	(a)	(a)	(a)
AVERAGE 1959–60 PRICES															
Gross National Product	(a)	(a)	(a)	(a)	(a)	5.89	4.91	1.70	2.08	7.29	3.88	4.41	1.18	5.50	5.26
Per Capita Gross National Product	(a)	(a)	(a)	(a)	(a)	3.68	2.39	–0.13	–0.15	5.10	1.18	2.12	–0.87	3.50	3.20

(a) Not available.

Sources: Commonwealth Bureau of Census and Statistics, Australian National Accounts, 1948–49 to 1963–64, (Canberra 1965), Tables 10, 11.

Table A3.2.2

GROSS NATIONAL PRODUCT AND ITS COMPONENTS, ANNUAL PERCENTAGE GROWTH RATES
AUSTRALIA, 1949–50 TO 1963–64

	1949–50	1950–51	1951–52	1952–53	1953–54	1954–55	1955–56	1956–57	1957–58	1958–59	1959–60	1960–61	1961–62	1962–63	1963–64
CURRENT PRICES															
Personal Consumption Expenditure	15.04	21.56	19.16	6.06	9.80	8.58	7.49	6.82	4.89	4.85	9.52	5.53	2.85	5.88	6.51
Current Expenditure by financial enterprises and public authorities	18.78	35.47	36.59	15.24	−4.21	7.74	11.84	4.34	3.83	7.53	11.18	7.77	7.34	6.03	11.80
Gross fixed capital expenditure —															
Public	40.85	43.50	37.97	−2.02	2.84	6.27	6.37	3.33	4.94	10.22	6.86	4.69	10.12	4.97	11.90
Private — Dwellings	30.14	43.16	25.74	5.26	4.44	10.64	1.44	0.00	15.17	9.88	13.48	8.25	−10.67	9.22	15.94
Other	28.98	42.73	21.30	−1.27	20.36	13.06	13.83	5.49	6.78	0.74	14.08	10.54	−1.51	9.80	10.75
Increase in value of stocks	15.07	60.79	42.73			531.82	23.74								
Total Gross National Expenditure	23.25	28.31	26.85	−9.65	13.06	13.38	3.41	8.88	2.04	6.94	8.83	7.41	−2.80	10.65	6.72
Gross National Expenditure after stock valuation adjustment	20.93	26.67	28.17	−6.25	14.40	12.02	7.40	2.42	7.00	7.52	9.13	9.88	−2.72	9.79	6.34
Plus — Exports of goods and services	14.21	65.24	−24.01	24.26	−3.14	−5.15	1.89	29.56	−15.92	0.88	14.86	1.13	13.54	0.82	27.32
Less — Imports of goods and services	28.57	36.83	41.42	−46.35	22.32	22.38	−1.32	−11.29	10.76	1.57	16.46	13.96	−18.35	18.07	9.32
Gross National Product after stock valuation adjustment	17.46	32.62	7.30	13.44	9.23	6.62	8.22	8.88	2.04	6.94	8.83	7.82	1.94	7.10	9.10
AVERAGE 1953–54 PRICES															
Personal Consumption Expenditure	6.14	6.93	−1.10	−2.34	7.00	7.13	2.99	1.03	3.58	3.40	7.10	(a)	(a)	(a)	(a)
Current Expenditure by financial enterprises and public authorities	8.08	11.60	13.86	4.26	7.00	2.51	3.27	0.59	0.59	7.62	2.00	(a)	(a)	(a)	(a)
Gross fixed capital expenditure —															
Public	29.58	25.72	17.14	−11.79	−1.24	3.01	0.97	0.24	3.85	8.56	4.48	(a)	(a)	(a)	(a)
Private — Dwellings	16.54	19.54	9.60	−3.09	0.00	5.32	−5.05	−3.72	14.36	9.18	11.06	(a)	(a)	(a)	(a)
Others	17.16	20.85	0.93	−9.24	18.83	10.92	8.69	0.71	3.70	−0.68	11.47	(a)	(a)	(a)	(a)
Gross National Expenditure after stock valuation adjustment	10.31	10.60	7.08	−14.09	11.37	9.69	2.33	−2.66	5.19	6.68	5.21	(a)	(a)	(a)	(a)
Plus — Exports of goods and services	6.31	−6.18	−8.20	23.21	−0.45	−0.11	9.75	12.36	−10.09	13.45	6.27	(a)	(a)	(a)	(a)
Less — Imports of goods and services	22.05	19.34	13.54	−42.72	31.15	21.25	5.57	−13.86	9.63	1.27	17.01	(a)	(a)	(a)	(a)
Gross National Product after stock valuation adjustment	7.40	5.38	2.73	−0.65	−6.05	5.71	5.32	2.31	1.24	8.87	3.68	(a)	(a)	(a)	(a)

(a) Not available.

Table A3. 2. 2 (Concluded)

	1949–50	1950–51	1951–1952	1952–53	1953–54	1954–55	1955–56	1956–57	1957–58	1958–59	1959–60	1960–61	1961–62	1962–63	1963–64
AVERAGE 1959 – 1960 PRICES															
Personal Consumption Expenditure	(a)	(a)	(a)	(a)	(a)	6.54	3.01	0.63	3.90	3.12	6.52	1.81	2.68	5.68	4.61
Current Expenditure by financial enterprises and public authorities	(a)	(a)	(a)	(a)	(a)	3.16	3.07	1.19	1.18	6.69	1.63	4.02	4.64	4.43	5.66
Gross fixed capital expenditure — Public	(a)	(a)	(a)	(a)	(a)	2.74	1.64	2.02	0.99	8.43	4.16	0.69	5.86	4.40	8.58
Private — Dwellings	(a)	(a)	(a)	(a)	(a)	4.82	–4.60	–2.63	12.61	9.20	10.99	3.63	–12.74	7.30	13.95
Others	(a)	(a)	(a)	(a)	(a)	11.11	8.55	1.04	3.24	–0.57	11.46	7.84	–2.38	9.65	10.36
Gross National Expenditure after stock valuation adjustment	(a)	(a)	(a)	(a)	(a)	9.23	2.38	–2.43	5.24	5.48	5.38	6.10	–3.64	9.33	4.07
Plus — Exports of goods and services	(a)	(a)	(a)	(a)	(a)	0.13	9.73	12.10	–10.07	13.37	6.75	6.99	12.44	–1.49	16.41
Less — Imports of goods and services	(a)	(a)	(a)	(a)	(a)	20.93	–5.33	–13.74	9.62	1.25	16.82	17.05	–15.47	21.34	8.90
Gross National Product after stock valuation adjustment	(a)	(a)	(a)	(a)	(a)	5.89	4.91	1.70	2.08	7.29	3.88	4.41	1.18	5.50	5.26

(a) Not available.

Source: Commonwealth Bureau of Census and Statistics, Australian National Accounts, 1948 – 49 to 1963 – 64 (Canberra, 1965), Tables 10 and 11.

Table A3.2.3

GROSS NATIONAL PRODUCT 1948–49 – 1963–64
AVERAGE ANNUAL GROWTH RATES

	1948–49-1963–64	1953–54-1963–64	1948–49-1959–60	1953–54 – 1959–60		1953–54-1963–64
	Current Prices	Current Prices	1953–54 Prices	1953–54 Prices	1959–60 Prices	1959–60 Prices
Personal Consumption Expenditure	8.8	6.3	3.8	4.2	4.0	3.9
Current Expenditure by Financial Enterprises and Public Authorities	11.6	7.9	4.2	2.8	2.8	3.5
Gross Fixed Capital Expenditure –						
Public	11.9	6.9	6.7	3.5	3.3	4.0
Private – Dwellings	11.4	7.0	6.4	4.9	4.8	4.0
Other	12.7	8.2	7.2	5.7	5.7	5.9
Increase in Value of Stocks	1.8	13.1	n.a.	n.a.	n.a.	n.a.
Total Gross National Expenditure	9.6	6.9	n.a.	n.a	n.a.	n.a.
Gross National Expenditure after stock Valuation Adjustment	9.7	6.8	4.4	4.3	4.1	4.0
Exports of Goods and Services*	6.9	5.8	3.9	5.0	5.0	6.4
Imports of Goods and Services*	7.3	5.8	4.3	4.2	4.2	5.3
Gross National Product after Stock Valuation Adjustment	9.6	6.7	4.3	4.5	4.2	4.2

* = G.N.E. plus Exports minus Imports.

Source: Commonwealth Bureau of Census and Statistics, Australian National Accounts, 1948–49 to 1963–64 (Canberra, February 1965), Tables 10, 11.

Table A4.1.1

SIX COMMODITY CLASSIFICATION OF AUSTRALIAN FOOD CONSUMPTION EXPENDITURES: PRICE COEFFICIENTS FOR LINEAR PREDICTING EQUATIONS

$\{\hat{\alpha}_{ij}\}$

Equation i	Coefficient with Respect to the Price[a] of					
	Bread and Cereals	Meat and Fish	Dairy and Eggs	Sugar, Preserves and Confectionery	Fruit and Vegetables	Other
j =	1	2	3	4	5	6
1. Bread and Cereals	2.95	-1.29	-1.04	-0.64	-0.74	-0.25
2. Meat and Fish	-2.00	3.11	-3.06	-1.89	-2.16	-0.73
3. Dairy and Eggs	2.18	4.13	8.91	2.04	2.35	0.79
4. Sugar, Preserves and Confectionery	-1.11	-2.10	-1.70	2.38	-1.20	-0.41
5. Fruit and Vegetables	-1.49	-2.83	-2.28	-1.40	2.33	-0.55
6. Other	-0.54	-1.03	-0.83	-0.51	-0.59	1.13
Sum[b]	0	0	0	0	0	0

(a) Price indicators are those of Table 4.1.8

(b) Discrepancies are due to rounding errors.

Table A4.2.1

SCALE OF CONSUMPTION UNITS PER PERSON

Population	Milk	Meat	Fats	Cheese and Eggs	Cereals and Potatoes	Fruit	Beer	Wine	Spirits	All Consumption
0—4 years	1.25	.20	.40	.50	.50	.30	0	0	0	.70
5—9 years	1.05	.35	.75	.80	.90	.50	0	0	0	.70
Males 10—14 years	1.05	.70	1.05	.90	1.20	.70	0	0	0	.70
15—19	1.05	1.00	1.10	1.00	1.20	.90	1.00	1.00	1.00	.80
20—64	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
over 65	1.10	.70	.85	.95	.85	.90	1.00	1.00	1.00	.80
Females 10—14 years	.90	.60	.80	.80	.80	.70	0	0	0	.70
15—19	.90	.70	.80	.80	.80	1.10	0	.70	.50	.80
20 —64	1.00	.70	.80	.80	.80	1.10	0	.70	.50	1.00
over 65	1.10	.60	.70	.75	.70	.90	0	.70	.50	.80

Table A4. 8. 1

PRODUCTION AND UTILIZATION OF TALLOW
AUSTRALIA, 1954—55 TO 1964—65
('000 tons)

Year	Edible Tallow				Inedible Tallow			
	Production	Exports	Production less Exports	Factory Utiliz-ation	Production	Exports	Production less Exports	Factory Utiliz-ation
1954—55	43.8	3.1	40.7	n. l.	56.3	18.3	38.0	59.7
1955—56	52.1	6.3	45.8	n. l.	66.8	41.5	25.3	60.5
1956—57	51.4	6.0	45.4	38.2	81.7	46.8	34.9	60.4
1957—58	35.9	5.8	30.1	30.2	87.0	43.9	43.1	64.0
1958—59	51.0	3.7	47.3	34.4	112.8	51.1	61.7	60.8
1959—60	51.8	5.9	45.9	40.1	117.5	76.7	40.8	63.9
1960—61	51.8	2.5	49.3	48.9	98.8	48.5	50.3	53.8
1961—62	67.4	6.5	60.9	43.8	140.4	92.7	47.7	53.9
1962—63	74.2	6.1	68.1	46.7	164.4	111.5	52.9	55.0
1963—64	77.0	6.8	70.2	50.3	159.6	98.9	60.7	54.6
1964—65	n. a.	4.8	n. a.	n. a.	n. a.	92.3	n. a.	n. a.

n. l. — edible tallow not separately listed
n. a. — not yet available

Sources: Commonwealth Bureau of Census and Statistics, Production Bulletins, Secondary Industries, Part II — Manufacturing Industries, Nos. 49—57 (Canberra)
Commonwealth Bureau of Census and Statistics, Oversea Trade, Nos. 52—62 (Canberra).

TABLE A5.8.1

TOTAL DOMESTIC SUPPLY, IMPORTS AND EXPORTS OF UNMANUFACTURED TOBACCO LEAF AND MANUFACTURED TOBACCO PRODUCTS : AUSTRALIA, 1950-51 to 1964-65

Year	Unmanufactured (Unstemmed) Tobacco					Manufactured (Cut) Tobacco					Cigarettes and Cigars				
	Total Domestic Supply (a)	Import (a)	Export	Per Cent Import (b)	Per Cent Import (b)	Total Domestic Supply (c)	Import	Export	Per Cent Import (b)	Per Cent Export (b)	Total Domestic Supply (c)	Import	Export	Per Cent Export (b)	Per Cent Export (b)
	'000 lb			%		'000 lb			%		'000 lb			%	
1950-51	30,033	26,031	-	86.7	-	21,506	539.6	381.3	2.5	1.8	21,498	10,640.6	71.8	49.5	0.3
1951-52	31,585	27,699	1.6	87.7	-	22,218	602.7	464.5	2.7	2.1	24,105	12,181.4	81.3	50.5	0.3
1952-53	34,591	30,115	-	87.1	-	22,491	156.9	358.6	0.7	1.6	18,511	4,501.2	41.0	24.3	0.2
1953-54	40,222	35,061	2.5	87.2	-	23,601	200.9	310.7	0.9	1.3	24,729	6,250.1	83.6	25.3	0.3
1954-55	43,015	38,216	47.7	88.8	0.1	21,739	273.3	330.0	1.3	1.5	25,915	2,904.6	128.6	11.2	0.5
1955-56	45,297	39,643	137.7	87.5	0.3	19,052	216.4	301.0	1.1	1.6	28,321	1,025.8	337.2	3.6	1.2
1956-57	49,143	43,312	283.9	88.1	0.6	19,153	236.3	333.4	1.2	1.7	31,142	513.9	229.9	1.7	0.7
1957-58	48,759	40,674	500.2	83.4	1.0	18,595	402.4	373.8	2.2	2.0	33,326	457.0	374.8	1.4	1.1
1958-59	52,003	42,590	92.7	81.9	0.2	17,455	367.4	471.9	2.1	2.7	35,844	478.2	214.0	1.3	0.6
1959-60	52,758	40,477	54.9	76.7	0.1	15,854	591.8	383.9	3.7	2.4	40,613	1,115.1	152.3	2.7	0.4
1960-61	55,614	39,909	87.6	71.8	0.2	15,870	611.1	412.4	3.9	2.6	44,161	1,184.1	187.2	2.7	0.4
1961-62	53,541	34,277	129.8	64.0	0.2	13,772	761.0	438.2	5.5	3.2	44,103	1,202.5	323.5	2.7	0.7
1962-63	54,473	32,521	459.6	59.7	0.8	12,650	1,106.1	250.8	8.7	2.0	46,979	1,630.6	528.6	3.5	1.1
1963-64	54,184	32,477	341.3	59.9	0.6	11,406	1,355.5	530.9	11.9	4.7	47,973	1,784.1	589.4	3.7	1.2
1964-65	n. a.	29,946	555.1	n. a.	n. a.	n. a.	1,524.3	298.8	n. a.	n. a.	n. a.	1,708.9	590.8	n. a.	n. a.

n. a. – Not available.
(a) Converted to unstemmed leaf from stemmed leaf used in manufacture, before exports, including imports;
(b) Per cent of total domestic supply, before export, including import;
(c) Total domestic supply, including import, before export.

Source: Commonwealth Bureau of Census and Statistics, Manufacturing Industries, No. 26 - Tobacco, Cigars and Cigarettes (Canberra, published annually).

TABLE A6.1.1

AVERAGE ANNUAL GROWTH RATES IN AUSTRALIAN FARM OUTPUT
(all figures in percentages per annum)

	1945-46 Seasonally		1946-47 Seasonally		1947-48 Seasonally		1948-49 Seasonally		1949-50 Seasonally		1950-51 Seasonally		1951-52 Seasonally		1952-53 Seasonally		1953-54 Seasonally		1954-55 Seasonally	
	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.
1945-46			+3.1	-1.1	+3.5	+8.9	+3.6	+5.8	+2.7	+5.7	+2.3	+3.5	+1.9	+1.9	+2.1	+4.0	+2.6	+3.6	+2.1	+3.3
1946-47					4.0	+19.8	+3.9	+9.4	+2.6	+8.1	+2.2	+4.6	+1.7	+2.5	+1.9	+4.9	+2.5	+4.3	+2.1	+3.8
1947-48							+3.8	0	+1.9	+2.7	+1.6	0	+1.2	-1.2	+1.5	+2.1	+2.3	+1.9	+1.8	+1.7
1948-49									0	+5.5	+0.5	0	+0.3	-1.8	+0.9	+2.6	+1.9	+2.3	+1.5	+2.0
1949-50											+0.9	-5.2	+0.5	-5.1	+1.2	+1.7	+2.4	+1.5	+1.8	+1.4
1950-51													0	-5.5	+1.3	+5.4	+2.9	+3.8	+2.0	+3.1
1951-52															+2.7	+17.5	+4.5	+8.7	+2.7	+6.1
1952-53																	+6.2	+0.8	+2.6	+0.9
1953-54																			-0.8	+0.8

	1955-56 Seasonally		1956-57 Seasonally		1957-58 Seasonally		1958-59 Seasonally		1959-60 Seasonally		1960-61 Seasonally		1961-62 Seasonally		1962-63 Seasonally		1963-64 Seasonally		1964-65 Seasonally	
	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj	Adj.	Unadj.	Adj.	Unadj.
1945-46	+1.9	+3.6	+2.5	+3.3	+3.1	+2.5	+2.8	+4.7	+2.9	+3.3	+2.7	+3.4	+2.9	+3.3	+3.1	+3.5	+2.9	+3.6	+3.0	+3.6
1946-47	+2.2	+4.1	+2.5	+3.7	+3.2	+2.9	+2.8	+4.2	+2.9	+3.6	+2.6	+3.7	+2.9	+3.6	+3.1	+3.8	+2.9	+3.9	+2.9	+3.8
1947-48	+2.0	+2.3	+2.3	+2.1	+3.1	+1.3	+2.7	+2.9	+2.8	+2.4	+2.5	+2.6	+2.8	+2.5	+3.0	+2.8	+2.8	+2.9	+2.8	+3.0
1948-49	+1.7	+2.7	+2.1	+2.3	+3.0	+1.5	+2.5	+3.2	+2.8	+2.6	+2.4	+2.8	+2.7	+2.7	+3.0	+2.1	+2.7	+3.1	+2.7	+3.2
1949-50	+2.0	+2.2	+2.4	+1.9	+3.4	+1.0	+2.8	+2.9	+3.0	+2.3	+2.6	+2.6	+3.0	+2.5	+3.2	+2.9	+2.9	+3.0	+2.9	+3.0
1950-51	+2.3	+3.8	+2.7	+3.1	+3.7	+1.9	+3.1	+4.0	+3.3	+3.2	+2.8	+3.4	+3.2	+3.3	+3.4	+3.6	+3.1	+3.6	+3.0	+3.6
1951-52	+2.8	+6.2	+3.2	+4.9	+4.4	+3.2	+3.5	+5.4	+3.7	+4.3	+3.1	+4.4	+3.5	+4.2	+3.7	+4.4	+3.3	+4.4	+3.3	+4.3
1952-53	+2.9	+2.7	+3.4	+2.0	+4.7	+0.5	+3.6	+3.5	+3.8	+2.5	+3.2	+2.9	+3.6	+2.8	+3.8	+3.2	+3.4	+3.3	+3.3	+3.3
1953-54	+1.3	+3.6	+2.4	+2.4	+4.3	+0.4	+3.1	+4.1	+3.4	+2.8	+2.7	+3.2	+3.3	+3.0	+3.5	+3.5	+3.1	+3.6	+3.0	+3.5
1954-55	+3.4	+6.5	+4.1	+3.2	+6.1	+0.3	+4.1	+4.9	+4.3	+3.2	+3.3	+3.6	+3.9	+3.4	+4.1	+3.8	+3.6	+3.9	+3.4	+3.4
1955-56			+4.9	0	+7.4	-2.7	+4.4	+4.0	+4.6	+2.4	+3.4	+3.0	+3.9	+2.8	+4.2	+3.4	+3.6	+3.5	+3.5	+3.5
1956-57					+10.1	-5.4	+4.2	+6.6	+4.5	+3.2	+3.0	+3.8	+3.8	+3.4	+4.1	+4.0	+3.4	+4.1	+3.3	+4.0
1957-58							+1.4	+20.2	+1.7	+7.8	+0.7	+7.0	+2.2	+5.7	+3.0	+6.0	+2.3	+5.7	+2.4	+5.4
1958-59									+5.0	-3.4	+1.8	+1.0	+3.4	+1.3	+4.0	+2.7	+3.1	+3.0	+3.4	+3.1
1959-60											-1.4	+5.6	+2.7	+3.7	+3.7	+4.9	+2.6	+4.7	+2.6	+4.5
1960-61													+6.9	+2.0	+6.4	+4.5	+4.0	+4.4	+3.6	+4.2
1961-62															5.8	+7.1	+2.6	+5.6	+2.5	+4.9
1962-63																	-0.6	+4.2	+0.9	+2.5
1963-64																			+2.5	+3.5

Source: Table 6.1.1.

TABLE A6.2.1

LAND UTILISATION, AUSTRALIA : 1948-49 to 1963-64

Year	No. of of Rural Holdings	Area in Holdings	Area under Crop	Area under Sown Grasses and Clovers	Area fertilised		Quantity of Super-phosphate Used	Quantity of Other Artificial Fertilisers Used	Aerial Agriculture		
					Crops	Pastures			Total Area Treated	Area Fertilised Super-phosphate	Quantity of Super-phosphate Used
	('000)	(million acres)					('000 tons)		('000 acres)		('000 tons)
1948-49	247.2	927	20.6	14.2(a)	14.8	11.2	1,187	158			
1949-50	245.3	929	20.6	18.2(a)	14.9	13.0	1,307	146			
1950-51	243.6	938	19.9	17.9(a)	14.5	13.9	1,338	150			
1951-52	243.9	939	19.8	n. a.	13.9	15.6	1,404	151			
1952-53	245.2	940	20.4	20.5	14.2	16.8	1,492	166			
1953-54	247.0	947	21.1	23.1	14.7	17.9	1,568	175			
1954-55	247.5	955	20.9	26.1	15.2	19.6	1,708	172			
1955-56	252.8(b)	1.124(b)	21.2	28.4	15.1	21.5	1,814	181	n. a.	n. a.	n. a.
1956-57	251.9	1.137	18.2	32.6	13.3	22.3	1,814	192	1,466	902	55
1957-58	252.6	1.143	20.4	33.8	15.3	24.9	2,023	228	2,031	1,384	79
1958-59	252.4	1.135	23.3	33.6	17.9	23.7	2,048	215	2,268	1,151	63
1959-60	252.2	1.148	25.0	33.3	18.1	24.5	2,094	230	3,669	2,312	126
1960-61	252.0	1.157	27.1	35.6	19.6	26.6	2,252	231	6,240	4,347	237
1961-62	252.7	1.172	27.9	39.1	19.9	27.6	2,331	262	7,163	5,132	278
1962-63	252.2	1.178	30.1	41.0	21.6	29.4	2,518	289	8,764	6,302	329
1963-64	253.2	1.185	29.5	44.1	21.3	32.5	2,744	337	13,794	10,468	547

(a) Not strictly comparable with later figures.
(b) New Series.
n. a. Not available prior to 1955-56.

Source: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries (Bulletin Nos. 40-56, issues for 1945-46 through 1961-62, Canberra).

TABLE A6.2.2

FARM DISPOSAL AND PRODUCTION ACCOUNT AT CURRENT PRODUCER PRICES
AUSTRALIA : 1948-49 to 1960-61
(£ Millicn)

	1948-49	1949-50	1950-51	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61
	AT CURRENT PRICES												
Disposal of Farm Products -													
Consumption	217	261	340	388	406	442	452	484	486	510	523	560	563
Exports	417	518	826	502	640	589	573	571	716	544	545	671	635
Seed and stock fodder	40	44	53	70	66	80	77	76	75	114	78	100	97
Change in farm stocks	-72	-38	-38	-16	34	37	7	31	-31	-38	132	-19	54
Balance	3	1	6	16	17	3	-5	-4	29	-1	-17	16	25
Gross Value of Production	605	786	1187	960	1163	1151	1104	1158	1275	1129	1261	1328	1374
Less Costs -													
Marketing costs	53	64	79	88	110	114	106	118	117	100	142	128	156
Seed and fodder	55	58	69	93	94	109	109	109	111	137	107	136	145
Wages and salaries	47	54	68	84	96	105	109	110	116	122	118	122	122
Other costs	96	106	122	149	183	194	197	206	224	240	241	252	264
Total Costs	251	282	338	414	483	522	521	543	568	599	608	638	687
Gross Operating Surplus	354	504	849	546	680	629	583	615	707	530	653	690	687
	AT 1953-54 PRODUCER PRICES												
Disposal of Farm Products -													
Consumption	404	408	423	414	418	442	456	469	469	502	509	513	516
Exports	660	672	580	529	632	589	630	701	745	641	717	810	823
Balance	-58	-13	17	34	76	120	76	80	53	61	211	77	131
Gross Value of Production	1006	1067	1020	977	1126	1151	1162	1250	1267	1204	1437	1400	1470
Less Costs -													
Marketing costs	76	89	106	99	114	114	107	114	110	107	135	128	140
Seed and fodder	92	94	99	102	101	108	105	115	112	121	112	130	132
Wages and salaries	102	102	102	103	107	105	104	102	103	108	111	102	101
Other costs	174	180	182	180	190	195	205	211	213	222	230	236	241
Total Costs	444	465	489	484	512	522	521	542	538	588	588	596	614
Gross Operating Surplus	562	602	531	493	614	629	641	708	729	646	849	804	856

Source: F. Juhasz and B. Hillsdon, "Farm Income Estimates in Relation to Economic Changes" (Paper presented to Section G, Australian and New Zealand Association for the Advancement of Science, 37th Congress, 1964).

Table A6. 5. 1

CANNED FRUIT OUTPUT BY STATES, 1963 – 64
('000 std. cartons)

Fruit	Queensland	New South Wales	Victoria	South Australia	Western Australia	Tasmania	Total
Peaches	29	859	1686	747	12	-	3333
Pears	22	164	2854	117	-	50	3207
Apricots	7	49	250	133	1	3	443
Mixed Fruits	30	45	361	180	-	-	616
Pineapple	1150	-	-	-	-	-	1150
Tropical Fruit Salad	551	-	-	-	-	-	551
Total	1789	1117	5151	1177	13	53	9300

Source: Commonwealth of Australia, *Australian Canned Fruits Board, Annual Report and Accounts, 1964,* Appendices A to F.

Table A6.5.2

ACREAGE OF DECIDUOUS TREE FRUITS SUPPLYING FRUIT FOR CANNING IN VICTORIA, NEW SOUTH WALES, AND SOUTH AUSTRALIA, 1963—64
(Acres)

Fruit	Victoria		New South Wales		South Australia	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
Canning Peaches	8892	3299	3705	541	3670(a)	890
Total Apricots[b]	3623	392	1708	362	3643	877
Canning Pears	7265	2755	933	260	761(a)	145

(a) Figures for South Australian canning peaches and pears refer to areas of these fruit grown in the Murray River Irrigation District and are extracted from a South Australian Department of Agriculture paper; "Survey and Review of Canning Apricot, Peach and Pear Plantings in South Australia — Period 1963—64".

(b) No data are published which distinguish between canning and non-canning apricots on a state wide basis.

Source: Commonwealth Bureau of Census and Statistics, Statistical Bulletin, The Fruit Growing Industry, Australia, No. 20, 1963—64, Canberra, Tables 2 and 3

Table A6.5.3

ACREAGE, FRESH FRUIT PRODUCTION, AND CANNED OUTPUT OF APRICOTS, AUSTRALIA, 1945—46 TO 1964—65

Year	Acreage		Raw Production		Canned Output	Proportion Canned	Minimum Price
	Bearing	Non-bearing	Total	per bearing acre			
	acres		'000 bus. (a)	bushels	'000 std. cases	percent	$'s/ton
1945—46	10137	2308	1107	109	234	14.1	34
1946—47	10601	2583	1239	117	272	14.6	34
1947—48	10538	2641	1551	147	397	17.0	38
1948—49	10745	2819	1347	125	453	22.4	40
1949—50	10526	2751	1463	139	647	29.5	44
1950—51	10533	2769	1309	124	505	25.7	52
1951—52	10692	2590	1492	140	882	39.4	80
1952—53	10510	2389	1265	120	630	33.2	84
1953—54	10592	2289	1744	165	1271	48.6	88
1954—55	10819	2274	1544	143	846	36.5	80
1955—56	10813	2274	1383	128	789	38.0	90
1956—57	10192	2301	1417	139	802	37.7	90
1957—58	10029	2660	1575	157	891	37.7	90
1958—59	9466	2637	1430	151	449	20.9	70
1959—60	9374	2685	1546	165	576	24.8	60
1960—61	9187	2758	1323	144	334	16.8	76
1961—62	9376	2085	1869	199	918	32.8	86
1962—63	9896	1951	1913	193	846	29.5	86
1963—64	10029	1861	1610	160	443	18.3	86
1964—65	9364	1910	1968	210			96

(a) A bushel of apricots weighs approximately 48 lb.

Source: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I - Rural Industries (Canberra), 1945—46 to 1961—62.
Commonwealth Bureau of Census and Statistics, The Fruit Growing Industry (Statistical Bulletins No. 19, Season 1962—63 and No. 20, Season 1963—64, Canberra).
Commonwealth of Australia: Annual Report of the Australian Canned Fruits Board, 1961 to 1964.

Table A6. 5. 4.

ACREAGE, FRESH FRUIT PRODUCTION AND CANNED OUTPUT OF PEACHES, NEW SOUTH WALES AND VICTORIA, 1949—50 TO 1963—64

Year	Canning Acreage			Raw Production		Canned Output	Minimum Price
	Bearing	Non-bearing	Total	Total	per bearing acre		
	acres			'000 bus. (a)	bushels	'000 std. cases	$'s/ton (c)
1949—50	11569	2355	13924	1431	124	1292	40
1950—51	11406	2157	13563	1564	137	1426	50
1951—52	11382	1965	13347	1984	174	1909	74
1952—53	10581	1702	12283	1834	173	1749	78
1953—54	10420	1594	12014	2312	222	2526	82
1954—55	10149	1759	11908	1987	196	2155	82
1955—56	9296	1698	10994	1488	160	1672	92
1956—57	8007	1912	9914	1136	142	1300	112
1957—58	8072	2778	10850	1655	205	2223	112
1958—59	5644	6887	12531	1257	223	1492	92
1959—60	5913	7278	13191	1583	268	1780	80
1960—61	6093	7377	13470	1236	203	1301	88
1961—62	10062	5931	15993	2285	227	2781	88
1962—63	12056	4402	16458	2438	202	2910	88
1963—64	12597	3840	16437	2505	199	3160	82

(a) A bushel of peaches weighs approximately 45 lb.

(b) Includes an adjustment equivalent to 50 percent of canned mixed deciduous fruits. Years 1949—50 to 1954—55 are approximated by subtracting the average "Rest of Australia" output for that period from the annual total Australian output of canned mixed fruits in those years.

(c) Minimum price established by the F.I.S.C.C. for clear centre, clingstone peaches.

Source: Commonwealth Bureau of Census and Statistics, Production Bulletin, Primary Industries, Part I - Rural Industries (Canberra), 1945—46 to 1961—62.
Commonwealth Bureau of Census and Statistics, The Fruit Growing Industry (Statistical Bulletins No. 19, Season 1962—63 and No. 20, Season 1963—64, Canberra)
Commonwealth of Australia: Annual Report of the Australian Canned Fruits Board 1941 to 1964.

Table A6.5.5

ACREAGE, FRESH FRUIT PRODUCTION AND CANNED OUTPUT OF PEARS, AUSTRALIA, 1945—46 TO 1963—64

Year	Acreage		Raw Production		Canned Output	Proportion Canned	Minimum Price - W.B.C.
	Bearing	Non-bearing	Total	per bearing acre			
	acres		'000 bus. (a)	bushels	'000 std. cases (b)	percent	$'s/ton (c)
1945—46	18484	4132	2644	143	656	27.54	30.0
1946—47	19888	2142	3607	181	850	26.15	30.0
1947—48	19839	2946	3240	163	893	30.59	32.0
1948—49	19662	2972	3125	159	1025	36.41	32.0
1949—50	18854	2725	2861	152	1024	39.73	34.0
1950—51	18839	2898	3549	188	1177	36.81	41.0
1951—52	18346	2611	3534	193	1366	42.90	66.0
1952—53	18523	2831	3513	189	1336	42.21	66.0
1953—54	18436	2604	4442	241	1774	44.32	70.0
1954—55	18461	2786	4708	255	1913	45.01	72.0
1955—56	18522	3508	4206	227	1898	50.08	82.0
1956—57	17484	4015	4606	263	2324	56.00	96.0
1957—58	17454	4535	5307	303	2384	49.86	96.0
1958—59	17805	5209	4738	366	2111	49.45	76.0
1959—60	17871	5813	5268	295	2516	53.01	76.0
1960—61	17785	6150	5361	302	2716	56.23	84.0
1961—62	18455	6883	6567	356	3227	54.53	84.0
1962—63	19997	5948	5667	283	2874	56.29	84.0
1963—64	20184	5586	6916	341	3515	56.47	84.0

(a) A bushel of pears weighs approximately 45 lb.

(b) Includes an adjustment equivalent to 50 percent of canned mixed deciduous fruits.

(c) Minimum price established by the F.I.S.C.C. for William Bon Chretian pears.

Source: As for Appendix Table A6.5.4.

Table A6.5.6

PRODUCTION OF DRIED TREE FRUITS, AUSTRALIAN STATES[(a)], 1963—64
(tons)

Dried Tree Fruit	New South Wales	Victoria	South Australia	Tasmania	Total
Apples	-	-	-	312	312
Apricots	-	9	2325	-	2334
Figs	-	-	23	-	23
Peaches	-	2	789	-	791
Pears	-	7	270	-	277
Prunes	4212	215	398	-	4825
Nectarines	-	-	24	-	24
Total	4212	233	3829	312	8586

(a) Queensland and Western Australia produce no dried tree fruits.

Source: Commonwealth Bureau of Census and Statistics, Statistical Bulletin: The Fruit Growing Industry, Australia, No. 20 - Season 1963—64 (Canberra) Table II.

Table A6.7.1

AREA OF TOBACCO, BY STATES : AUSTRALIA
(acres)

Season	New South Wales	Victoria	Queensland	Western Australia	Total
Average of 3 years ending					
1938—39	679	4,262	3,735	1,055	9,964
1948—49	415	1,046	1,948	609	4,018
Years					
1950—51	342	1,021	4,142	967	6,472
1951—52	432	1,500	5,038	1,229	8,199
1952—53	445	1,613	4,339	1,525	7,922
1953—54	501	2,246	4,065	1,434	8,246
1954—55	635	2,471	3,135	1,418	9,659
1955—56	893	2,876	6,301	1,235	11,305
1956—57	1,031	2,935	7,029	1,176	12,171
1957—58	1,193	3,252	7,493	1,266	13,204
1958—59	1,543	4,248	7,916	1,444	15,151
1959—60	2,142	6,424	9,527	1,561	19,654
1960—61	893	9,932	14,395	1,478	29,213
1961—62	1,031	9,286	14,069	194	26,627
1962—63	1,193	9,844	16,346	28	29,381
1963—64	1,543	10,519	14,910		28,356

Sources: Commonwealth Bureau of Census and Statistics, Yearbook of the Commonwealth of Australia (Canberra); Rural Land Use and Crop Production (Statistical Bulletin No. 21, Season 1963—64, Canberra).

Table A6. 7. 2
MINIMUM PERCENTAGES AND FACTORY UTILISATION OF AUSTRALIAN TOBACCO LEAF
1950—51 TO 1965—66

Year	Cigarettes			Cut Tobacco		
	Minimum Percentage	Australian Leaf Actually Used		Minimum Percentage	Australian Leaf Actually Used	
	%	%	'000 lb	%	%	'000 lb
1950—51	3.0	5.3	570	5.0	18.4	3,205
1951—52	3.0	6.3	744	5.0	16.3	2,920
1952—53	3.0(a)	8.5	1,202	5.0(a)	16.4	3,021
1953—54	6.0	9.3	1,746	10.0	16.4	3,120
1954—55	6.0	8.3	1,895	12.5	14.9	2,587
1955—56	7.5	8.4	2,264	17.5	19.1	2,939
1956—57	7.5	7.9	2,404	17.5	18.4	2,895
1957—58	12.5	12.8	3,910	21.0	21.9	3,244
1958—59	15.5	17.3	5,985	16.5	19.6	2,807
1959—60	22.0	22.9	8,447	23.5	24.1	3,086
1960—61	28.5	29.7	11,431	24.5	25.8	3,302
1961—62	35.0	36.4	14,395	32.0	33.6	3,656
1962—63	40.0(b)	40.3	16,633	40.0	37.8	3,643
1963—64	40.0	39.6	16,814	40.0	40.1	3,342
1964—65	41.5(c)	n. a.	n. a.	41.5(c)	n. a.	n. a.
1965—66	45.0(d)	n. a.	n. a.	45.0(d)	n. a.	n. a.

(a) From 1.4.1953: 6% for cigarettes and 10% for tobacco.

(b) From 1.7.1962 to 12.9.1962: 43% for cigarettes, 40% for tobacco; from 12.9.1962 to 30.6.1963; 40% for both cigarettes and cut tobacco.

(c) From 1.7.1964 to 31.3.1965: 41.5% ; 1.4.1965 to 30.6.1965: 43.0%

(d) From 1.7.1965 to 30.9.1965: 45.0% ; 1.10.1965 to 31.12.1965: 47.0%; from 1.1.1966: 50.0%.

n. a. Not available.

Sources: N.D. Honan and W.J Byrne, "The Growing Australian Market for Tobacco Products", Quarterly Review of Agricultural Economics, Vol. 15, No. 1 (January 1962), p. 17.
Commonwealth Bureau of Census and Statistics, Manufacturing Industries, No. 26 - Tobacco, Cigars and Cigarettes, (annual, Canberra).
Australian Financial Review, 19 February, 1965.

TABLE A6.7.3

AUSTRALIAN EXPORTS OF RICE: QUANTITY AND AVERAGE VALUE (a)

Year	Brown Rice Whole or Broken (b)		Milled Rice Whole		Milled Rice Broken		Rice: Total All Types Reduced to Milled Equivalent	
	Quantity	Average Price	Quantity	Average Price	Quantity	Average Price	Quantity	Average Price
	'000 tons	$	'000 tons	$	'000 tons	$	'000 tons	$
1945—46	15.4	44.33	8.8	54.55	1.1	17.44	23.7	49.91
1946—47	1.3	62.42	23.1	60.97	0.6	54.79	24.8	61.24
1947—48	0.2	73.28	27.6	74.71	0.2	60.20	28.0	74.66
1948—49	0.4	97.12	24.1	88.69	3.2	99.50	27.6	90.19
1949—50	—	90.40	25.7	91.41	1.0	14.82	26.7	88.46
1950—51	0.1	104.25	29.3	103.41	0.1	93.42	29.4	103.42
1951—52	0.2	188.37	24.4	135.84	0.6	138.32	25.1	136.39
1952—53	0.1	149.38	23.7	154.92	0.1	119.68	23.9	154.86
1953—54	0.8	179.98	28.5	198.95	6.2	117.35	35.4	184.78
1954—55	2.8	161.57	15.4	165.47	12.2	116.28	30.1	146.87
1955—56	9.0	129.65	23.0	135.26	11.0	85.62	42.0	124.18
1956—57	8.9	124.93	18.2	138.24	2.2	83.90	28.3	134.52
1957—58	10.3	120.98	17.2	139.45	4.2	100.45	30.8	133.26
1958—59	8.9	134.38	26.9	134.96	8.3	89.22	43.3	129.24
1959—60	13.3	118.67	40.9	107.02	11.8	76.09	64.6	106.14
1960—61	18.0	99.96	33.0	115.92	10.8	77.34	60.0	108.80
1961—62	14.0	112.02	31.4	116.92	6.0	87.52	50.0	115.60
1962—63	12.0	116.10	35.9	135.85	9.4	104.26	56.0	122.80
1963—64	6.4	121.43	47.2	132.57	2.2	95.42	55.0	129.80
1964—65	4.3	117.70	54.8	125.44	4.9	127.20	63.5	125.10

(a) Average price per ton calculated from total quantity exported and total value (f.o.b.) of export.

(b) Includes exports of rice in the husk (paddy).

Sources: G. N. Steele "The Changing Outlook for Australian Rice", Quarterly Review of Agricultural Economics, Vol. 13, No. 3 (July 1960), pp. 101—111.
Commonwealth Bureau of Census and Statistics, Oversea Trade Bulletin (published annually, Canberra).

Table A7.5.1

PROJECTION OF DRIED PRUNE OUTPUT, NEW SOUTH WALES, VICTORIA AND SOUTH AUSTRALIA; AND DRIED APRICOT OUTPUT, SOUTH AUSTRALIA; 1965, 1970, 1975 AND 1980.

Factors Estimated	Units	Base Period	1965	1970		1975		1980	
		(a)	(a)	Low	High	Low	High	Low	High
Prunes:									
Bearing Acreage	acres	3,481	3,475	3,450	3,550	3,500	3,650	3,600	3,800
Yield per bearing acre	tons	3.04	3.69	3.5	4.2	3.8	4.5	4.0	4.7
Production of fresh prunes	tons	10,615	12,820	12,075	14,910	13,300	16,425	14,400	17,860
Ratio of fresh prunes to dried prunes		2.88	2.47	2.55	2.45	2.55	2.45	2.55	2.45
Production of dried prunes	tons	3,685	5,204	4,735	6,085	5,215	6,704	5,647	7,289
Apricots:									
Production of fresh apricots	tons	16,162	25,430	25,300	30,000	28,850	34,000	32,100	37,400
Quantity of fresh apricots dried	tons	10,318	15,191	14,880	18,677	17,710	22,116	20,460	25,154
Output of dried apricots	tons	1,870	2,760	2,705	2,395	3,220	4,021	3,720	4,573

(a) Actual data. Source: Table 6.5.14 for prunes and Table 6.5.15 for apricots. Base period is average of years 1958–59 to 1961–62.

Table A7. 7. 1

ESTIMATED AND PROJECTED REQUIREMENTS OF UNMANUFACTURED STEMMED AND UNSTEMMED TOBACCO LEAF FOR LOCAL MANUFACTURE : AUSTRALIA[(a)]
(million lbs)

Period	Stemmed Leaf Used For:-						Unstemmed Leaf Used For:—					
	Cut Tobacco		Cigarettes		Total		Cut Tobacco		Cigarettes		Total	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Base Period*	12.7		37.0		49.7		13.5		39.4		52.9	
1965 (Estimated)	8.4	9.2	43.2	44.2	51.6	53.4	8.9	9.8	46.0	47.0	54.9	56.8
1970	10.5	11.7	46.2	55.4	56.7	67.1	11.2	12.4	49.1	58.9	60.3	71.3
1975	11.1	12.6	49.0	68.5	60.1	81.1	11.8	13.4	52.1	72.9	63.9	86.3
1980	11.7	13.4	51.6	83.0	63.3	96.4	12.4	14.3	54.9	88.3	67.3	102.6

* Base Period is the average for the 4 years 1958—59 to 1961—62.

(a) Derived from Table 7.7.3.

TABLE A8.3.1

PROJECTED CONSUMPTION OF DAIRY PRODUCTS AT CONSTANT PRICES
COUNTRY PROJECTIONS FOR E. E. C., OTHER NON-COMMUNIST EUROPE, CANADA AND U. S. A.

Country	Demand Function Adopted	Base Period Income Elasticity of Demand	Base Consump-tion Av. 1959-61	Projection Consumption[a]					
				1970		1975		1980	
				Low	High	Low	High	Low	High
			Thousand Metric Tons, Milk Equivalent						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<u>E. E. C.</u>									
Belgium-Luxembourg									
Milk and Cream	Log-inverse	-0.3	969	970	950	970	940	970	930
Butter	"	-0.4	1,994	1,950	1,890	1,930	1,870	1,930	1,830
Cheese	"	0.7	551	660	690	720	770	770	830
Other Products	"	0	290	300	300	310	310	320	320
Total (b)			3,804	3,880	3,840	3,940	3,890	3,990	3,910
France									
Milk and Cream	Log-inverse	0.2	4,843	5,470	5,620	5,860	6,000	6,200	6,340
Butter	"	0.6	6,502	8,130	8,710	9,040	9,100	9,820	11,180
Cheese	"	0.2	3,987	4,510	4,620	4,820	4,940	5,100	5,220
Other Products	"	0.5	548	670	710	730	790	790	850
Total (b)			15,880	18,780	19,660	20,450	20,830	21,910	23,590
West Germany									
Milk and Cream	Log-inverse	-0.2	5,863	5,860	5,800	5,750	5,690	5,800	5,690
Butter	"	0.4	9,163	10,900	11,180	11,450	11,820	12,100	12,460
Cheese	"	0.3	2,049	2,380	2,420	2,460	2,520	2,560	2,640
Other Products	"	0.6	1,454	1,830	1,910	1,960	2,060	2,110	2,230
Total (b)			18,529	20,980	21,310	21,620	22,090	22,570	23,020
Italy									
Milk and Cream	Log-inverse	0.6	3,146	4,000	4,180	4,400	4,750	4,840	5,100
Butter	"	0.9	1,635	2,270	2,420	2,580	2,800	2,910	3,160
Cheese	"	0.5	5,040	6,250	6,400	6,750	7,060	7,360	7,710
Other Products	"	0	123	130	130	140	140	140	140
Total (b)			9,944	12,650	13,140	13,880	14,740	15,250	16,100

TABLE A8.3.1 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Netherlands									
Milk and Cream	Log-inverse	0.1	1,407	1,600	1,600	1,700	1,720	1,790	1,800
Butter	"	1.1	1.035	1,520	1,650	1,770	1,950	2,000	2,250
Cheese	"	0.9	833	1,170	1,240	1,320	1,430	1,480	1,620
Other Products	"	2.2	325	540	730	810	980	990	1,250
Total (b)			3,600	4,830	5,220	5,600	6,080	6,260	6,920
Other Non-Communist Europe									
Austria									
Milk and Cream	Log-inverse	0	1,175	1,200	1,200	1,200	1,200	1,210	1,210
Butter	"	0.1	613	640	640	640	660	660	670
Cheese	"	0.2	358	380	380	390	400	400	410
Other Products	"	0.5	30	30	30	40	40	40	40
Feed and Waste			624	730	770	780	830	840	890
Total			2,800	2,980	3,040	3,050	3,130	3,150	3,220
Denmark									
Milk and Cream	Log-inverse	0	622	670	670	680	680	710	710
Butter	"	0.1	955	1,040	1,050	1,080	1,090	1,120	1,150
Cheese	"	0.5	36	40	40	50	50	50	50
Other Proudcts	"	—	0	0	0	0	0	0	0
Feed and Waste			337	320	360	330	370	340	380
Total			1,950	2,070	2,120	2,140	2,190	2,220	2,290
Finland									
Milk and Cream	Log-inverse	-0.4	1,269	1,270	1,230	1,280	1,240	1,290	1,260
Butter	"	0.2	1,369	1,520	1,590	1,660	1,680	1,740	1,790
Cheese	"	0.5	130	160	160	170	180	190	200
Other Products	"	0	24	30	30	30	30	30	30
Feed and Waste			126	120	160	130	160	130	170
Total			2,918	3,100	3,170	3,270	3,290	3,380	3,450
Greece									
Milk and Cream	Semi-log	0.7	375	480	520	540	600	610	690
Butter	"	0.7	198	250	280	290	320	320	370
Cheese	"	0.7	372	470	520	540	600	600	690
Other Products	"	0.7	84	110	120	120	140	140	160
Feed and Waste			224	340	340	400	400	450	460
Total			1,253	1,650	1,780	1,890	2,060	2,120	2,370

TABLE A8.3.1 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ireland									
Milk and Cream	Log-inverse	0	597	600	600	600	600	600	600
Butter	"	-0.1	896	880	870	880	870	880	870
Cheese	"	0	30	30	30	30	30	30	30
Other Products	"	0.2	390	400	410	410	420	420	430
Feed and Waste			420	550	590	600	650	660	710
Total			2,333	2,460	2,500	2,520	2,570	2,590	2,640
Norway									
Milk and Cream	Log-inverse	-0.2	682	720	710	740	720	760	740
Butter	"	0	258	280	280	290	290	310	310
Cheese	"	0.7	304	370	390	420	450	460	500
Other Products	"	0	180	200	200	210	210	210	210
Feed and Waste			160	180	180	180	190	190	190
Total			1,584	1,750	1,760	1,840	1,860	1,930	1,950
Portugal									
Milk and Cream	Semi-log	1.2	221	320	340	360	400	400	460
Butter	"	1.2	80	110	120	130	140	150	170
Cheese	"	1.2	133	190	210	220	240	240	280
Other Products	"	-	0	0	0	0	0	0	0
Feed and Waste			n. a.						
Total			434	620	670	730	780	790	910
Spain									
Milk and Cream	Semi-log	1.0	1,817	2,650	2,850	3,050	3,340	3,430	3,850
Butter	"	1.0	95	140	150	160	170	180	200
Cheese	"	1.0	368	540	580	620	680	700	780
Other Products	"	1.0	107	160	170	180	200	200	230
Feed and Waste			870	1,020	1,000	1,080	1,060	1,150	1,120
Total			3,257	4,510	4,750	5,090	5,450	5,660	6,180
Sweden									
Milk and Cream	Log-inverse	-0.1	1,146	1,190	1,180	1,210	1,200	1,250	1,240
Butter	"	-0.1	1,350	1,400	1,390	1,430	1,420	1,470	1,460
Cheese	"	0.5	370	430	450	460	480	490	520
Other Products	"	0	640	680	680	700	700	720	720
Feed and Waste			232	200	210	180	190	170	180
Total			3,738	3,900	3,910	3,980	3,990	4,100	4,120

TABLE A8.3.1 (concluded)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Switzerland									
Milk and Cream	Log-inverse	-0.4	1,070	1,060	1,040	1,030	1,020	1,060	1,020
Butter	"	0.1	836	940	940	970	990	1,020	1,030
Cheese	"	0.2	405	470	480	490	500	520	530
Other Products	"	0.4	122	150	150	160	160	170	180
Feed and Waste			531	620	590	660	630	690	670
Total			2,964	3,240	3,200	3,310	3,300	3,460	3,430
Turkey									
Milk and Cream	Semi-log	0.6	795	1,210	1,300	1,470	1,630	1,690	2,030
Butter	"	0.6	1,064	1,620	1,740	1,970	2,180	2,270	2,720
Cheese	"	0.6	1,096	1,670	1,800	2,030	2,250	2,330	2,810
Other Products	"	0.6	n. a.						
Feed and Waste			n. a.						
Total			2,955	4,500	4,840	5,470	6,060	6,290	7,560
U. S. A. and Canada									
Canada									
Milk and Cream	Log-inverse	0.2	3,413	4,270	4,340	4,710	4,850	5,260	5,460
Butter	"	-1.0	3,100	3,250	2,910	3,380	2,910	3,500	3,010
Cheese	"	0.6	567	740	790	850	930	970	1,080
Other Products	"	0	670	810	810	890	890	980	980
Feed and Waste			350	380	390	410	420	440	450
Total			8,100	9,450	9,240	10,240	10,000	11,150	10, 980
U. S. A.									
Milk and Cream	Log-inverse	-1.0	26,850	26,850	24,700	27,120	24,170	27,380	24,170
Butter	"	-1.0	13,490	13,490	12,410	13,620	12,140	13,760	12,140
Cheese	"	0.6	6,830	8,530	8,940	9,480	10,170	10,650	11,470
Other Products	"	-0.2	7,520	8,420	8,280	8,880	8,730	9,480	9,400
Feed and Waste			1,170	1,080	1,270	1,080	1, 280	1,090	1,290
Total			55,860	58,370	55,600	60,180	56,490	62,360	58,470

Sources (for base period consumption): As for Table 8.3.2.

Table A8.3.2

ESTIMATED AND PROJECTED PRODUCTION OF WHOLE MILK AT CONSTANT PRICES
COUNTRY PROJECTIONS FOR OTHER NON-COMMUNIST EUROPE, CANADA AND U.S.A.
(Thousand Metric Tons)

Country	Base Period Production Av. 1959—61	Estimated Production 1965	Projected Production					
			1970		1975		1980	
			Low	High	Low	High	Low	High
Other Non-Communist Europe								
Austria	2,959	3.200	3,490	3,630	3,770	3,920	4,060	4,220
Denmark	5,488	5,360	5,590	5,810	5,730	5,970	5,880	6,120
Finland	3,516	3,930	3,950	4,110	4,050	4,200	4,100	4,300
Greece	1,131	n.a.	1,630	1,800	1,900	2,100	2,170	2,390
Ireland	2,646	2,990*	3,280	3,650	3,630	4,030	3,970	4,410
Norway	1,764	1,660	1,870	2,070	1,960	2,170	2,050	2,270
Portugal	436	n.a.	520	570	570	630	620	680
Spain	3,232	n.a.	3,690	4,080	3,930	4,340	4,160	4,590
Sweden	3,976	3,900	3,430	3,610	3,190	3,350	2,940	3,090
Switzerland	3,108	3,040*	3,290	3,640	3,500	3,860	3,700	4,080
Turkey	2,960	n.a.	3,650	4,030	4,110	4,540	4,570	5,050
U.S.A. and Canada								
Canada	8,533	8,290	9,210	10,180	9,890	10,930	10,570	11,690
U.S.A.	55,955	56,720	57,500	58,500	58,500	59,500	59,500	60,500

* 1964.

Sources (for base period and 1965 production): As for Table 8.3.4 and Commonwealth Economic Committee, Dairy Produce, 1965 (H.M.S.O., London, 1966).

TABLE A8.4.1

PROJECTED CONSUMPTION OF MEATS AT CONSTANT PRICES
COUNTRY PROJECTIONS FOR E. E. C., OTHER NON-COMMUNIST EUROPE, CANADA, U. S. A. AND OTHER AMERICAS

Country	Base Period Income Elasticity of Demand	Base Period Consumption Av. 1959-61	Projected Consumption (b)					
			1970		1975		1980	
			Low	High	Low	High	Low	High
		Thousand Metric Tons						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
E. E. C.								
Belgium-Luxembourg								
Beef and Veal	0.7	222	266	282	290	315	313	347
Mutton and Lamb	0.6	4	5	5	5	5	6	6
France								
Beef and Veal	0.5	1,425	1,770	1,880	1,940	2,120	2,120	2,370
Mutton and Lamb	0.3	138	161	168	175	186	188	201
West Germany								
Beef and Veal	0.7	1,068	1,400	1,480	1,530	1,650	1,690	1,840
Mutton and Lamb	0.6	16	20	21	22	24	24	26
Italy								
Beef and Veal	1.4	675	1,060	1,160	1,280	1,430	1,500	1,710
Mutton and Lamb	1.4	40	63	63	76	85	89	102
Netherlands								
Beef and Veal	0.7	216	287	305	326	354	363	400
Mutton and Lamb	0.7	3	4	4	5	5	5	6
Other Non-Communist Europe								
Austria								
Beef and Veal	0.4	128	143	151	150	161	159	173
Mutton and Lamb	-	1	1	1	1	1	1	1

TABLE A8.4.1 [continued]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Denmark								
Beef and Veal	0.5	87	103	107	110	117	119	129
Mutton and Lamb	-	1	1	1	1	1	1	1
Finland								
Beef and Veal	0.7	75	96	101	106	115	117	130
Mutton and Lamb	0.6	2	3	3	3	3	3	3
Greece								
Beef and Veal	1.2	51	73	84	86	101	99	120
Mutton and Lamb	1.0	71	98	109	112	130	129	152
Ireland								
Beef and Veal	0.5	42	46	48	49	52	51	55
Mutton and Lamb	0.5	30	33	35	35	37	36	39
Norway								
Beef and Veal	0.6	51	62	66	69	77	75	83
Mutton and Lamb	0.6	15	18	18	20	21	21	22
Portugal								
Beef and Veal	1.5	49	78	86	93	106	108	126
Mutton and Lamb	1.3	20	29	32	33	37	37	43
Spain								
Beef and Veal	1.4	180	288	315	340	380	392	450
Mutton and Lamb	1.2	108	165	180	192	213	219	249
Sweden								
Beef and Veal	0.6	148	176	185	191	204	206	225
Mutton and Lamb	-	2	2	2	2	3	3	3
Switzerland								
Beef and Veal	0.5	117	149	154	160	170	174	187
Mutton and Lamb	-	3	4	4	4	4	4	5

TABLE A8.4.1 [concluded]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Turkey								
Beef and Veal	1.4	143	255	293	330	396	420	522
Mutton and Lamb	1.0	127	210	232	264	307	329	394
U. S. A. and Canada								
Canada								
Beef and Veal	0.8	622	840	920	970	1,100	1,130	1,300
Mutton and Lamb	0.4	27	35	37	39	42	45	48
United States								
Beef and Veal	0.8	7,303	9,420	10,080	10,590	11,680	12,050	13,580
Mutton and Lamb	0.4	396	480	500	530	570	600	640
Other Americas								
Beef and Veal								
Argentina	0.1	1,537	1,840	1,880	2,030	2,040	2,210	2, 240
Brazil	0.7	1,341	2,040	2,150	2,480	2,680	3,020	3, 350
Mexico	0.8	386	630	670	800	880	1,030	1, 150
Paraguay	0.7	60	90	90	110	120	130	150
Uruguay	0.1	228	260	260	280	280	300	300
Other	0.8	1,259	1,940	2,060	2,400	2,630	2,920	3, 260

(a) Semi-log demand functions have been adopted.

(b) "Low" and "high" refer to the income growth assumption. Apparent errors of addition are due to rounding.

Sources (for base period consumption): As for Table 8.3.2.

TABLE A8.4.2

ESTIMATED AND PROJECTED PRODUCTION OF BEEF AND VEAL AT CONSTANT PRICES

COUNTRY PROJECTIONS FOR OTHER NON-COMMUNIST EUROPE, CANADA, U. S. A., AND OTHER AMERICAS

(Thousand Metric Tons)

Country	Base Period Production Av. 1959-61	Estimated Production 1965	Projected Production					
			1970		1975		1980	
			Low	High	Low	High	Low	High
Other Non-Communist Europe								
Austria	127	129	164	168	179	189	195	214
Denmark	147	153	194	199	213	227	233	258
Finland	72	96	90	96	100	106	110	117
Greece	29	60	52	68	63	83	75	99
Ireland	106	112	176	194	191	213	209	233
Norway	53	55	63	65	68	71	73	78
Portugal	40	50	56	58	62	68	68	78
Spain	170	177	215	225	241	264	266	311
Sweden	138	153	181	184	197	208	215	234
Switzerland	101	109	120	129	130	140	140	150
Turkey	143	160	180	255	210	330	250	420
U. S. A. and Canada								
Canada	619	832	880	920	990	1,040	1,110	1,160
U. S. A.	7,071	8,920	9,520	9,710	10,620	10,830	11,720	11,960
Other Americas								
Argentina	1,969	2,150	2,350	2,500	2,500	2,650	2,650	2,850
Brazil	1,396	1,400	1,650	1,850	1,800	2,050	2,000	2,250
Mexico	416	500	550	600	620	700	700	800
Paraguay	98	120	100	120	100	130	100	140
Uruguay	290	340	300	350	310	370	320	390
Other	1,269	n. a.	1,510	1,650	1,620	1,800	1,750	1,950

Sources (for base period and 1965 production): As for Table 8.4.5.

TABLE A8.4.3

ESTIMATED AND PROJECTED PRODUCTION OF MUTTON AND LAMB AT CONSTANT PRICES
COUNTRY PROJECTIONS FOR E. E. C., OTHER NON-COMMUNIST EUROPE, CANADA AND U. S. A.
(Thousand Metric Tons)

Country	Base Period Production Av. 1959-61	Estimated Production 1965	Projected Production					
			1970		1975		1980	
			Low	High	Low	High	Low	High
E. E. C.								
France	135	98	150	155	160	165	170	175
Italy	38	n. a.	47	50	50	55	55	60
Other	23	n. a.	35	39	44	47	48	50
Other Non-Communist Europe								
Greece	53	n. a.	75	83	86	96	99	109
Ireland	38	n. a.	61	68	73	81	85	95
Norway	15	n. a.	16	18	19	20	20	21
Portugal	20	n. a.	27	29	31	33	35	37
Spain	108	133	160	170	180	190	210	220
Turkey	127	n. a.	200	210	260	270	310	330
Other	17	n. a.	19	21	21	27	23	28
U. S. A. and Canada								
Canada	16	16	16	20	16	22	16	24
U. S. A.	353	290	400	442	433	479	467	517

Sources (for base period and 1965 production): As for Table 8. 3. 3.

TABLE A8.5.1

PROJECTED FOOD CONSUMPTION OF GRAINS AT CONSTANT PRICES

COUNTRY PROJECTIONS FOR E.E.C., OTHER NON-COMMUNIST EUROPE, CANADA AND U.S.A.

Country	Base Period Income Elasticity of Demand (a)	Base Period Food Consumption Av. 1959-61	Projected Consumption[b]					
			1970		1975		1980	
			Low	High	Low	High	Low	High
		Thousand Metric Tons						
E.E.C.								
Belgium-Luxembourg								
Wheat	-0.4	1,115	1,090	1,060	1,080	1,050	1,080	1,030
Coarse Grains	-0.4	34	30	30	30	30	30	30
France								
Wheat	-0.2	5,924	6,100	5,920	6,220	6,100	6,400	6,160
Coarse Grains	-0.2	89	90	90	90	90	100	90
West Germany								
Wheat	-0.3	3,912	3,830	3,720	3,720	3,640	3,720	3,600
Coarse Grains	-0.3	1,779	1,740	1,690	1,690	1,640	1,690	1,640
Italy								
Wheat	-0.2	7,985	8,070	7,980	8,060	7,980	8,300	8,060
Coarse Grains	-0.2	608	610	610	610	610	630	610
Netherlands								
Wheat	-0.4	1,077	1,080	1,060	1,100	1,060	1,120	1,070
Coarse Grains	-0.4	129	130	130	130	130	130	130
Other Non-Communist Europe								
Austria								
Wheat	-0.4	562	530	510	510	480	490	460
Coarse Grains	-0.4	423	400	380	380	360	370	340
Denmark								
Wheat	-0.4	263	260	250	260	250	260	250
Coarse Grains	-0.4	175	170	170	170	170	170	170

TABLE A8.5.1 (continued)

Finland								
Wheat	-0.3	385	390	380	400	390	410	400
Coarse Grains	-0.3	222	230	220	230	220	230	230
Greece								
Wheat	-0.3	1,542	1,540	1,480	1,530	1,500	1,530	1,480
Coarse Grains	-0.3	52	50	50	50	50	50	50
Ireland								
Wheat	-0.4	401	370	360	360	350	360	340
Coarse Grains	-0.4	28	30	30	30	20	20	20
Norway								
Wheat	-0.35	288	290	290	300	290	310	290
Coarse Grains	-0.35	71	70	70	70	70	70	70
Portugal								
Wheat	-0.2	637	640	640	640	630	640	630
Coarse Grains	-0.2	452	460	450	450	450	460	450
Spain								
Wheat	-0.2	4,131	4,210	4,170	4,380	4,300	4,460	4,420
Coarse Grains	-0.2	213	220	220	230	220	230	230
Sweden								
Wheat	-0.4	510	510	500	500	490	510	480
Coarse Grains	-0.4	175	170	170	170	160	170	160
Switzerland								
Wheat	-0.45	591	580	560	570	550	570	540
Coarse Grains	-0.45	102	100	100	100	90	100	90
Turkey								
Wheat	-0.05	4,117	5,390	5,310	6,130	6,050	7,040	6,870
Coarse Grains	-0.05	1,058	1,380	1,360	1,570	1,550	1,810	1,760
U. S. A. and Canada								
Canada								
Wheat	-0.5	1,520	1,720	1,610	1,820	1,700	1,960	1,810
Coarse Grains	-0.5	189	200	200	200	200	200	200
U. S. A.								
Wheat	-0.5	13,517	14,460	14,060	15,000	14,330	15,820	14,730
Coarse Grains	-0.5	4,596	4,900	4,800	5,100	4,900	5,400	5,000

(a) Log-inverse function applied for all countries except Turkey, for which country the semi-log function was utilized.

(b) "Low" and "High" refer to the income growth assumption.

Sources (for base period consumption): As for Table 8.3.2.

TABLE A8.5.2

PROJECTED NON-FOOD USAGE OF GRAINS AT CONSTANT PRICES
COUNTRY PROJECTIONS FOR OTHER NON-COMMUNIST EUROPE, CANADA AND U.S.A.

Country	Base Period Non-Food Usage Av. 1959—61	Projected Non-Food Usage 1970 Low	Projected Non-Food Usage 1970 High	Projected Non-Food Usage 1975 Low	Projected Non-Food Usage 1975 High	Projected Non-Food Usage 1980 Low	Projected Non-Food Usage 1980 High
		Thousand Metric Tons					
Other Non-Communist Europe							
Austria							
Wheat	198	200	220	210	230	220	240
Coarse Grains	1,584	2,000	2,100	2,200	2,300	2,400	2,600
Denmark							
Wheat	165	210	230	230	250	250	270
Coarse Grains	5,131	6,100	6,400	6,600	7,000	7,100	7,700
Finland							
Wheat	86	120	125	125	130	130	140
Coarse Grains	1,314	1,500	1,700	1,600	1,850	1,700	2,000
Greece							
Wheat	227	230	270	230	270	230	270
Coarse Grains	742	1,000	1,200	1,150	1,450	1,300	1,700
Ireland							
Wheat	219	230	250	240	260	250	270
Coarse Grains	991	1,100	1,300	1,200	1,400	1,400	1,600
Norway							
Wheat	55	70	75	80	85	85	95
Coarse Grains	672	850	950	950	1,100	1,050	1,250
Portugal							
Wheat	76	75	90	75	90	75	90
Coarse Grains	259	500	550	600	700	700	800

TABLE A8.5.2 [concluded]

Spain							
Wheat	509	520	580	550	610	570	650
Coarse Grains	3,893	5,500	6,300	6,000	7,000	6,500	8,000
Sweden							
Wheat	216	260	300	280	340	300	380
Coarse Grains	2,615	3,700	3,900	3,800	4,100	4,000	4,400
Switzerland							
Wheat	121	150	170	165	185	180	200
Coarse Grains	635	800	1,000	900	1,150	1,000	1,300
Turkey							
Wheat	2,161	2,800	2,900	3,000	3,100	3,200	3,400
Coarse Grains	4,324	5,000	5,500	5,300	6,100	5,700	6,700
U.S.A. and Canada							
Canada							
Wheat	2,442	3,400	3,800	3,600	4,200	3,800	4,400
Coarse Grains	10,937	13,000	13,500	13,900	14,500	14,800	15,800
U.S.A.							
Wheat	2,685	5,500	6,000	5,700	6,200	6,000	7,000
Coarse Grains	113,543	133,000	137,000	143,000	149,000	153,000	161,000

Sources (for base period consumption): As for Table 8.3.2.

TABLE A8.5.3

ESTIMATED AND PROJECTED PRODUCTION OF GRAINS AT CONSTANT PRICES
COUNTRY PROJECTIONS FOR OTHER NON-COMMUNIST EUROPE, CANADA AND U.S.A.

Country	Base Period Production Av. 1959—61	Estimated Production 1965	Projected Production					
			1970		1975		1980	
			Low	High	Low	High	Low	High
	Thousand Metric Tons							
Other Non-Communist Europe								
Austria								
Wheat	667	706	750	800	850	950	900	1,000
Coarse Grains	1,478	1,490	1,550	1,600	1,620	1,700	1,700	1,900
Denmark								
Wheat	373	549	550	580	600	630	630	660
Coarse Grains	4,408	5,800	6,000	6,200	6,500	6,800	7,000	7,300
Finland								
Wheat	357	481	500	520	520	550	540	580
Coarse Grains	1,496	1,540	1,600	1,650	1,650	1,750	1,750	1,850
Greece								
Wheat	1,684	1,988	1,800	2,100	1,800	2,100	1,800	2,100
Coarse Grains	697	920	900	1,000	1,120	1,200	1,150	1,400
Ireland								
Wheat	436	245	320	400	380	440	420	450
Coarse Grains	904	890	1,000	1,100	1,050	1,150	1,150	1,250
Norway								
Wheat	23	18	15	20	15	20	15	20
Coarse Grains	541	610	700	800	800	900	900	1,050
Portugal								
Wheat	506	571	500	600	500	600	500	600
Coarse Grains	692	810	850	900	900	1,000	1,000	1,100
Spain								
Wheat	3,862	4,120	4,000	4,500	4,200	4,700	4,400	5,000
Coarse Grains	3,739	3,580	4,300	4,600	4,500	5,000	5,000	5,700
Sweden								
Wheat	824	950	900	1,000	1,000	1,100	1,100	1,200
Coarse Grains	2,690	3,400	3,800	3,900	3,900	4,000	4,100	4,400
Switzerland								
Wheat	330	374	400	440	440	480	480	550
Coarse Grains	210	230	460	500	550	500	500	600
Turkey								
Wheat	6,350	7,484	8,200	8,500	8,700	9,200	9,300	10,000
Coarse Grains	5,328	5,545	6,000	6,200	6,400	6,600	6,800	7,000
U.S.A. and Canada								
Canada								
Wheat	10,764	17,395	17,000	19,000	18,000	21,000	19,000	22,000
Coarse Grains	11,010	13,200	14,000	15,000	15,000	16,000	16,000	17,500
U.S.A.								
Wheat	33,684	35,620	39,000	42,000	41,000	44,000	43,000	46,000
Coarse Grains	135,551	136,250	160,000	165,000	172,000	180,000	185,000	195,000

Sources (for base period and 1965 production): As for Table 8.3.3.

TABLE A9.3.1

RELATION BETWEEN WOOL AND STAPLE SYNTHETICS CONSUMPTION AND INCOME: 20 NON TROPICAL COUNTRIES

Equation No.	Type of Equation	Year	Constant	Coefficient of Independent Variables		Standard Error of Estimates	R^2
				Log Income	Reciprocal of Income		
9.3.23	Semi-log	1953	-2.90	0.700 (0.127)		0.35	0.63
9.3.24	"	1956	-3.48	0.805 (0.161)		0.44	0.58
9.3.25	"	1959	-3.29	0.778 (0.166)		0.43	0.55
9.3.26	Log-inverse	1953	0.883		-245.5 (34.5)	0.24	0.74
9.3.27	"	1956	0.999		-283.6 (37.9)	0.22	0.76
9.3.28	"	1959	1.021		-291.4	0.24	0.68
9.3.29	Log-log-inverse	1953	1.69	-0.112 (0.350)	-289.1 (140.1)	0.25	0.74
9.3.30	"	1956	2.66	-0.227 (0.370)	-385.3 (170.1)	0.23	0.76
9.3.31	"	1959	4.41	-0.458 (0.440)	-520.4 (225.0)	0.24	0.70

Sources: See Table 9.3.2

Table A9. 4. 1

STAPLE SYNTEHTICS' MARKET SHARES, PROJECTIONS AND ACTUAL DATA SELECTED COUNTRIES, 1955 TO 1964

Year	Wool Consumption (1) (a)	Synthetics Consumption (2) (b)	Synthetics Production (3)	(2) as Percentage of (1) + (2) (b) (c) (d)	(3) as Percentage of (1) + (3) (d)
	million lbs			percent	
UNITED KINGDOM					
1955	475	11.5	10.5	2.36	2.16
1956	475	17.7	15.4	3.59	3.14
1957	481	30.3	25.5	5.93	5.03
1958	444	23.1	18.8	4.95	4.06
1959	509	32.1	28.2	5.93	5.25
1960	481	59.3	52.3	10.98	9.81
1961		(57.8)		(10.91)	
"	472	60.2	58.4	11.31	11.01
1962		(65.0)		(12.67)	
"	448	67.5	68.8	13.10	13.31
"				14.26	
1963		(80.6)		(14.96)	
"	458		90.6	16.90	16.51
1964	418		113.1	19.51	21.30
ITALY					
1955	113	10.5	10.0	8.50	8.13
1956	127	12.6	12.2	9.03	8.76
1957	161	19.6	18.4	10.85	10.86
1958	149	17.2	15.6	10.35	9.48
1959	166	15.3	15.3	8.45	8.44
1960	198	20.0	22.1	9.17	10.04
1961		(25.9)		(12.17)	
"	187		31.7	14.92	14.49
1962		(48.4)		(19.10)	
"	205		47.9	17.64	18.94
"				10.95	
1963		(59.3)		(23.23)	
"	196		63.3	11.27	24.41
1964	182		91.3	11.59	33.41

TABLE A9. 4. 1 (Continued)

Year	Wool Consumption (1)(a)	Synthetics Consumption (2)(b)	Synthetics Production (3)	(2) as Percentage of (1) + (2) (b) (c) (d)	(3) as Percentage of (1) + (3) (d)
	million lbs			percent	
FRANCE					
1955	246	8.2	8.8	3.23	3.45
1956	276	12.6	11.4	4.37	3.95
1957	310	19.0	16.5	5.78	5.05
1958	266	17.0	19.3	6.01	6.76
1959	284	27.7	38.5	8.89	11.94
1960	301	44.1(e)	53.8	12.78	15.16
1961	301	45.6(e)	63.6	13.16	17.44
1962	291	55.9	102.5	16.11	26.05
"				12.97	
1963	295	75.0	106.1	20.27	26.45
"				14.56	
1964	267		131.0	15.97	32.91
JAPAN					
1955	127	19.1	18.9	13.07	12.95
1956	171	35.8	35.1	17.31	17.03
1957	188	48.7	47.9	20.57	20.31
1958	161	51.3	50.6	24.16	23.91
1959	228(+28.4)	96.7	102.2	29.78	30.95
1960	269(+31.8)	153.3	157.8	36.30	36.97
1961		(194.9)		(35.75)	
"	311(+39.2)	191.8	199.0	38.15	39.02
1962		(221.3)		(40.88)	
"	297(+23.0)	229.8	231.6	43.62	43.81
"				42.83	
1963		(270.8)		(45.45)	
"	325(e)		287.9	46.18	46.97
1964	334(e)		400.0	48.95	54.49
GERMANY					
1955	168	6.9	8.6	3.95	4.87
1956	176	7.9	11.6	4.30	6.18
1957	181	12.9	17.7	6.65	8.91
1958	139	16.0	17.8	10.32	11.35
1959	150	32.9	27.5	17.99	15.49
1960	151	42.4	40.5	21.92	21.15

TABLE A9.4.1 (Continued)

Year	Wool Consumption (1)(a)	Synthetics Consumption (2)(b)	Synthetics Production (3)	(2) as Percentage of (1) + (2) (b) (c) (d)	(3) as Percentage of (1) + (3) (d)
	million lbs			percent	
GERMANY (Continued)					
1961		(47.1)		(23.90)	
"	150	48.5	47.4	24.42	24.01
1962		(71.9)		(32.68)	
"	148	72.0	60.4	33.03	29.26
"				24.95	
1963		(66.6)		(30.33)	
"	153		77.2	25.79	33.54
1964	142		88.5	26.27	38.39
UNITED STATES					
1955	414	93.7	105.3	18.46	20.28
1956	440	118.4	127.2	21.20	22.43
1957	369	154.8	180.7	29.55	32.87
1958	331	160.7	170.5	32.68	34.00
1959	430	207.5	233.1	32.55	35.15
1960	407	212.1	239.8	34.26	37.07
1961		(234.7)		(36.40)	
"	410	233.0	253.7	36.24	38.23
1962		(338.8)		(44.24)	
"	427	336.3	345.5	44.06	44.72
"				36.36	
1963		(433.5)		(51.27)	
"	411		443.2	36.64	51.82
1964	354		559.1	36.80	61.16

Sources: Estimated virgin wool consumption at the carding stage from Commonwealth Economic Committee, Intelligence Branch, Wool Intelligence (London, monthly issues, January 1955 through May 1965).
F.A.O., Per Caput Fiber Consumption Levels, 1948 to 1958 (Rome 1960).
F.A.O., "Per Caput Fiber Consumption Levels", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 11, No. 1 (January, 1962), pp. 1—28.
F.A.O., "World Apparel Fiber Consumption, 1960 to 1962", Monthly Bulletin of Agricultural Economics and Statistics, Vol. 13, No. 4 (April, 1964), pp. 1—33.
F.A.O., World Apparel Fiber Consumption 1961 to 1963 (Rome, 1965).
Staple synthetics production from Textile Organon, Vol. 36, No. 6 (June, 1965), p. 108.
M. Polasek and A. Powell, "Wool Versus Synthetics: An International Review of Innovation in the Fibre Market", Australian Economic Papers, Vol. 3, Nos. 1 and 2 (June — December, 1964), p. 61, Table IV.

(a) From 1959 through 1962 figures in parentheses refer to consumption by commission combers. The latter are included in total wool consumption for 1963 and 1964.

(b) For the latest F.A.O. estimates, synthetic fibre production is divided into "discontinuous" and "continuous" fibres, whereas the previous classification was into "staple" and "filament". Figures in parentheses represent the F.A.O. revisions of the "staple" estimates when classification was changed to "discontinuous".

(c) Underlined figures are Polasek and Powell's projections of synthetics' share of the market.

(d) Calculated from wool consumption figures inclusive of consumption by commission combers.

(e) These figures differ from those given by Polasek and Powell, partly because of later revisions of the F.A.O. estimates.

TABLE A9.5.1

CONSUMPTION PROJECTIONS FOR WOOL AND 'WOOL-TYPE' FIBRES USING INTER-COUNTRY INCOME COEFFICIENTS FOR E. E. C., OTHER NON-COMMUNIST EUROPE, CANADA AND U. S. A.
(million pounds)

Region	Base Period Consumption Average 1959-61	Consumption Projections (a)							
		1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
E. E. C.									
Belgium									
Wool	36.6	38.1	38.6	40.3	41.0	42.3	43.4	43.9	45.2
Wool-type	55.3	58.0	58.9	61.3	62.8	64.6	66.6	67.2	69.7
France									
Wool	153.0	166.9	170.0	177.5	182.5	190.3	197.3	201.3	209.7
Wool-type	248.2	272.9	278.7	291.7	301.6	314.2	328.0	333.8	350.3
West Germany									
Wool	270.3	292.6	295.4	308.0	313.1	318.6	325.2	331.6	339.3
Wool-type	373.0	406.8	411.6	431.0	439.2	447.5	458.8	467.6	480.6
Italy									
Wool	88.2	98.3	100.8	109.6	112.9	119.5	124.3	129.9	135.8
Wool-type	142.9	162.3	166.2	182.3	189.6	201.1	211.6	220.2	232.4
Netherlands									
Wool	52.5	58.2	58.9	63.1	64.6	69.9	70.3	73.0	75.4
Wool-type	67.0	74.7	75.8	81.8	84.0	89.1	92.2	95.7	99.4

TABLE A9.5.1 (Continued)

Region	Base Period Consumption Average 1959-61	Consumption Projections (a)							
		1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
Other Non-Communist Europe									
Austria									
Wool	27.6	28.9	29.3	30.0	30.9	30.9	32.0	31.7	33.3
Wool-type	35.3	37.0	37.9	38.8	40.1	40.1	41.9	41.7	43.9
Denmark									
Wool	20.7	21.8	22.0	23.1	23.6	24.3	24.9	25.6	26.5
Wool-type	24.0	25.4	25.8	27.1	27.8	28.4	28.9	30.2	31.3
Finland									
Wool	18.1	19.8	20.3	21.6	22.3	23.1	24.0	24.9	26.0
Wool-type	21.	24.3	24.7	26.5	27.	28.7	30.0	30.9	32.6
Greece									
Wool	22.9	26.9	28.7	31.3	34.6	35.7	40.3	40.3	47.2
Wool-type	22.9	27.6	29.8	32.8	36.8	38.1	43.9	43.7	51.1
Ireland									
Wool	12.6	13.0	13.2	13.7	14.1	14.1	14.3	14.6	15.4
Wool-type	12.6	13.2	13.4	13.7	14.3	14.6	14.6	15.0	15.9
Norway									
Wool	18.1	19.2	19.6	20.7	21.2	22.0	22.7	23.6	24.3
Wool-type	20.3	21.6	22.0	23.4	24.0	25.1	26.0	26.9	27.8

TABLE A9.5.1 (Continued)

Region	Base Period Consumption Average 1959-61	Consumption Projections (a)							
		1965		1970		1975		1980	
		Low	High	Low	High	Low	High	Low	High
Portugal									
Wool	17.6	20.7	21.6	24.0	25.6	26.7	29.3	29.1	32.2
Wool-type	20.1	24.3	25.4	28.9	30.9	32.2	35.7	35.7	40.3
Spain									
Wool	39.0	48.1	50.0	56.9	60.6	64.6	70.1	72.5	79.8
Wool-type	48.7	61.7	64.8	74.7	80.7	86.4	95.2	98.3	110.0
Sweden									
Wool	29.3	30.9	31.3	32.6	33.3	34.2	35.1	35.7	36.8
Wool-type	37.7	39.9	40.6	42.3	43.2	44.5	46.1	46.7	48.5
Switzerland									
Wool	28.7	31.7	32.0	33.5	34.2	35.3	36.2	37.3	39.0
Wool-type	36.4	40.6	41.0	42.3	44.1	45.4	46.7	48.1	49.6
Turkey									
Wool	56.0	72.3	77.6	93.5	105.6	119.0	137.6	148.6	175.3
Wool-type	63.9	84.4	91.7	111.6	127.9	144.6	171.5	183.4	222.9
U.S.A. and Canada									
Canada									
Wool	50.3	56.7	57.3	62.6	64.2	69.7	71.9	78.0	80.7
Wool-type	80.9	91.5	92.8	101.2	104.3	113.1	117.1	126.8	131.8
United States									
Wool	490.7	535.9	539.5	576.3	592.4	622.4	632.9	679.0	692.7
Wool-type	1040.8	1139.3	1147.7	1227.3	1245.2	1327.4	1328.5	1450.6	1485.5

(a) "Low" and "High" refer to the income growth assumption.

Sources: As for Table 9.5.1

TABLE A9.6.1

WORLD SHEEP NUMBERS[(a)] 1938-39 AND 1947-48 TO 1964-65
(million head)

	Australia	New Zealand	South Africa (b)	Argentina	Uruguay	United States	United Kingdom	Other Non-Communist	Total Non-Communist	U.S.S.R	Mainland China (c)	Eastern Europe	Total Communist Bloc	World Total
1938-39	111.1	31.9	33.1	45.9	18.0	51.3	26.9	309.9	634.0	69.9	43.4	28.7(d)	142.0	776.0
1947-48	102.6	32.5	24.2	50.9	20.5	34.3	18.2	287.4	573.0	63.3	26.3	20.4(e)	110.0	683.0
1948-49	108.7	32.8	26.2	48.0	22.6	30.9	19.5	286.9	582.0	70.4	26.2	25.4	120.0	702.0
1949-50	112.9	33.9	25.6	50.0	22.6	29.8	20.4	312.5	614.0	77.6	26.4	24.0	128.0	742.0
1950-51	115.6	34.8	26.0	50.5	23.4	30.6	20.0	319.7	626.0	82.6	32.5	24.9	140.0	766.0
1951-52	117.6	35.4	29.6	50.5	24.5	32.0	21.7	328.9	645.0	90.5	29.9	24.6	145.0	790.0
1952-53	123.1	36.2	30.3	49.2	25.7	31.9	22.5	341.9	666.0	94.3	38.9	25.6	158.0	824.0
1953-54	126.9	38.0	31.4	46.8	25.7	31.4	22.9	346.2	674.0	99.8	43.3	25.9	169.0	843.0
1954-55	130.8	39.1	32.9	43.8	24.5	31.6	22.9	356.3	686.0	99.0	60.0	29.0	188.0	874.0
1955-56	139.1	40.3	33.5	45.2	23.3	31.3	23.6	299.7	636.0	103.3	62.2	29.5	195.0	831.0
1956-57	149.8	42.4	34.4	45.9	22.9	30.8	24.8	303.0	654.0	108.2	65.5	20.3	203.0	857.0
1957-58	149.3	46.0	34.4	47.9	22.6	31.3	26.1	307.9	665.5	120.2	66.0	28.6	214.8	880.3
1958-59	152.7	46.9	33.7	48.1	21.4	32.6	27.6	309.9	672.9	129.9	71.8	29.9	231.6	904.5
1959-60	155.2	47.1	34.5	48.5	21.7	33.2	27.9	315.1	683.2	137.1	72.3	30.6	240.0	923.2
1960-61	152.7	48.5	33.8	46.0	21.5	33.0	29.0	316.7	681.2	133.1	70.5	31.5	235.1	916.3
1961-62	157.7	49.0	35.8	45.0	21.3	31.3	29.5	309.8	679.4	137.5	70.8	32.7	241.0	920.4
1962-63	158.6	50.2	34.2	47.5	21.6	29.8	29.3	308.3	679.5	139.7	71.0	32.3	243.0	922.5
1963-64	165.0	51.3	34.0	48.0	21.6	28.0	29.7	307.7	685.3	133.9	71.4	32.7	238.0	923.3
1964-65	170.6	53.5				26.7	30.0			125.2				

(a) 1938-39 to 1954-55 includes woolled and non-woolled sheep; 1955-56 to 1964-65 woolled sheep only are included.
(b) South African figures refer only to woolled sheep.
(c) Includes Manchuria, Sinkian, Tibet and Outer Mongolia.
(d) 1934-38 Average.
(e) 1947-48 figures from F. A. O. Production Yearbook 1950.

Sources: Bureau of Agricultrual Economics, Statistical Handbook of the Sheep and Wool Industry Third Edition 1961, pp. 5-6; Supplement to the Statistical Handbook of the Sheep and Wool Industry 1964, pp. 6-7; The Wool Outlook, Various Issues; Wool in Communist Countries (1960), p. 89.

TABLE A9.6.2

SUMMARY OF REGRESSIONS OF SHEEP NUMBERS ON TIME[a]

Country/Region	Constant	Coefficient of Independent Variable	Standard Error of Estimate	R^2
Australia	147.114	2.193 (0.407)	5.1143	0.853
New Zealand	44.943	0.871 (0.057)	0.2466	0.979
South Africa	34.186	0.039 (0.145)	0.2516	0.014
Argentina	47.914	-0.157 (0.257)	0.8107	0.070
Uruguay	22.100	-0.107 (0.075)	0.0794	0.289
United States	33.800	-0.621 (0.274)	1.2654	0.507
United Kingdom	26.186	0.564 (0.097)	0.3114	0.871
Other Non-Communist	312.071	-0.325 (0.739)	6.5430	0.037
Total Non-Communist	668.314	2.457 (0.878)	14.6102	0.611
U. S. S. R.	124.329	2.182 (0.937)	15.0541	0.520
Mainland China	68.671	0.468 (0.380)	1.5699	0.233
Eastern Europe	28.443	0.686 (0.102)	0.3899	0.901
Total Communist Bloc	221.443	3.336 (1.314)	30.9083	0.563
World	889.757	5.793 (2.014)	78.2097	0.623

(a) For all countries and groups of countries time is the independent variable and sheep numbers the dependent variable. 1957–58 = 1 for all countries.

Source: Table A9.6.1.

Australia: Long Term
Agricultural Supply
and Demand Projections.
1965-1980.

Australia: Long Term Agri-
cultural Supply and Demand
Projections. 1965-1980.