MARKET RESEARCH CENTRE

ECONOMIC ASPECTS OF NEW ZEALAND APPLE PRODUCTION WITH POLICY ALTERNATIVES

by

A. N. Rae

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MASSEY UNIVERSITY PALMERSTON NORTH NEW ZEALAND

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Market Research Centre,
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Commodity Report No. 4
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Preface

In keeping with the objective of providing up-to-date marketing analyses, this fourth publication in the Market Research Centre's Commodity Report series reviews selected aspects of the production and marketing of New Zealand apples. The report presents supply and demand projections for the period up to 1980, with more cautious extensions to 1985. After summarising the supply and demand situation likely to face the apple industry in the years ahead, the report discusses policy alternatives. A final section presents recommendations for action by the industry.

The report was prepared by Dr. A.N. Rae, who has considerable experience in horticultural management and in analysing the economics of horticultural production and marketing. Dr. Rae began work on the report while a Market Research Officer in the Centre. Although he now has greater teaching responsibilities, he maintains a close association with the Centre's Research programme.

The rapid increase in new plantings of apple orchards in New Zealand since the mid-1960's, and the introduction of new rootstocks that have made it possible to increase yields per unit of land, suggests the possibility of a large increase in the total supply of apples to the domestic market. As a result of similar production developments overseas, similar increases in supply may also reach New Zealand's major foreign markets. Growers in New Zealand have therefore been debating the value of supply-control schemes. One of the aims of the study reported here was to examine the effects of certain variables on the production, pricing and consumption of New Zealand-produced apples, to assess the likely impact of projected supply and demand levels on the revenues of the New Zealand Apple and Pear Marketing Board and apple growers, and to indicate what supply-control (or other) policies might be warranted.

The conclusions reached by Dr. Rae deserve careful study because they appear to question some of the viewpoints currently held by apple growers. It is hoped that this report will help to generate further debate concerning the choice of production and marketing strategies for the apple industry.

November 1973

R.W. Cartwright
Director

Acknowledgements

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Contents

Summary

* The situation of chronic overproduction in Europe that seemed likely in the late 1960's has, at least temporarily, eased somewhat. As a result, world prices are now higher than they were a few years ago. Such countries still possess the capacity for over production, however, and the situation that emerges up to the 1980's will depend primarily on the success, or otherwise, of the adjustment policies that are being implemented in that region. As a result, New Zealand's share of the European market is expected to fall only slightly from its present level but, because of supply expansion in the southern hemisphere, and the inevitable increase in freight costs, the profitability of New Zealand's apple sales in Europe could fall appreciably.

* New Zealand pip-fruit producers had on average, up to 1970 at least, earned 'above-normal' profits. Escalation in costs since then could have reduced profit margins, in common with the effect of cost increases in many industries in New Zealand. The expected result of the 1973 trading year should place the Apple and Pear Marketing Board (A.P.B.) in a breakeven situation as regards the Apple and Pear Industry Reserve Account.

* The New Zealand supply projections indicate that, by 1980, the quantity of fresh apples available for export would be double the quantity exported in 1972. For processed apples, the quantity available for export in 1980 would be about six times as great as the quantity exported in 1972. Even if such quantities are exported, a surplus of fresh fruit, equivalent to around 10 lbs per capita (or 25 per cent of 1972 per capita consumption) will exist on the local market by 1980, leading to a reduction in prices.

* The projected supply expansion will require further, and significant, investment in handling and storage facilities. The A.P.B. does not appear, at the present time, to be able to provide the necessary investment finance.

* In view of a likely future reduction in the revenue earned by New Zealand apple producers, it is important that cost reductions in production and marketing be implemented wherever possible. This will include the reconstruction of the industry to the semi-intensive method of production, and the possible realisation of economies of size in the production, harvesting, packing, handling and marketing of the apple crop. It is also important that any policies adopted by the industry <u>should not hinder</u> the rapid adoption of such cost-saving methods.

* A non-refundable levy, sufficient to completely finance any additional capital investment that may be required in fruit handling and storage facilities, should be imposed on planned expansions of output. The levy should be based on fruit quantity, rather than acres of new plantings.

* If speculative orchard development is a problem, removal of the tax incentives that makes such behaviour profitable should remove the problem.

* Adequate production and market data should be made easily available to existing and potential apple producers, to allow decisions regarding new apple plantings to be made in a rational manner, and in recognition of likely future developments.

* A scheme of supply control would be justified if it was believed that the increase in revenue from local market sales as a result of supply controls would more than compensate for the reduction in export revenues that would also result, and administration costs. However, supply control might also be justified on the basis of the considerable degree of uncertainty surrounding future market prospects. If the industry feels that the projected supply of fruit over the 1980-85 period is likely to ppse problems and that removal of tax incentives, imposition of considerable levies on new plantings and provision of adequate information to existing and potential apple growers would not lead to a sufficient reduction in new plantings, then a supply control scheme might be warranted. Any system of supply control tends to protect the inefficient producer, to prevent desirable developments such as the reconstruction and re-location of the industry, and to be costly to administer. However, it is felt that a scheme based on negotiable quantity-permits would be preferable to an acreage-licensing scheme. If policing such a scheme was considered to be impossible, then the use of marketing certificates issued by the A.P.B. could effectively curb the over-expansion of the apple industry.

* Any supply control scheme, however, will only solve the problems of the pip-fruit industry by transferring such problems to other industries. Thus control of pip-fruit production could lead to a transfer of resources to other forms of horticultural production, leading perhaps to over-supply problems and hence the need for supply control in these industries also.

* Grubbing grants would not appear to be justified in New Zealand at the present time.

* Emphasis in extension should be placed on identifying low-profit trees and varieties, and demonstrating to growers that net incomes could be increased on their removal, and perhaps replacement with more-preferred varieties.

Emphasis should also be placed on the planting of varieties, or reworking of existing trees to varieties, that are suitable for export and provide a high export grade-out. In this way, any expansion in supply should have as little effect as possible on the supplies of non-export-quality fruit.

* Research should continue to be conducted, or be implemented, in the following areas:
  - new processed product development;
  - consumer testing of new processed products;
  - export market development;
  - the determination of optimal marketing strategies;
  - the identification of economies of size in apple production, packing, handling and marketing;
  - the provision of production and market forecasting in relation to the New Zealand and export markets, and important competitors in supply.

1. A Review of the Present Situation

1.1 Production and marketing of New Zealand apples

Total production, acreage and yields per bearing acre[1] for the period 1957/58 - 1972/73 are shown in Figure 1.1. Also shown are estimates of the total acres of new plantings and removals made in each year. A rapid increase in new plantings since the introduction of the semi-intensive system has occurred since 1965, and the high levels of removals since 1969 would be at least partly due to orchard replacement programmes. As will be shown, the increased rate of growth of total acreage due to additional plantings since the mid-1960's will have a significant impact on production levels in the latter half of the present decade. Total acreage of apples (bearing and non-bearing) and total bearing acreage, have both increased each year. Production has shown a marked tendency towards biennial bearing, although yields per bearing acre have shown a steady upward trend after allowing for the fluctuations due to biennial bearing.

Producers of apples in New Zealand have the option of supplying their fruit to the Apple and Pear Marketing Board (A.P.B.) for a guaranteed price, or selling the crop direct to the public.[2] Legislation restricts, however, the quantity of fruit that a grower may sell 'at the gate'. Growers may enter a contract to supply all of their crop that passes inspection by the Ministry of Agriculture and Fisheries (M.A.F.) to the A.P.B. for a three-year period. Growers signing the contract are not permitted to sell 'at the gate' in excess of two bushels per customer, or to display fruit so that it can be seen from the road, can advertise only by announcing 'fruit for sale', and cannot vigorously advertise for mail-order sales. Growers who do not sign the contract are obliged to observe only the 'two-bushel' sales requirement, but any fruit these growers might consign to the A.P.B. will be paid for at the rate of only 50 percent of the scheduled price.

The Apple and Pear Prices Authority determines each season, not later than the end of February, the average price to be paid by the A.P.B. for apples and pears, produced in New Zealand, and acquired by the Board in that season. In setting the price, the Authority takes into account such matters as the stability and efficiency of the industry, movements in production and marketing costs, market prospects and trends, and submissions from the A.P.B. and the Fruitgrowers' Federation. The A.P.B. then sets prices to be paid to growers. They may fix different prices in

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1 The collection and subsequent analysis of all production and acreage data is discussed in Appendix A. Trees at least six years of age are classified as 'bearing'. In the figure, the 1957/58 season, for example, includes the new plantings and removals made in 1957 and the total harvest of 1958.

2 With the permission of the A.P.B., growers may also sell fruit direct to private processing firms.

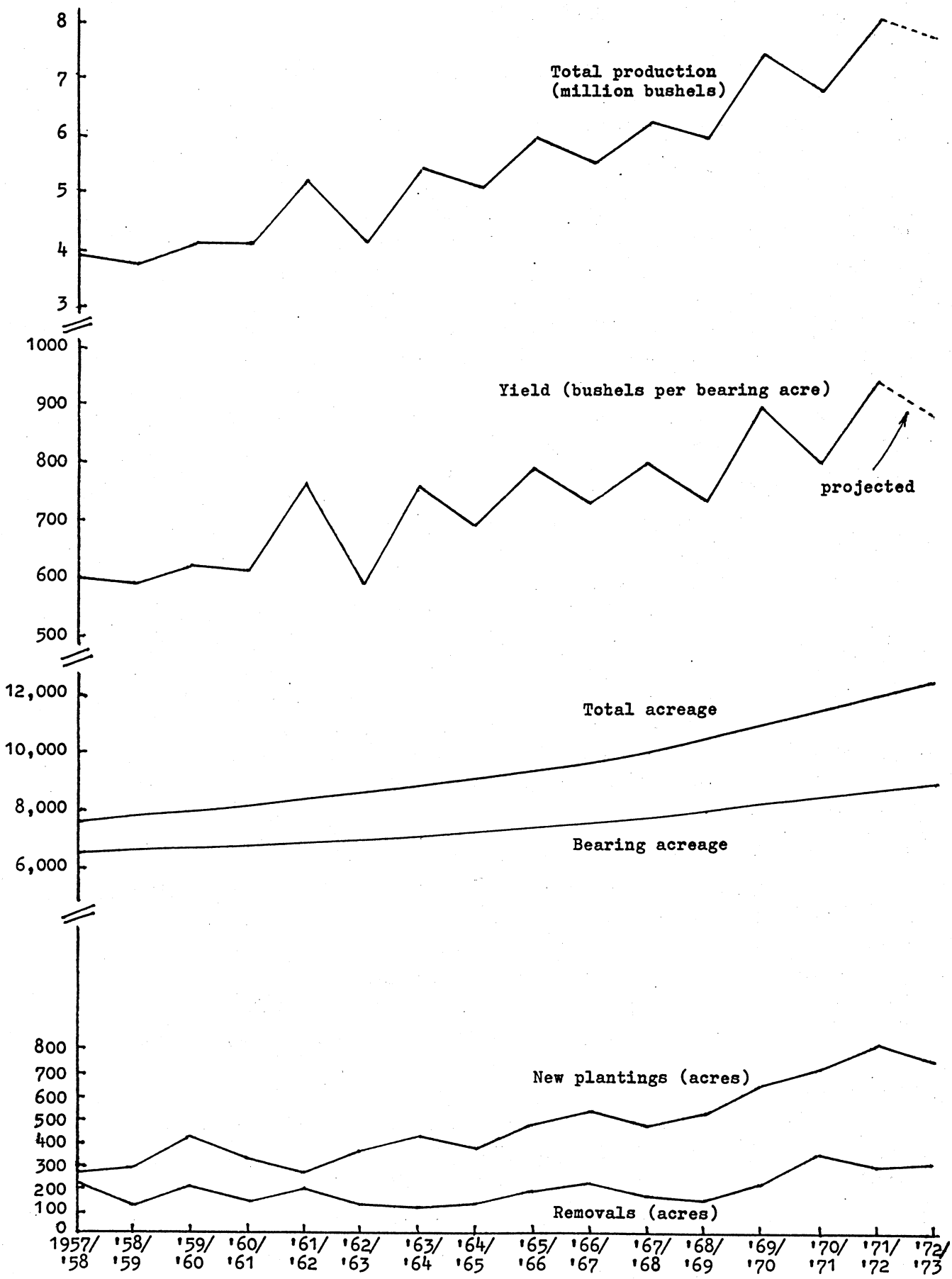

Figure 1.1: New Zealand Apple Production, Acreage and Yield

respect of variety, size, grade and quality, although the total amount paid to growers cannot exceed the amount that would be payable by the A.P.B. if all fruit acquired by it were purchased at the average price as determined by the Prices Authority. In addition, the A.P.B. may pay to growers amounts relating to the labour and material costs of grading, packing and containers, and a district differential.

Early in the season, the A.P.B. estimates its total receipts of fruit for the season. This is then allocated between local fresh consumption, export (fresh), and processing. The A.P.B. state that the local market allocation is made first, based mainly on past sales experience. Their aim is to at least break-even on the local market, but not necessarily to maximise profits. Past experience suggests that around 1.5 million bushels (40,000 per week) can be sold, at a price which permits the A.P.B. to 'break even'. Next, the A.P.B. allocates a quantity of apples to be processed. These are mainly varieties that are less-preferred for fresh consumption, or low-grade fruit. The A.P.B. operates its own processing factory in Nelson, with a present capacity of one million bushels, and a new factory (which could be expanded to a similar capacity) is at present under construction in Hastings.[3] Processed products are sold both in New Zealand and overseas. Finally, the remainder of the apple crop may be exported, either 'on consignment' or under forward sales. Depending on the level of sales and prices received, the A.P.B. can, to a certain extent, re-allocate fruit between uses. For example if turnover was rapid on the local market, fruit could be diverted to this market from either export or process supplies.

The pricing policy adopted by the A.P.B. on the local market is aimed at supplying a reasonably constant quantity, from week to week, from the Board's cool-stores. Early varieties are sold first, and later varieties are offered for sale once the earlier varieties have been sold. The A.P.B. attempts to make both price and supply decisions. Each week, the quantity to be released is determined, and the price at which the A.P.B. sells fruit to wholesalers is usually set for a 2-4 week period, although this can be changed more frequently if required. These prices are set with regard to past sales and prices, knowledge of the 'break-even' price, and the A.P.B.'s costs, including the cost of the fruit. If turnover is high, the A.P.B. would rather divert supplies (if possible) to the local market rather than raise prices; if turnover is low, prices would be lowered. The A.P.B. uses a retail price formula to set the suggested maximum retail price of apples, which allows a 40 percent mark-up on the price at which the retailer buys the fruit from the wholesaler. This maximum price has not been binding in the past however, and evidence suggests that retailers did exceed it. Recent legislation has put apples and pears under direct retail price control.

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3 Sales of fruit for processing are also made from the A.P.B. to private processing firms.

Table 1.1 indicates the total size of the New Zealand apple crop from 1955 to 1972, and the way in which it has been distributed between various markets and uses. The proportion of the total crop exported as fresh fruit has increased from about 40 percent over the early part of the period to nearer 50 percent by 1972. On the other hand, consumption of fresh fruit on the domestic market accounted for 50 - 60 percent of the total crop during the 1950's, but less than 40 percent of the total crop in 1972. The trend towards the sale of fruit 'direct' to consumers from the mid-1960's meant that the A.P.B.'s total receipts of apples from growers fell from 86 percent in 1956 to 76 percent in 1968, but had increased again to 81 percent in 1972, the same as in 1955. Finally, the proportion of the total crop to be processed has increased from 10 percent in 1962 to 15 percent in the 1972 season.

A breakdown of apple exports by destination is given in Table 1.2. The importance of the U.K. market has declined over time, with the share of total fresh exports consigned to that country falling from 62 percent in 1966 to 48 percent in 1972. The U.K. still remains by far our most important single export market however - the next largest importer in 1972 was West Germany, taking 430,000 bushels, or 11 percent of the total export quantity. The total quantity of apples exported to Scandanavia has shown an upward (if erratic) trend, although quantities exported to West Europe have varied greatly from year to year, and exhibit no clear trend. Efforts to diversify the export marketing of apples have resulted in the steady growth in the quantity consigned to North America, Asia and the Pacific Islands. The countries of these regions accounted for only 9 percent of total exports in 1966, but 16 percent by 1972. Quantities consigned to Central and Southern America have shown little growth over time. Figure 1.2 shows clearly the trends in quantities sold to various overseas markets, and illustrates the results of the A.P.B.'s efforts to reduce the importance of the U.K. as an importer of New Zealand apples. However, it can be observed that the reduction in the proportion of total exports consigned to the U.K. has been made possible mainly through an increase in the proportion shipped to West Europe, rather than to countries of the Pacific.

Table 1.1: Production and Disposition of New Zealand Apple Crop: 1955-72

Year	Total production[a]	Sales to A.P.B.[b]				Direct sales	
		Export fresh	Local fresh	Process[c]	Total	Fresh[d]	Process[e]
	('000 bushels)						
1955	3066.5	1028.1	1443.0	-	2471.1	433.8	161.6
1956	3550.9	1548.4	1482.9	-	3031.3	397.4	122.2
1957	3369.0	1399.2	1388.5	-	2787.7	457.0	124.3
1958	3885.4	1750.7	1605.4	-	3356.1	325.3	204.0
1959	3820.3	1765.6	1525.4	-	3291.0	343.7	185.6
1960	4093.0	1901.5	1461.1	-	3362.6	616.8	113.6
1961	4087.9	1784.2	1680.0	-	3464.2	437.5	186.2
1962	5152.5	2482.0	1635.9	324.3	4442.2	525.1	185.2
1963	4056.4	1385.4	1533.1	264.8	3183.3	748.4	124.7
1964	5385.2	2133.7	1786.5	477.1	4397.3	745.4	242.5
1965	5064.0	2257.3	1534.9	362.3	4154.5	705.1	204.4
1966	5942.9	2861.7	1469.1	560.8	4891.6	853.1	198.2
1967	5533.1	2237.0	1373.0	582.4	4192.4	1150.3	190.4
1968	6227.3	2534.2	1502.1	677.4	4713.7	1316.1	197.5
1969	5895.5	2607.5	1415.8	611.3	4634.6	1052.6	208.3
1970	7371.3	3313.0	1548.3	954.1	5815.4	1310.3	245.6
1971	6654.6	3099.5	1414.3	670.5	5184.3	1281.5	188.8
1972	8038.1	3962.9	1667.8	881.7	6512.4	1244.7	281.0

a/ Ministry of Agriculture and Fisheries estimates of marketable production.

b/ A.P.B. Annual Reports.

c/ Includes export and local marketings, and equals A.P.B. total receipts less fresh sales (export and local markets).

d/ Computed as a residual.

e/ 1955-1966, from A.P.B. Annual Reports, 1967-1972, from Ministry of Agriculture and Fisheries.

Table 1.2: N.Z. Exports of Apples: 1966-72

Year	U.K.[a]	E.E.C.[b]	Scandanavia[c]	Other W.Europe	Nth. America	C. & S. America[d]	Asia	P.Islands	Africa	Total fresh	Processed[e]
	('000 bushels)										
1966	1787.9	500.9	182.0	52.2	145.7	71.7	88.5	29.5	3.4	2861.7	136.0
1967	1595.6	190.8	89.3	57.0	134.1	84.5	57.8	24.1	3.8	2237.0	256.6
1968	1669.1	226.0	200.4	23.6	166.0	88.6	122.2	38.2	-	2534.2	360.5
1969	1515.1	320.6	177.7	51.6	237.9	119.6	121.2	60.2	3.0	2607.5	326.7
1970	1835.1	697.3	221.4	27.4	244.0	82.4	138.1	67.2	-	3313.0	377.4
1971	1882.5	513.8	116.7	18.5	284.7	89.4	123.3	70.6	-	3099.5	211.5
1972	1906.0	1197.8	138.0	2.6	381.0	87.2	194.0	56.3	-	3962.9	157.4

a/ U.K. and Northern Ireland.

b/ Belgium, Luxembourg, W. Germany, Netherlands, Italy, France, Eire, Denmark.

c/ Norway, Finland, Sweden, Iceland.

d/ Central America, Carribean, South America.

e/ Includes small quantities of pears in some years (figures are in terms of fresh fruit equivalents).

Sources: N.Z. Apple and Pear Board Annual Reports.

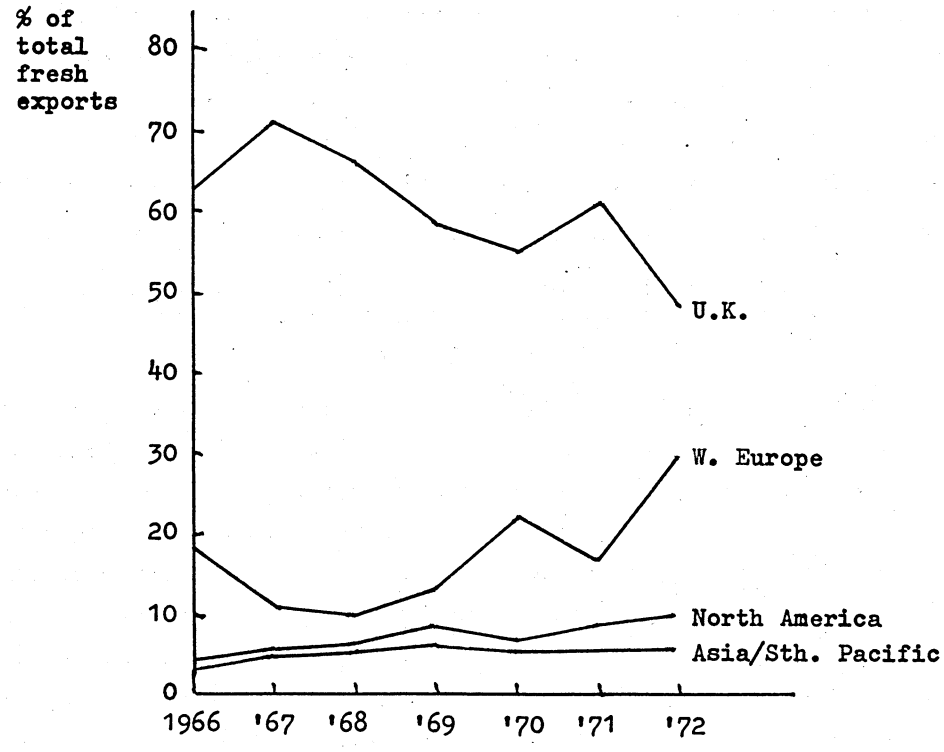

Figure 1.2: Market Diversification Trends

1.2 World situation-production

The volume of world production of apples is indicated by Table 1.3. World production reached a record of 20 million metric tons in 1969, due mainly to the heavy crops obtained in North America, West Germany and Eastern Europe. While output in these areas remained reasonably high in 1970 it was not up to that of 1969, and world production fell to about the previous record level of just over 18 million metric tons established in 1967. Total production in 1971 was slightly less than that of 1970, and preliminary data for 1972 suggests that world output of apples in that year was the same, or slightly less, than in 1971. Although North America and Southern Hemisphere supplies were maintained in 1972, West European supplies were reduced due to widespread bad weather. The areas most affected were the U.K. and countries of the original E.E.C. Italy was the only exception, but her increase in production was comparatively small in relation to the 32 percent fall in output in West Germany.

Europe (including the U.S.S.R. which produces an estimated 2.3 million metric tons) accounts for around 60 percent of total world apple production. Southern Hemisphere supplies account for about 8 percent, and New Zealand less than 1 percent. Apart from the occasional light or heavy year, production in North America and the Southern Hemisphere countries has remained fairly stable, showing a slight upward trend. Wide fluctuations, due mainly to the effects of climate, characterise European production, which reached a peak in 1969. As a result, prices fell to very low levels during 1969 and 1970, and caused the F.A.O. to remark[4]

> "the threat of chronic overproduction of apples and pears in the northern hemisphere, particularly in the E.E.C., has not diminished, and is likely to persist during the years ahead. This is a result of inadequate structural changes on the production side ..."

Since 1969 West European production has been reduced, especially in Italy, West Germany and to a lesser extent, France, due to the fortuitous combination of poor growing conditions and policies aimed at assisting the removal of old orchards. Although the E.E.C. introduced measures in 1969 to adjust production to market requirements, especially uprooting premiums which, moreover, were increased from U.S.$500 to U.S.$800 per hectare in January 1970, response has been slower than expected. This program was to be completed by April 1, 1973, but no announcement has yet been made of its results. While it is likely that the program will have brought about the removal of marginal operators as well as varieties and types of trees that should have been removed long ago, the core of efficient producers and marketers no doubt remains. Also, any decrease in area has tended to be offset by improvements in yields per hectare, and some member countries apply a number of other regulations that tend to encourage production such as aids to exports to selected third countries,[5] and market intervention measures.

The degree to which the latter intervention measures need to be applied is a good indicator of the extent of over-production in any year. Table 1.4 indicates that very large quantities of apples were withdrawn from sale during the 1967/68, 1969/70 and 1970/71 seasons (and, for comparison, were well in excess of New Zealand's total production). However, the total amount of apples withdrawn in 1971/72 fell sharply and intervention was limited practically to buying-in operations in Italy.

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4 Commodity Review and Outlook, 1970-1971, F.A.O., Rome, 1971.

5 For example, the E.E.C. announced that from November 28, 1972, an export subsidy would be applicable to all Member States' exports to Brazil, Venezuela and Peru.

Table 1.3: World Apple Production

Region	Average 1961-65	1966	1967	1968	1969	1970	1971[b]	1972[b]
	('000 metric tons)							
NTH. AMERICA	3196	3166	3020	3006	3645	3384	3339	3313[c]
Canada	416	430	446	410	444	398	378	394[c]
United States	2672	2612	2447	2468	3063	2823	2791	2746[c]
Other	108	124	127	128	138	163	170	173[c]
WESTERN EUROPE	7013	7566	8359	7714	9106	8223	7871	7653[c]
United Kingdom[a]	474	448	305	356	441	547	530	403[c]
Original 6 E.E.C. countries	5063	5678	6488	5832	7177	6243	5948	5559[c]
Belgium/Luxembourg	155	215	300	186	312	261	281	243[c]
West Germany	1355	1451	2238	1554	2552	1763	1887	1284[c]
Netherlands	343	345	488	340	475	450	480	457[c]
France[a]	960	1378	1550	1831	1841	1718	1591	1725[c]
Italy	2250	2289	1932	1932	2009	2062	1719	1850[c]
Other[a]	1476	1440	1566	1526	1488	1433	1393	1691[c]
EASTERN EUROPE	1806	2470	2810	2567	3371	2608	2935	...
ASIA	2002	2195	2606	2689[b]	2524[b]	2584[b]	2577	...
AFRICA	44	49	46	38	43[b]	42[b]	45	...
TOTAL NORTHERN HEMISPHERE	14061	15446	16841	16014	18689	16841	16767	...
Argentina	440	414	516	470	436	452	431	520
Australia	340	377	370	374	422	431	459	395
New Zealand	86	108	100	113	107	134	121	146
South Africa	127	193	177	225	230	234	254	234
Others	180	91	201	183[b]	194[b]	202[b]	209	195
TOTAL SOUTHERN HEMISPHERE	1173	1183	1364	1365	1389	1453	1474	1490
WORLD TOTAL	15234	16629	18205	17379	20078	18294	18241	...

... Data not available.

a/ Table apples only.

b/ F.A.O. estimates.

c/ Preliminary.

Sources: 1961-1971: Production Yearbook 25, F.A.O., 1971.
1972: Monthly Bulletin of Agricultural Economics and Statistics 22 (2), F.A.O., 1973.

Table 1.4: Withdrawal Operations in the E.E.C. (Apples)

Region	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73 (preliminary)
	← (tons) →					
West Germany	-	-	-	4,827	-	-
Belgium	4,274	587	17,414	4,550	-	-
Luxembourg	-	-	151	134	-	-
France	116,173	21,382	62,962	85,402	-	-
Italy	167,107	-	79,950	41,644	39,683	-
Netherlands	9,274	-	22,858	43,698	-	-
TOTAL	296,828	21,969	183,335	180,353	39,683	-

Source: Monthly Bulletin of Agricultural Economics and Statistics 22 (2), F.A.O., 1973.

Total 1973 production in 10 major West European producing countries - France, Italy, the Netherlands, West Germany, the U.K., Sweden, Norway, Austria, Spain and Yugoslavia - is about 7 percent above the 1972 level but 4 percent under the 1968-71 average.[6] Of these countries, only Spain shows a crop above the 1968-71 average. Production in the remaining countries is moderately to significantly below average. The combined production of France, Italy and the Netherlands (the top European exporters) is only 1 percent above last year's output, and some 4.5 percent below average. Only France expects a larger crop than last year (5 percent greater), but still 2.5 percent below the 1968-71 average. Italy's crop is roughly 2 percent under 1972's and 5 percent below the 1968-71 average. The Dutch crop is about the same as last year's but 10 percent below average. Both West Germany and the U.K. have recovered from the light crops of 1972, but not sufficient to bring production back to average levels. The West German crop is 38 percent above last year's but 13 percent below average, and in the U.K., production is 16 percent greater than in 1972 but still 4 percent below average. Scandanavia also reports poorer crops than in 1972. Swedish production is estimated at 6 percent less than in 1972 and 12 percent below average. In Norway, a crop 15 percent below 1972's and 22 percent below average, is expected.

Table 1.5 shows the portion of total production that was used for manufacturing purposes in various countries. Unfortunately, data for years after 1968 and 1969 was not available. In North America, around 35-45 percent of total apple production is processed, compared with about 15 percent in the U.K. and New Zealand, 10 percent in Australia and only 6-7 percent in South Africa. Total process

6 Sindelar, G.E., "European Apple Growth Falters - U.S. Exports Make Gains", Foreign Agriculture, U.S.D.A., October 15, 1973.

Table 1.5: Apple Processing Trends - Selected Countries

		Total production	Total processing	Canned	Dried	Frozen	Other[a]	Process as % total production
		('000 tons)						
South Africa	1965	118	4	...	...	...	...	3
	1966	155	10	...	...	...	...	7
	1967	154	7	...	...	...	...	5
	1968	181	11	...	...	...	...	6
U.K.	1965	472	71	...	...	...	...	15
	1966	340	50	...	...	...	...	15
	1967	299	41	...	...	...	...	14
	1968	347	52	...	...	...	...	15
	1969	433	53	...	...	...	...	12
Aust.	1964/65	360	30	20	1	-	9	8
	1965/66	377	31	24	2	-	5	8
	1966/67	370	39	28	1	-	10	11
	1967/68	374	37	28	1	-	8	10
Canada	1965/66	448	150	15	101	-	34	34
	1966/67	423	159	22	106	-	31	38
	1967/68	439	156	21	103	-	32	36
	1968/69	403	116	9	74	-	33	29
U.S.A.	1965/66	2,676	1,169	584	29	97	459	44
	1966/67	2,521	1,086	466	114	92	415	43
	1967/68	2,408	994	494	71	115	314	41
	1968/69	2,425	1,006	525	78	102	302	42
N.Z.	1965	90	10	...	...	...	...	11
	1966	106	14	...	...	...	...	13
	1967	99	14	...	...	...	...	14
	1968	111	16	...	...	...	...	15
	1972	144	21	...	...	...	...	15

a/ Juice, wine, cider and vinegar.

Source: Fruit: A Review of Production and Trade, Commonwealth Secretariat (various issues).
N.Z.A.P.B. Annual Reports, and M.A.F. data.

production has shown a slow but gradual upward trend in South Africa, Australia and New Zealand, a downward trend in the U.K. and U.S.A., and a downward trend over the latter three years of the period covered, for Canada. Dried apple products represent the main processing outlet in Canada, whereas U.S.A. production of frozen apple products has increased at the expense of canned products and those of the 'others' category, namely juice, vinegar and cider.

1.3 World situation - trade

Tables 1.6 and 1.7 give details of international trade in apples over the period 1965-71. Less than 10 percent of total world production enters international trade, but much of this trade is intra-European in nature. Over half the world's exports originate in Europe (mainly in France, Italy and Hungary), and over 80 percent of all apples that are traded internationally are sold in Europe (especially in the markets of the U.K., West Germany and, in the last few years, the U.S.S.R.). West German and U.K. imports from France and Italy alone make up about 25 percent of world apple trade - the proportion becomes almost one-third if the trade between Hungary and the U.S.S.R. is added. Supplies from non-European sources into Europe include large shipments from Australia to the U.K., West Germany and Sweden; from Canada, New Zealand and South Africa to the U.K.; from South Africa to West Germany and Belgium; and from Argentina to the Netherlands, West Germany, Sweden and Finland. Eastern Europe suppliers, mainly Hungary and Bulgaria, and North Korea are the principal exporters of apples to the U.S.S.R. The main flows of non-European trade include two-way trade between the U.S.A. and Canada, shipments from Argentina to Brazil, and the increasing volume of exports from Australia to Malaysia and Singapore, which amounted[7] to 12,000 tons in 1970.

During the northern hemisphere summer, shipments to Europe from the southern hemisphere are dominant in world trade. Imports from this source comprise over 60 percent of the total imports of the U.K., over 40 percent of those of the Netherlands, over 25 percent those of Belgium and around 15 percent of West Germany's total imports (see Table 1.8). The U.K. continues to be the major export market of Australia, New Zealand and South Africa. Because of the distances involved, South Africa is able to land fruit on the U.K. market as early as February, with April being her heaviest trading month. New Zealand's first supplies typically arrive in April whereas May marks the arrival of the main Australian supplies (see Table 1.9). The majority of the South African crop is sold in the U.K. by the end of May, although apples from the other two principal suppliers continue to arrive in the U.K. over July and August. During the 1969-71 period, U.K. imports from Europe averaged

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7 In contrast, New Zealand's exports to Singapore in 1970 totalled 500 tons.

only 4,800 tons in April and steadily decreased to 370 tons by July. From August onwards, European supplies to the U.K. increased steadily, reaching their peak during January to March.

Table 1.6: World Exports of Apples

Region	Average 1956/60	1965	1966	1967	1968	1969	1970	1971
	← ('000 metric tons) →							
NORTH AMERICA	115	174	166	152	118	101	100	95
Canada	47	59	53	70	71	59	49	38
United States	68	114R	112R	81R	46R	41R	49R	56
Other	-	1	*	1	1	1	1	1
WESTERN EUROPE	...	865	764	777	860	950	943	1054
United Kingdom	-	3R	6R	2R	1R	3R	11	11
Original 6 E.E.C.	...	824	723	752	818	922	911	1020
Belgium/Luxembourg	15	31	15	45	38	38	41	42
W. Germany	...	2	2	6	24	22	23	12
Netherlands	72	91	58	50	53	50	83	122
France	11	213	156	245	358	434	474	485
Italy	452	486	492	406	344	378	290	358
Other W. Europe	52	37	34	23	40	25	21	23
EASTERN EUROPE	81	180	209	267	249	401	348	305
ASIA	147	240	236	235	285	252	194	139
AFRICA	-	*	*	*	*	*	*	1
TOTAL: N. HEMISPHERE	...	1458	1375	1431	1512	1704	1585	1593
Argentina	112	253	192	246	261	246	200	211
Australia	94	134	159	131	126	130	135	150
New Zealand	30	43	49	39	41	42	54	52
South Africa	39	85	109	111	130	125	121	131
Others	79	20	22	18	21	15	19	15
TOTAL: S. HEMISPHERE	284	535	532	546	579	558	528	559
WORLD TOTAL	...	1993	1907	1977	2092	2262	2113	2152

* Less than 500 tons.

R Includes re-export of apples.

Sources: 1956-60: Fruit: A Review of Production and Trade, Commonwealth Secretariat, 1972.
1965-70: Trade Book 35, F.A.O., 1971.
1971: Monthly Bulletin of Agricultural Economics and Statistics 22 (2), F.A.O., 1973.

Table 1.7: World Imports of Apples

Region	Average 1956/60	1965	1966	1967	1968	1969	1970	1971
	← ('000 metric tons) →							
NORTH AMERICA	...	59	53	72	94	87	91	75
Canada	23	29	25	21	32	28	42	39
United States	21	16	14	36	48	48	34	27
Other	...	15	14	15	13	11	15	9
WESTERN EUROPE	...	1346	1273	1231	1291	1336	1340	1397
United Kingdom	190	247	279	290	300	290	259	277
Original 6 E.E.C.	496	856	747	722	780	800	799	868
Belgium/Luxembourg	27	51	51	55	65	70	69	68
W. Germany	339	667	585	549	591	592	590	637
Netherlands	14	21	23	46	70	62	65	77
France	77	116	83	69	49	56	50	60
Italy	-	1	1	4	6	19	25	25
Other W. Europe	153	243	252	219	211	246	283	252
EASTERN EUROPE	169	279	278	361	399	429	319	...
ASIA	43	156	154	161	211	191	168	171
AFRICA	...	25	23	25	32	25	26	18
TOTAL: N. HEMISPHERE	...	1866	1780	1850	2026	2068	1940	...
TOTAL: S. HEMISPHERE	...	94	98	127	144	138	155	167
WORLD TOTAL	....	1960	1868	1977	2170	2206	2095	...

Sources: 1956-60: Fruit: A Review of Production and Trade, Commonwealth Secretariat, 1972.
1965-70: Trade Yearbook 25, F.A.O., 1971.
1971: Monthly Bulletin of Agricultural Economics and Statistics 22 (2), F.A.O., 1973.

Table 1.8: Southern Hemisphere Exports to Selected European Countries

Destination	Country of origin					Total as % total imports all sources
	Australia	New Zealand	South Africa	Argentina	Chile	
	('000 tons)					
United Kingdom						
1968	58.2	26.1	71.3	0.3	-	58.5
1969	69.8	25.2	72.1	-	-	66.1
1970	68.3	29.6	64.1	-	-	65.2
West Germany						
1968	23.4	1.6	17.0	53.3	6.3	17.5
1969	21.7	3.1	16.6	42.9	3.7	15.1
1970	15.7	6.2	19.3	34.1	4.2	13.7
Netherlands						
1968	0.5	0.2	1.0	28.7	-	44.4
1969	1.8	-	1.2	21.4	-	40.0
1970	1.7	1.3	2.3	24.5	1.4	48.9
Belgium						
1968	-	-	18.7	-	-	29.4
1969	-	-	17.7	-	-	25.9
1970	-	-	18.4	-	-	27.3

Source: Fruit: A Review of Production and Trade, Commonwealth Secretariat, 1972.

Table 1.9: Monthly Imports into the United Kingdom

Month	Australia			New Zealand			South Africa			Total, all sources		
	1969	1970	1971	1969	1970	1971	1969	1970	1971	1969	1970	1971
	('000 tons)											
January	-	-	-	-	-	-	-	-	-	26.0	20.4	22.5
February	-	-	-	-	-	-	0.8	0.6	-	20.3	21.3	19.0
March	-	-	-	-	1.1	-	17.1	15.6	8.3	35.4	35.7	30.1
April	1.6	0.9	0.1	5.4	3.1	9.2	35.1	31.9	28.8	45.6	43.1	43.8
May	15.9	20.6	25.3	5.7	10.9	9.1	18.0	14.1	18.4	39.9	46.8	53.8
June	26.4	29.0	29.6	9.0	11.4	6.6	1.2	2.0	3.6	37.2	43.1	40.6
July	26.6	11.7	13.5	3.5	1.1	5.0	-	-	-	30.6	13.4	18.9
August	1.2	6.2	-	-	2.2	-	-	-	-	2.2	8.8	1.6
Sept.-Dec.	-	0.5	-	-	0.4	0.2	-	-	0.2	48.5	23.2	28.6

Source: Fruit: A Review of Production and Trade, Commonwealth Secretariat, 1972.

1.4 Price trends overseas

Due mainly to over-production in Europe, prices for apples on European markets dropped to very low levels during the 1969/70 season. The 1970/71 season in Europe was also characterised by substantial imbalances between supply and demand. Prices remained low during the first half (July-December) of the season - a crisis period of one month was declared in the E.E.C. in September 1970, and substantial quantities were withdrawn from the market. Prices showed some improvement in February-March 1971, allowing E.E.C. average prices for 1970/71 to be about 10 percent higher than the distressed levels recorded in 1969/70. As a result of a still further reduction in supplies, prices in E.E.C. for 1971/72 rose by nearly 30 percent above the 1969/70 levels. However, current producer prices in E.E.C. are no higher than those of six years ago so that in real terms, a substantial reduction in price has taken place. Coupled with the inevitable cost increases, falling profitability must be making itself felt in E.E.C. producing countries.

In February of this year the F.A.O. forecast further price increases and a favourable trade outlook for the 1972/73 European season.[8] This was seen to be due to a further reduction in European supplies, plus expected short supplies from the southern hemisphere during 1973. The New Zealand A.P.B.'s expected record profit level for the year ending 1973 would be partly due to the more favourable prices now being earned in Europe, in comparison with those prevailing three years earlier. World prices are expected to remain reasonably favourable through 1974, with 1973/74 European crops only moderately greater than those of the previous season. The trade and price situation that emerges during the latter half of the present decade, though, will depend largely on developments in France. Producer satisfaction with prices last season, plus the French belief that total European production will decline further in coming years, indicate that French production could once again expand, despite past experiences of production surpluses and depressed prices.

Of more relevance to New Zealand producers are prices received for New Zealand apples in the various European markets, especially the United Kingdom. Available data[9] allowed an estimate to be obtained of the average wholesale price of New Zealand apples at certain markets in England and Wales. These prices are graphed in Figure 1.3. They show a gradual upward trend until 1967, and then a falling trend over the next three years, in line with the general falling price situation in Europe at that time. Prices received in 1973 are expected to be somewhat higher than the average price received in 1972.

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8 Monthly Bulletin of Agricultural Economics and Statistics 22 (2), F.A.O., 1973.

9 From Fruit: A Review of Production and Trade, Commonwealth Secretariat (various issues.)

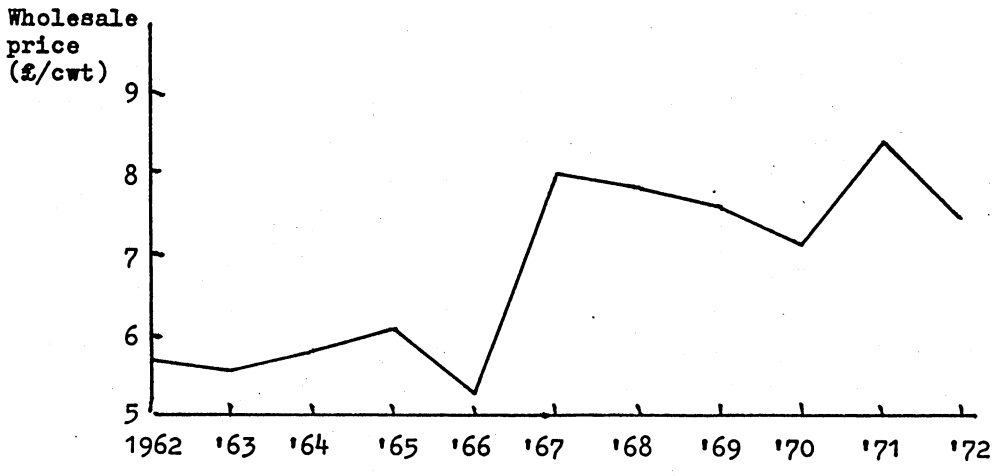

Figure 1.3: Prices Received for N.Z. Apples in U.K.

1.5 The new E.E.C. trading regulations

In the past, the U.K. has maintained varying import duties on apples and in addition, has used quotas to control imports from outside the sterling area.[10] The duty was imposed on apples (other than cider apples) from non-Commonwealth countries, between April 16 and August 15. During the remainder of the year, no duty existed; also, Commonwealth countries and South Africa enjoyed duty-free status all year round. The quotas to control non-sterling imports were set twice each year by the Ministry of Agriculture, Fisheries and Food.

On February 1, 1973, the E.E.C.'s Common Agricultural Policy began applying to the U.K. and the usual January-June quota was cancelled. However, compensatory levies were introduced, in addition to U.K. duties on imported apples. The purpose of these payments is to protect the U.K. apple industry and to ensure a price advantage for apples imported from the E.E.C. during their main shipping season. The duty advantage received by southern hemisphere Commonwealth suppliers (including South Africa) is to be gradually phased out over the five-year transition period, 1974-1978. These countries will thereafter compete on an equal basis with apples from all other third (non-E.E.C.) countries. They will not, however, be affected by the compensatory levy system over much of their marketing period, since it is to be in effect from August 1 to March 31. South Africa will have to pay this levy, though, on her early supplies during February and March. Thus any advantage she may have received in the past through being able to supply the U.K. market before Australia and New Zealand each year, will be diminished.

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10 Puterbough, R.F., "British Entry into E.C. Changing World Apple Market", Foreign Agriculture, U.S.D.A., April 2, 1973.

The transitional arrangements of compensatory levies and U.K. duty are to be phased out over a five-year period by five annual 20 percent reductions. The Common External Tariff that will apply to all third countries will be phased in, in five equal steps, over the same period. By 1978, then, there will be no customs duties between the members of the enlarged E.E.C. Ad valorem duties on imports from all third countries will apply as follows:

January 1 - March 31:	10 percent
April 1 - July 31:	8 percent
August 1 - December 31:	14 percent.

Thus New Zealand supplies that arrive during April 1 - July 31 will be subject to the 8 percent tariff, as will all other supplies from outside the E.E.C. at this time. Earlier supplies, such as those from South Africa during March, will be penalised by an additional 2 percent, and supplies to the U.K. during August will pay a considerably greater tariff.

1.6 Outline of the report

Knowledge of present income levels of growers is important in any discussion of policy alternatives that might affect the production of apples in New Zealand. The next section, then, reviews movements in prices, costs and incomes received by both producers and the A.P.B. in the past. In Section 3, the method adopted to make a projection of future supply of apples in New Zealand is described, and the supply projections are presented. These are broken down into the supply of export-quality apples, and the supply of apples likely to be suitable for only domestic fresh consumption or processing. Projections of the rate of growth of demand for apples, both in New Zealand and certain overseas countries, are made in Section 4. Supply and demand projections are compared in Section 5. Where an imbalance between supply and demand appears likely to exist, the future behaviour of prices can also be projected, although a lack of suitable data precludes the quantification of such price movements. Section 6 concludes the Report by summarising previous sections, discussing various policies that could be adopted by the New Zealand apple industry, and presenting general conclusions.

It should be noted that this Report deals only with the apple, and not the entire pip-fruit (apples, plus pears) industry. This was decided because of the dominance of the apple in New Zealand's pip-fruit industry.[11] However, insofar as the problems facing the pear industry are similar to those experienced by apple growers, it is expected that any conclusions regarding choice of policies for implementation in the apple industry could probably be applied to the entire pip-fruit industry.

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11 In 1968, for example, pear production accounted for only 13 percent of total pip-fruit acreage, and in 1970, 13 percent of total pip-fruit production.

2. Costs, Prices and Incomes

Before policy alternatives can be evaluated, it is important to examine the financial situation of both growers and the A.P.B. at the present time. Study of the absolute values of prices and costs, and of their trends over time, might also indicate the degree to which the industry as a whole could absorb future cost increases and price decreases and yet remain viable. Possible failure of the industry to remain viable under such circumstances would indicate the need for evaluation of policy alternatives; if the industry is likely to be able to survive any cost/price squeeze, then direct support of the industry would not be justified. In either case, important policy alternatives would be those aimed at increasing the cost efficiency of the industry as a whole.

2.1 Financial situation of growers

It would appear that no comprehensive survey of costs and returns of individual pip-fruit orchardists has been carried out in New Zealand. The Department of Statistics, however, publishes annually the results of its Survey of Orchardists' Incomes. The survey is based on a sample of about 200 individual growers' income tax returns. The sample includes producers of apples, pears and stone fruit, and includes only orchards under individual ownership - hence companies and partnerships are excluded. Since the majority of pip-fruit orchardists also produce some stone fruit, the inclusion of stone fruit incomes and costs is not seen as a problem.

Survey results are classified initially for each district, by orchard acreage (0-10 acres, 11-20 acres and greater than 20 acres) and averages are computed for each size group. These are then weighted by the number of sampled orchards in each size group to obtain a district average. The latter are then weighted by the number of sampled orchards in each district to obtain a national average. Unfortunately, results for individual years are not strictly comparable. The composition of the sample could change from year to year, for example, some growers' might cease to be eligible for inclusion in the sample. In this situation, an attempt is made to replace that orchard with another of similar size. Also, the results are expressed 'per holding', so cannot be converted to a 'per acre' or 'per bushel' basis, and no indication is given of the age distribution of orchards in the sample, or their stage of development. However, the results of the survey are considered useful for indicating trends in incomes over time, and for making comparisons with such trends in other sectors of agriculture and horticulture.

Table 2.1: Net Farm Incomes of Various Farm Types

Year	Town milk	Dairy	Sheep	Market garden	Orchard
1964/65	$4,506	$3,584	$4,946	$2,636	$3,908
1965/66	4,898	3,852	4,668	2,616	4,075
1966/67	5,421	4,163	3,408	3,205	3,944
1967/68	5,165	3,766	3,476	3,000	3,909
1968/69	4,799	3,462	4,063	2,823	4,145
1969/70	4,854	3,779	4,458	2,455	4,579
1970/71	5,402	4,117	3,712	3,323	4,388
Average	$5,006	$3,818	$4,104	$2,865	$4,135

Source: Survey of Farm Incomes, Department of Statistics.

Table 2.1 includes estimates of net farm income[1] (before the payment of taxes) for orchardists and some other farmer classifications. The average net farm incomes for the period 1964/65 to 1970/71 indicate that the earnings of orchardists have been second only to those of town milk producers, although the very low wool prices earned by sheep farmers over part of this time period, and their subsequent drastic improvement since, should be remembered. Orchardists also enjoyed greater stability of income than other farmers, and their incomes showed a steady upward trend. This is no doubt due to the A.P.B. carrying the financial burden of fluctuations in market realisations from year to year, with the grower receiving a per unit payout that cannot, by law, deviate by more than plus or minus 5 percent from one year to the next. In direct contrast is the apparent instability of sheep farmers' and market gardeners' incomes, whose produce is sold largely at auction.

Table 2.2 indicates the capital structure[2] of the various farm classifications, and the average annual return earned by the capital invested by the owner in his farm. The equity ratio, or the percentage of the total value of assets actually owned by the operater, is highest for the orchard sector at almost 70 percent. Further, the capital invested by the orchardist in his holding earned, on average, almost 26 percent per year over the period under review, which was higher, but not significantly so, than the annual earnings of town milk producers', dairy farmers' and market gardeners' capital investments.

1 The net farm income estimates include an implicit payment to the owner's labour and capital. Also, the reported survey results have been adjusted to give a more realistic estimate for our purposes, by deleting payments and receipts associated with income equalisation schemes, net income from private investment, and various tax incentives, allowances, subsidies and relief payments.

2 Assets are valued according to original cost less current depreciation. Since such a valuation generally understates the asset's current market value, the equity estimates of Table 2.2 will also be understated.

Table 2.2: Capital Structure and Annual Return to Owner's Capital (1964/65 - 1970/71 averages)

	Town milk	Dairy	Sheep	Market garden	Orchard
Total assets	$36,676	$28,594	$44,972	$17,371	$22,881
Total liability	16,212	12,024	16,710	5,462	6,927
Farmer's equity	20,464	16,570	28,262	11,909	15,954
Equity as % total assets	55.8	58.0	62.9	68.6	69.7
Net farm income as % of equity	24.5	23.1	14.5	24.1	25.9

Source: Survey of Farm Incomes, Department of Statistics.

The farmer's labour, however, was responsible for producing some of the net farm income, although in Table 2.2 all net farm income has been imputed to the owner's capital. An estimate of the return to the owner's labour can be made by assuming an opportunity cost of say 7 percent on the owner's capital. That is, if such capital was employed off-farm, it could have earned (before tax) around 7 percent. By deducting the interest on owned capital from net farm income, an estimate of the return to the owner's labour is obtained in Table 2.3. If this figure is equal to the annual wage the owner could have earned (before tax) in some other employment, then the farmer is said to be earning 'normal' profits from his farm.

Table 2.3: Return to Owner's Labour (1964/65 - 1970/71 averages)

	Town milk	Dairy	Sheep	Market garden	Orchard
Net farm income	$5,006	$3,818	$4,104	$2,865	$4,135
Interest on own capital (7%)	1,432	1,160	1,978	834	1,117
Return to labour	3,574	2,658	2,126	2,031	3,018

Source: Survey of Farm Incomes, Department of Statistics.

A cautious attempt to determine whether or not orchardists earned above or below 'normal' profits during the period under study was made. The New Zealand Official Year Book includes results of the Department of Labour's half-yearly surveys of weekly earnings for various industry groups (which exclude agriculture). From those data, the average annual earnings (before the payment of taxes) of all full-time

workers covered by the half-yearly survey, over the period 1964/65 - 1970/71, was calculated to be $2,271. Using this figure as an estimate of the wage a farmer could have earned 'off-farm', Table 2.3 suggests that town milk suppliers and orchardists, and to a lesser extent dairy farmers, earned considerably in excess of 'normal' profits. In contrast, sheep farmers and market gardeners earned slightly less than 'normal' profits.

2.2 Likely impact of improved productivity on orchard income and costs

Although the above data suggests that pip-fruit producers have earned above-normal profits in the recent past, it is necessary to consider the degree to which producers could absorb the effects of a future cost-price squeeze and yet still earn at least a 'normal' level of profits. The fact that producers have earned above-normal profits in the past, in itself suggests that to a certain extent, a reduction in prices or a rise in costs could be absorbed by the producer. However, if scope exists for improving the productivity of the resources employed in pip-fruit production, then average costs (total costs per unit of output) can be lowered. Thus, growers will be able to increase the degree to which they will be able to absorb adverse future marketing trends.

Figure 2.1 indicates the New Zealand average apple yield per bearing acre and the A.P.B. average payout per bushel to growers for apples. Multiplication of payout by yield gives an estimate of the average gross revenue per bearing acre of apples, and this is presented as an index in the figure. It would seem that gross revenue from apple production has increased mainly through an increase in average yields, with the A.P.B. payout on apples increasing only slowly over the period. In fact, based on averages of the first two and last two yield and price data, yields per bearing acre have increased by about 29 percent between 1962 and 1972, whereas the payout to growers increased by about 14 percent. Together, they increased gross revenue per bearing acre by around 47 percent.

Using the index of nominal wages paid in primary industries[3] as an indicator of movements in pip-fruit production costs, Figure 2.1 shows that since 1970, wages paid have increased at a slightly faster rate than has gross revenue per bearing acre. Further escalation of costs, particularly labour costs, is possible and productivity might need to be increased at a faster rate than in the past to maintain present profit margins. Fortunately a method by which great gains in productivity can be achieved is available. This is the so called 'semi-intensive' planting system.

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3 From the N.Z. Official Year Book. Use of this index seems reasonable in view of the high proportion of total orchard costs accounted for by labour.

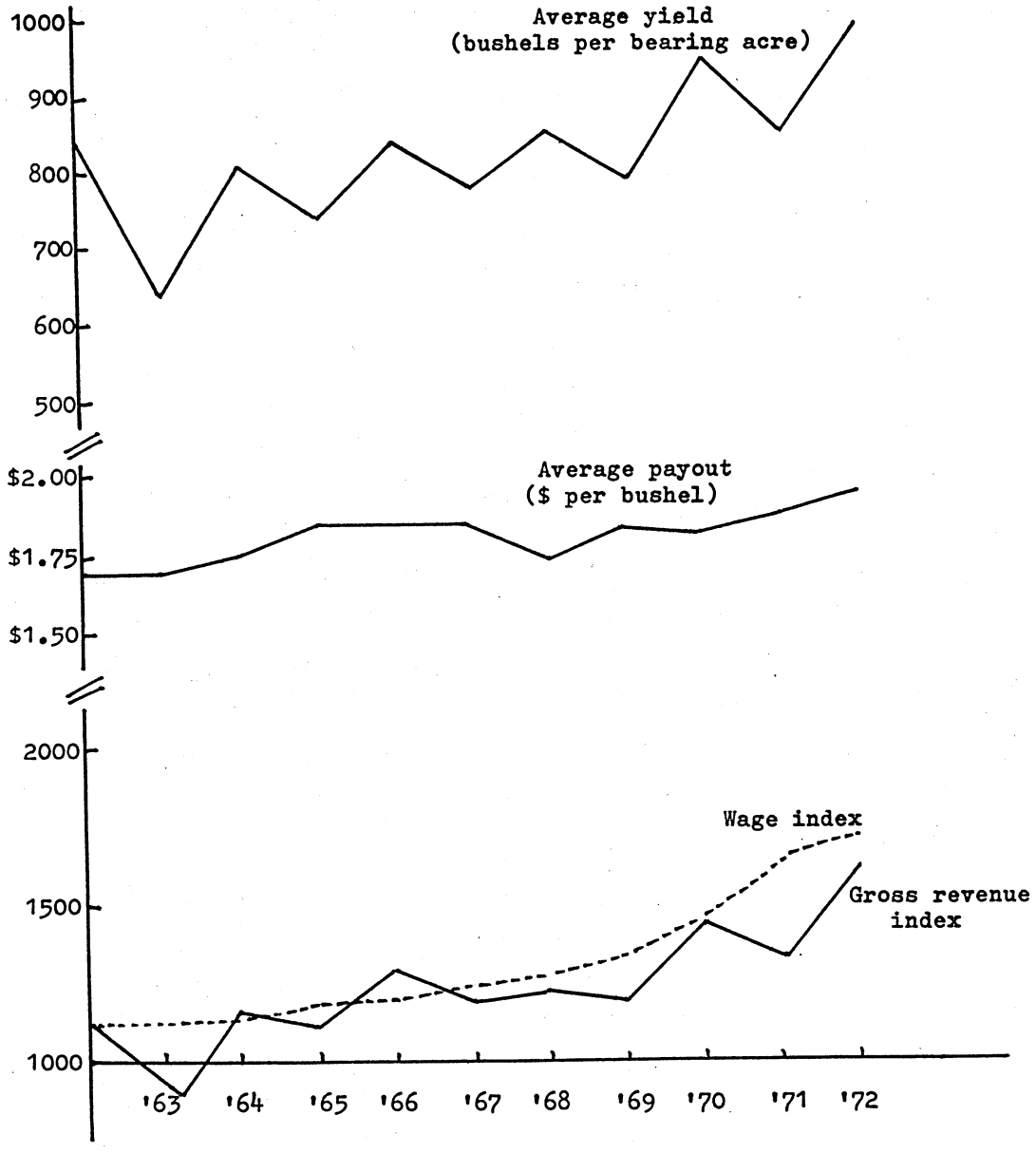

Figure 2.1: Apple Yield, Price and Cost Trends

Research data[4] indicates that the average productivity of an acre of land planted under the semi-intensive system would, at least over the first 20 years of the trees' life, be almost 2½ times as high as the productivity of standard plantings.[5] Increased productivity is generally achieved at a cost, however, and it is desirable that the productivity increase more than outweigh the increase in total costs. Various cost and profitability measures can be estimated from McKenzie's data. For example, the present (discounted) value of future earnings of an orchard is widely accepted as a reasonable measure of its profitability. The present value of a time-stream of net farm incomes may be estimated as:

$$PV = \sum_{t=1}^{20} (P(Y)_t . Y_t - FC_t - OC_t - CC_t) / (1 + r)^t$$

where PV = the present value of future net farm incomes, over a 20 year period;

$P(Y)_t$ = the price received for apples, \$/bu., in year t;

Y_t = the yield of apples, bu/acre, in year t;

FC_t = the fixed costs per acre, in year t;

OC_t = the operating costs per acre, in year t;

CC_t = the capital costs per acre, in year t; and

r = the discount rate.

Using a discount rate of 6½ percent, McKenzie's data gives estimates of present value as follows:

semi-intensive plantings : PV = \$10,434 per acre
standard plantings : PV = \$ 1,378 per acre.

Thus receipt of \$10,434 <u>now</u> is equivalent, in terms of the income it could generate over the next 20 years, to the income stream that would actually be earned from one acre of semi-intensive apple orchard.

Alternatively, the 'lump-sum' present value may be converted to an 'annualised present value' (APV), where the receipt of the constant sum, \$APV, for each of 20 years would be equivalent to the <u>actual</u> stream of income expected to be earned from the orchard. These values are:

semi-intensive plantings: APV = \$948 per acre per year
standard plantings: APV = \$126 per acre per year.

The comparative profitability of the two planting systems can also be gauged by estimating the 'return to capital investment' from the formula

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4 For example, McKenzie, D., "Planning a New Apple Orchard" and "The Value of an Established Orchard", cyclostyled reports, Havelock North Research Orchard, D.S.I.R., 1971.

5 For the first 20 years of the trees' life, McKenzie's data suggested an average yield per acre per year of 2161 bushels from semi-intensive plantings, (264 trees per acre) and 917 bushels from standard plantings (109 trees per acre).

$$RI = APV/PV(CC)$$

where RI = annual rate of return on capital investment;
APV = annualised present value; and
PV(CC) = the present value of the stream of capital costs.

The rates of return are estimated as:

semi-intensive plantings: 31.2%
standard plantings: 6.5%.

That is, the average rate of return per annum on the capital investment, over the 20 year period, is 31 percent for semi-intensive plantings, but only 6½ percent for standard plantings.

One might suspect from the above that the owner of a semi-intensive apple orchard could survive a considerably greater fall in product price (or increase in input prices) than could the owner of a standard orchard. In fact, the price per bushel of apples received by the owner of a semi-intensive orchard could fall to 76 percent of the present price (or from around $1.85 to $1.41 per bushel) before he would earn a return on his capital investment equivalent to that earned (6.5 percent) by owners of standard orchards at present apple prices. Thus owners of the latter type of orchard who believe prices could fall in the future would be wise to re-structure their existing orchards to the semi-intensive system.

Finally, McKenzie's research findings suggest that a volume of production, equivalent to that expected from one acre of standard orchard, could be obtained from just under one-half acre of a semi-intensive planting. The present value of the total cost required to produce this output over a 20 year period would be around $12,240 for the standard system, but $9,835 for the semi-intensive planting. Thus another possibility open to growers is the amalgamation of small, standard orchards, and the gradual re-planting of about half the total area with the semi-intensive system. Total production would remain the same as before, but total production costs would be lowered and land freed for some other use.

2.3 Financial situation of the A.P.B.

An early estimate[6] of the financial result of the A.P.B.'s trading operations for the year ending 30th November, 1973 is for a profit of "at least $1.5 million". This would offset the $1.5 million deficit that existed in the Apple and Pear Industry Reserve Account at the end of the previous year. Thus over the period since its inception in 1949 the A.P.B. has managed to break-even in its trading

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6 "The Evening Standard", Palmerston North, 9 August 1973.

operations. Figures 2.2 and 2.3 summarise the A.P.B.'s costs, revenues and financial achievements over the 11 year period since 1962.

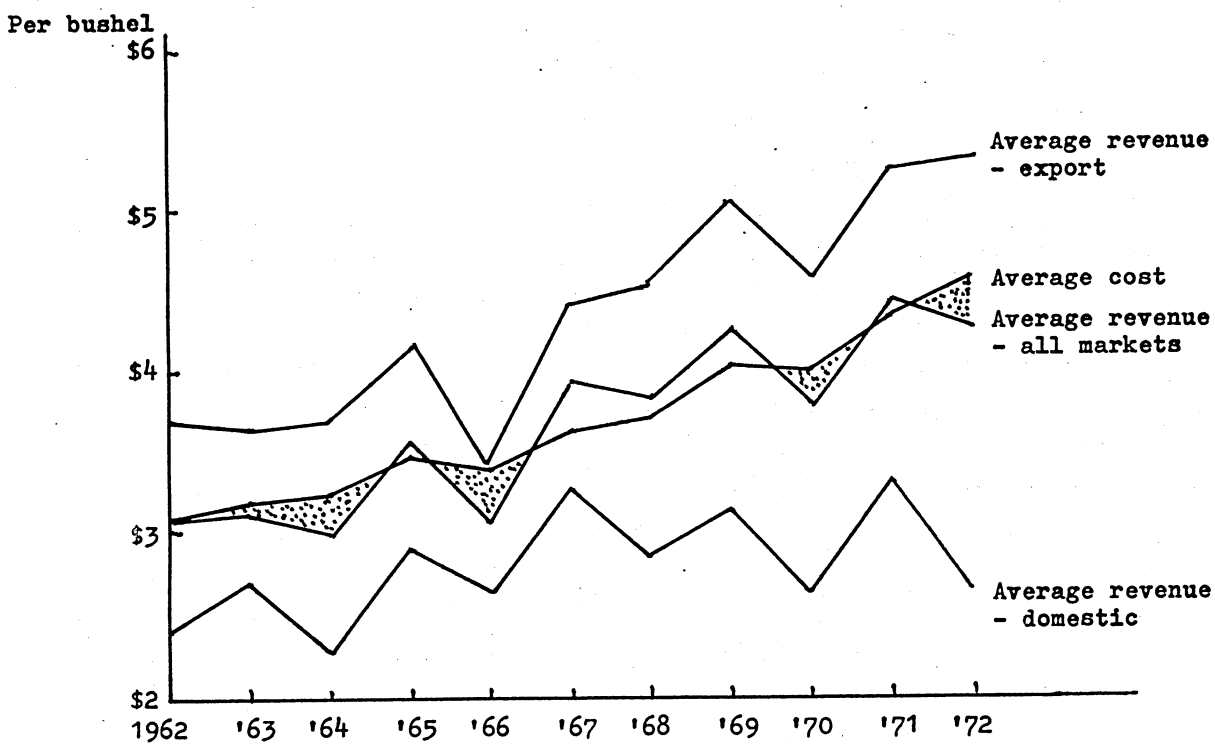

Figure 2.2: A.P.B. Revenue and Cost Trends

Figure 2.2 indicates that the margin between the total revenue received by the A.P.B. and its total costs, per bushel of fruit handled, has been a narrow one. During the 11 years, total revenue per bushel exceeded total cost on five occasions, equalled total cost in one year, and was less than total cost in the remaining five years. Total revenue per bushel has trended upwards at an average rate of 4.1 percent per annum, due principally to an average rate of increase of total revenue per bushel on the export market of 4.5 percent per annum, as the average rate of increase in total revenue per bushel on the N.Z. market was only 2.4 percent per annum. In addition, total costs per bushel of fruit have trended steadily upwards, at an a average rate of 4.1 percent per annum. Thus the average annual percentage increases in the A.P.B.'s total revenue and total costs, per bushel of fruit handled, were identical over the period 1962-1972. Although the initial purchase of fruit from growers has represented the A.P.B.'s major item of cost, this item, on a per bushel basis, has risen only slowly over the period, at an average rate of 1.5 percent per annum. The main determinant of the rise in total costs per bushel has been freight charges, which have risen at an average rate of 5.7 percent per annum.

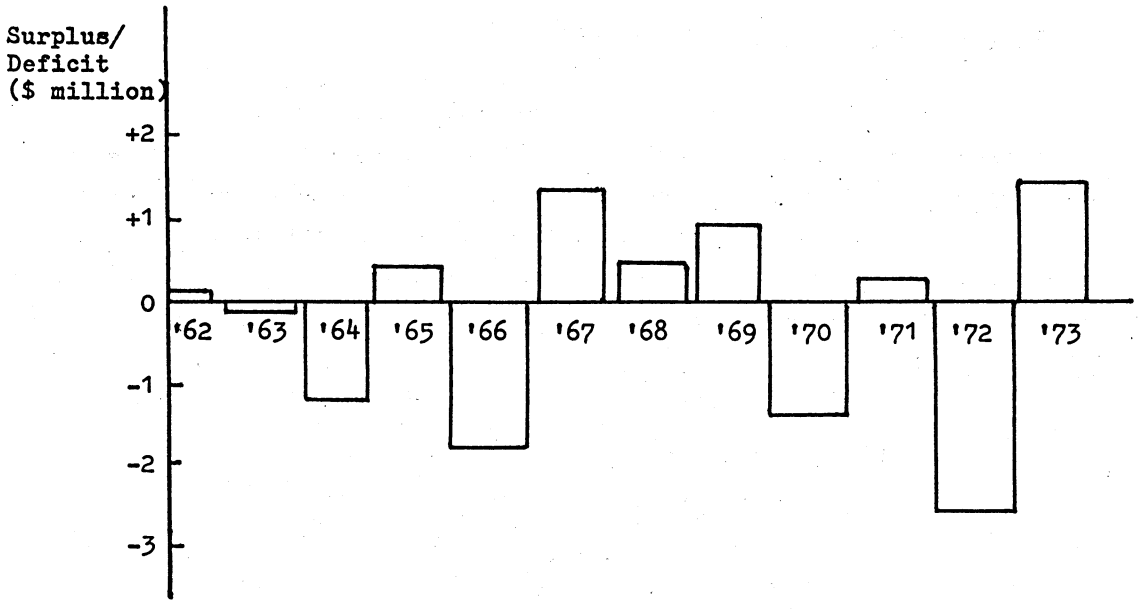

Figure 2.3: APB Trading Record

Per unit revenues and costs cannot, by themselves, indicate the absolute size of the A.P.B. profit (or loss) on its trading operations. Thus Figure 2.3 indicates the difference between the total revenue earned by the A.P.B. and its total costs. Surpluses were recorded in seven years, and deficits in the remaining five years. The deficits recorded in 1966 and 1970 were due to a large reduction in total revenue per bushel for both the local and export markets, and despite a reduction in total costs per unit from those of the previous year. That is, even though record quantities of fruit were handled in both years, the reduction in total revenue per bushel was greater than the reduction in total costs per bushel. The deficit in 1972 appears to be due mainly to a large increase in freight costs per bushel,[7] despite a slight improvement in export revenue per bushel from that received in the previous year.

The A.P.B. appears to have performed the function of a 'buffer' between the grower and the market place quite adequately. The grower has been shielded from four deficit trading years during the last 10 years, and the A.P.B. now finds itself in a break-even position after the disbursement of profits to growers, to investment in handling and storage facilities, or to the Industry Reserve Account.

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7 Freight rates from N.Z. to the United Kingdom and the Continent were increased by 16 percent in 1972. The A.P.B., however, was able to negotiate a rate with its carriers (Maritime Fruit Carriers and J. Lauritzen) that was about 52 cents per bushel below that which the A.P.B. would have had to pay had it remained with the British Conference Lines.

3. The Supply of New Zealand Apples

3.1 The adopted approach to supply projection

An econometric model was constructed to explain the growth in production that had taken place over the period 1958 to 1972. Once estimated, the model was used to make projections of future production levels. The model, and the data required for its estimation, are described in some detail in Appendix B. In this section, emphasis will be placed on providing a verbal description of the model, and the results of the supply projections.

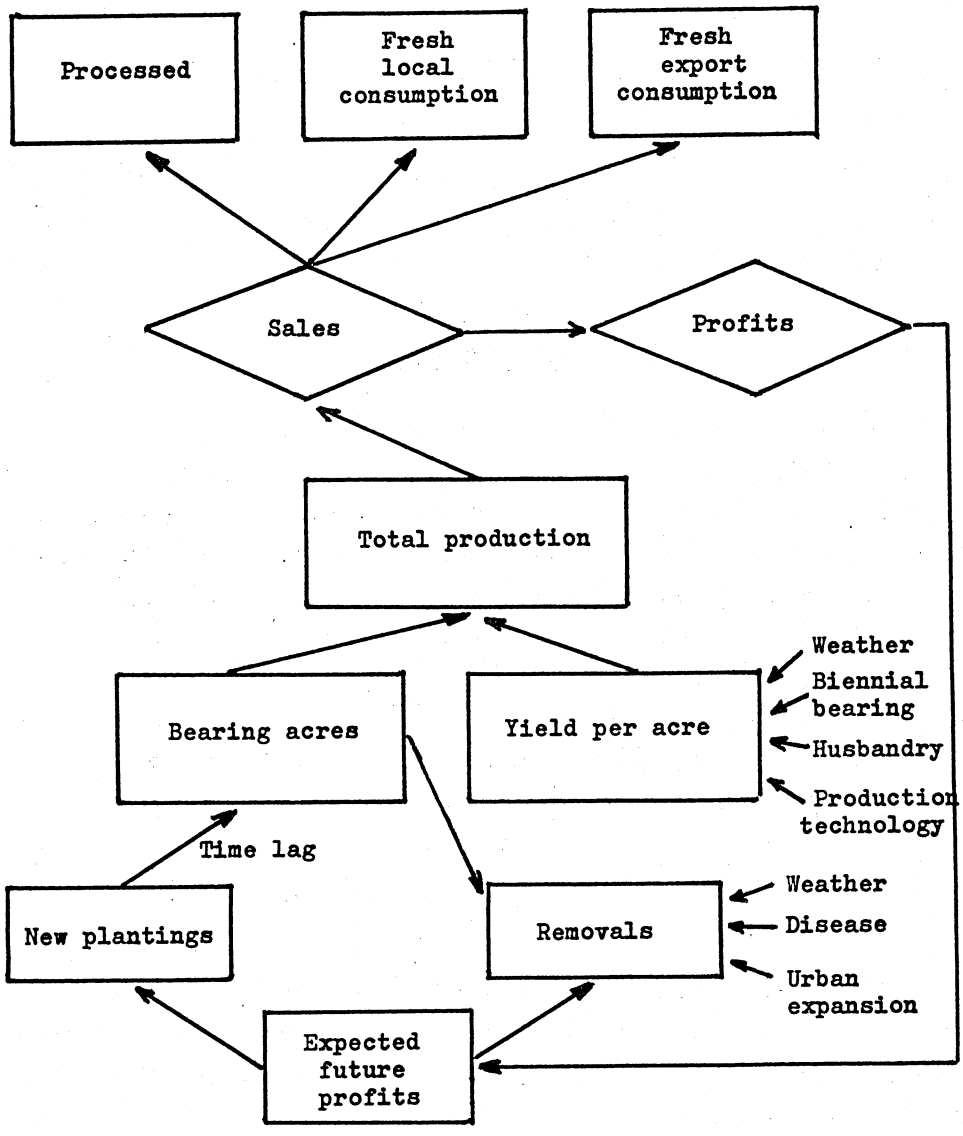

Figure 3.1: A Diagrammatic Outline of the Apple Supply Projection Model

Figure 3.1 explains the structure of the supply-projection model. Since it is a national model, production projections cannot be made for individual districts or varieties.[1] Total production of apples in any year will be given by the product of the number of bearing acres and the average yield per bearing acre. Total output is then sold for either fresh consumption or for further processing. The revenue from such sales, less production costs, provides the individual grower's profit for the season. It was hypothesised that growers made decisions about the level of new plantings in any year on the basis of their expectations of profitability, that is their expectations of product price, yields and the costs of orchard inputs. It was also assumed that, on average, a period of four years elapsed between a grower placing an order for trees and that grower receiving the trees. Next, it was hypothesised that the number of trees removed in any year would depend on such factors as the age-distribution of trees, rainfall experienced over the previous three years, the incidence of disease and urban expansion. Expectations of profit would also influence the rate at which trees were removed, since growers may feel encouraged to implement a programme of tree removal and replacement. The equation that was estimated to project levels of new plantings into the future explained 90 percent of the year-to-year variation in the acreages planted over the 1958-72 period. The equation that was estimated to project future levels of tree removals explained 56 percent of the year-to-year variation in the acreages removed over this period.

By assuming a lag of five years between a tree being planted, and its being classified as 'bearing', the actual bearing acreage in any year will be equal to the bearing acreage of the previous year, plus the acreage planted five years previously, less the acreage removed during the winter immediately preceding the current season. Since any supply projection must attempt to take the change-over to higher-yielding semi-intensive planting systems into account, the projections of new plantings and removals were divided into those involving standard, and semi-intensive, plantings. Thus the bearing acreage of both standard and semi-intensive plantings was estimated.

The national average yield per bearing acre of apples showed a marked biennial bearing pattern over the period 1958-72, with the even-numbered years being the heavy-cropping seasons. Also, a steady upward trend in yields was discernable. Since past plantings of semi-intensive orchards would have had only a minor impact on average yields up to the 1972 season, historical yield data were used to estimate the future yields to be expected from standard plantings of apple trees. The past pattern of biennial bearing and trend in yields was assumed to continue into the future. The estimated yield equation explained 93 percent of the year-to-year variation in yields over the period 1958-72.

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1 This could easily be achieved, however, by obtaining the relevant data on a district (or variety) basis, and estimating a sub-model for each district (or variety).

Estimation of a national average yield from semi-intensive orchards is a more difficult matter. The research data referred to in Section 2 indicated that, on the Havelock North research orchard at least, semi-intensive yields averaged about 2½ times the yield from standard plantings. Hence the national average yield from semi-intensive plantings is assumed to be about 2½ times the projected average yield for standard plantings. Because of uncertainty about the performance of semi-intensive orchards, their yield-superiority was also reduced by 25 percent to give a separate series of production projections.[2] This will allow an idea to be gained of the 'sensitivity' of projections of future supply to semi-intensive yields.

Some portion of the total apple crop in any year will, because of quality and/or variety considerations, be unsuitable for export as fresh-fruit. If these apples are to be used at all, then they must be processed or consumed fresh on the local market. If a large expansion of the New Zealand crop is projected, it is of importance to be able to estimate the resulting impact on the local market for fresh fruit, and processing operations. Thus, from past production and fruit utilisation data, an equation was estimated that expressed the total quantity of apples processed in any year as a function of <u>total</u> crop size. This equation, which explained 92 percent of the year-to-year variation in the quantity processed over the period 1962-72, was used to project total supplies of process apples. A further equation that expressed the total quantity of fruit either consumed fresh on the local market <u>or</u> processed, as a function of total crop size, explained 86 percent of variation in the historical data over the 1962-72 period. It is important to note that, since part of the local fresh consumption in any year could possibly have been of export quality, any projections of the proportion of the total crop that is available only for local fresh consumption or processing will be an <u>upper limit</u> to this proportion. These projections are also made on the assumption that the rate at which new varieties will be found, and at which growers change from less - to more-preferred varieties, will be the same in the future as in the last dozen years.

3.2 <u>The supply projections</u>

It is vital that a supply projection be given its correct interpretation. It is <u>not</u> a forecast of what will actually be produced in the future; the plantings and removals projections are similarly <u>not</u> forecasts of future levels of new plantings and removals. Rather, the projections are <u>conditional</u> estimates - they are estimates of what might happen given the existence of certain future conditions. These conditions are that:

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2 On the other hand, some commercial semi-intensive orchards in Hastings are, in their sixth year, cropping as heavily as did trees in their tenth year on the Research Orchard.

(1) levels of prices, costs and yields show a trend in the future similar to that exhibited in the recent past;

(2) decisions as regards the numbers of trees to be planted or removed are made with regard to the same criteria (such as profit expectations) as in the past;

(3) the trend towards semi-intensive, rather than standard, plantings continues;

(4) delays experienced in obtaining trees from nurserymen remain the same in the future as in the past;

(5) improvements in orchard husbandry that might affect fruit quality and therefore the fruit grade-out, and the rate at which less-preferred varieties are replaced by more-preferred varieties, continue to show the same trends in the future as in the past.

Note that the second of these conditions implies that no form of control or licensing is imposed on the industry. Thus the projections indicate what might result if growers, and potential growers, continued to possess their present freedom of action as regards orchard planting decisions. Also, the fourth condition would not apply if nurserymen had increased their production potential so as to clear their 'backlog' of orders. In this case, new plantings (at least for the next year or two) could be even higher than those projected, due to the 'backlog' being cleared.

Projections of new plantings, removals and total production, up to the 1984/85 season, are presented in Table 3.1. Note that, in order to make projections up to the 1984/85 season, new plantings must be projected, not up to that year, but only to five years earlier, or 1979/80. However, tree removals require projection up to 1984/85. A crop year from winter to autumn has been adopted - that is, the 1972/73 year includes plantings and removals made in 1972, and the production of the 1973 season. Although planting and removal projections were estimated on an acreage basis, they have been converted to tree numbers in the table, for no reason but that the industry seems to talk in terms of tree numbers, rather than acres. The new plantings, removals, total trees and total bearing trees data for the year 1972/73 has been derived from data provided by the Ministry of Agriculture and Fisheries.[3] They have not, therefore, been estimated within the model. However, 1972/73 production figures were estimated from the model, since M.A.F. statistics of 1973 production were not available at the time of writing. Hence by comparing the 1973 production estimates of Table 3.1 with the actual production level, once available, an indication can be gained of the accuracy with which the model estimates total production.

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3 Some of the M.A.F. data was modified before use, by comparing the degree to which this data 'matched up' with the results of the five-yearly orchard surveys. Details of data preparation are given in Appendix A.

Table 3.1: Projections of Apple Planting, Removal and Supply to 1985

Year	New plantings	Removals	Net increase	Total trees	Total bearing trees	Total production (million bu.)	
	('000 trees)					"low"	"high"
1972/73	170.6	43.4	127.3	1,982.9	1,278.9	7.61	7.79
1973/74	174.1	43.8	130.3	2,113.2	1,326.4	8.99	9.28
1974/75	179.1	46.7	132.4	2,245.6	1,398.4	8.68	9.04
1975/76	181.3	51.2	130.1	2,375.7	1,492.1	10.48	11.08
1976/77	184.1	56.7	127.4	2,503.1	1,613.9	10.40	11.19
1977/78	187.5	63.9	123.6	2,626.7	1,720.6	12.47	13.63
1978/79	189.1	70.1	119.0	2,745.7	1,824.6	12.18	13.50
1979/80	180.8	76.1	104.7	2,850.4	1,927.6	14.41	16.20
1980/81	N.R.	82.1	N.R.	N.R.	2,026.8	14.00	15.94
1981/82	N.R.	87.7	N.R.	N.R.	2,123.2	16.36	18.85
1982/83	N.R.	93.3	N.R.	N.R.	2,217.4	15.84	18.45
1983/84	N.R.	98.6	N.R.	N.R.	2,307.9	18.32	21.55
1984/85	N.R.	103.8	N.R.	N.R.	2,384.9	17.60	20.90

N.R. = data not required for projections up to 1985.

The projections indicate that, subject to conditions (1) to (5), the size of the New Zealand apple crop could be between about 14½ and 16 million bushels by 1980, and between 17½ and 21 million bushels five years later. The projections labelled "high" are made on the assumption that semi-intensive yields per acre are about 2½ greater than those of standard orchards; the projections labelled "low" assume that the relative yield-superiority of semi-intensive over standard orchards is only 75 percent of the above.

Total tree numbers (both bearing and non-bearing) are projected forward by adding the difference between the current year's new plantings and removals (i.e. the net increase in tree numbers) to the total number of trees in the previous year. Thus the total number of commercial apple trees in New Zealand by 1979/80 is projected to be:

$$\begin{aligned} & 2,745,700 + (180,800 - 76,100) \\ = \; & 2,745,700 + 104,700 \\ = \; & 2,850,400. \end{aligned}$$

The total numbers of trees in production are projected forward by adding the number of trees planted five years earlier to, and subtracting the number of trees removed in the current year from, the total number of bearing trees in the

previous year. Thus the total number of commercial apple trees in production in New Zealand by 1979/80 is projected to be:

$$1{,}824{,}600 + 179{,}100 - 76{,}100$$
$$= 1{,}927{,}600.$$

Table 3.2 breaks the supply projections down into the quantity of apples likely to be useful only for processing and local fresh consumption,[4] and the quantity available for fresh consumption either on the local or export markets. Thus by 1980, the quantity of apples available for processing is projected between 2½ and 3 million bushels, leaving around 12-13 million bushels for fresh consumption. By 1985, the quantity to be processed is projected to increase to 3-4 million bushels, with 14½-17 million bushels remaining for sale as fresh fruit. A supply of around 7 million bushels is likely to be suited, for quality and/or varietal reasons, for either processing or local consumption by 1980 - the comparable figure for 1985 is around 9 million bushels. For comparison, total production of apples in the 1972/73 season was around 8 million bushels, of which 1.2 million bushels were processed, and 6.8 million bushels consumed as fresh fruit. Of the 8 million bushels, about half (4.1 million) were used either for processing, or for sale as fresh fruit on the domestic market.

Table 3.2: Process and Fresh Supply Projections to 1985

Year	"Low" projection			"High" projection			Supply of non-export quality apples	
	process	fresh	total	process	fresh	total	"low"	"high"
	← (million bushels) →							
1972/73	1.12	6.49	7.61	1.15	6.64	7.79	4.00	4.08
1973/74	1.41	7.58	8.99	1.47	7.81	9.28	4.57	4.69
1974/75	1.34	7.34	8.68	1.42	7.62	9.04	4.44	4.59
1975/76	1.72	8.76	10.48	1.84	9.24	11.08	5.19	5.43
1976/77	1.70	8.70	10.40	1.87	9.32	11.19	5.15	5.48
1977/78	2.14	10.33	12.47	2.38	11.25	13.63	6.01	6.49
1978/79	2.08	10.10	12.18	2.35	11.15	13.50	5.89	6.43
1979/80	2.54	11.87	14.41	2.92	13.28	16.20	6.81	7.55
1980/81	2.46	11.54	14.00	2.87	13.07	15.94	6.64	7.44
1981/82	2.95	13.41	16.36	3.48	15.37	18.85	7.62	8.64
1982/83	2.84	13.00	15.84	3.39	15.06	18.45	7.40	8.48
1983/84	3.36	14.96	18.32	4.04	17.51	21.55	8.42	9.76
1984/85	3.21	14.39	17.60	3.91	16.99	20.90	8.13	9.49

4 If the change-over to more preferred varieties, and the improvement in aspects of crop husbandry, harvesting and marketing that affect fruit quality, increases at a faster rate in the future than the past, then the process and local market supply projections are likely to be somewhat too high.

Having estimated the likely supply position up to the 1984/85 season given the absence of production controls, attention is now turned to the likely demand for New Zealand apples over the same period. Once a comparison has been made between the demand and supply projections the need for some regulation of the projected growth in supply may be evaluated, and alternative policies for regulation discussed.

4. The Demand for New Zealand Apples

When projecting the likely level of demand for a product into the future it is useful, initially, to project the rate at which demand could increase over time if retail prices were to remain unchanged. Then, if the projected increase in demand is equal to the projected increase in supply, all of the increase in supply can be sold with no effect on price. However, if demand is projected to increase less rapidly than supply, then the market would be cleared only through a reduction in prices.

When developing demand projections 'at constant prices', it is useful to distinguish between

(1) changes in demand due to increases in population;

(2) changes in demand due to a rising level of consumers' disposable income; and

(3) changes in demand that are due to changes in consumers' attitudes ('tastes') to the product.

The third category of demand determinant is difficult to measure, but likely to be of some importance when projecting demand over a considerable length of time. In this study, only changes in demand that are caused by likely increases in population and income-levels are projected - hence, consumer attitudes, as well as prices, are assumed to remain the same in the future as in the recent past.

The annual rate of growth of demand at 'constant prices and tastes' can be approximated by summing the rate of growth due to population, and the rate of growth due to increases in incomes. To calculate the latter effect, though, involves estimating the annual rate of growth of personal incomes as well as the increase in per capita consumption that would result from the growth in personal incomes. Thus an estimate must be made of the income elasticity of demand for the product, which measures the percentage increase in per capita consumption that would result from a 1 percent increase in personal disposable income. Now, the rate of demand growth may be calculated as

$$G_D = G_N + G_I . E_I$$

where G_D = annual rate of growth of demand at constant prices and 'tastes';
G_N = annual rate of growth of population;
G_I = annual rate of growth of personal disposable income; and
E_I = the income elasticity of demand.

4.1 Projections of New Zealand demand

Commercially-produced apples can be purchased for fresh consumption from either of two principal sources - from retailers, or from the orchard. Figure 4.1 shows trends in the per capita consumption of fresh (commercial) apples in New Zealand over the period 1955-72. Consumption has increased slowly, from around 33 lbs per capita in the late 1950's to about 40 lbs by 1972. Since 1961, there appears to have been a quite drastic swing away from retail to direct purchases. This trend appears to have been halted, at least temporarily, by the late 1960's, and the A.P.B.'s 'contract to supply' scheme may have been responsible.

An estimate for New Zealand of the income elasticity of demand for 'all fruit other than citrus and bananas' has been estimated recently by F.A.O.[1] Thus their estimate of 0.29 presumably refers to the consumption of both pip and stone fruit, of which apple consumption would be a major part. The Department of Statistics population projections[2] show an average rate of increase in population, assuming an annual net immigration of 5,000 persons, of 2.1 percent per annum. Lastly, data on private incomes and expenditures, also found in the New Zealand Official Yearbook, allow construction of a time series of personal disposable income that showed an average rate of growth of 1.52 percent per annum over the period 1955-72. Assuming incomes continue to grow at this rate, we have

$$G_N = 2.10\% ,$$
$$G_I = 1.52\% ,$$
$$E_I = 0.29 , \text{ and}$$
$$G_D = 2.10\% + (1.52\% \times 0.29)$$
$$= 2.54\% .$$

Total demand for fresh apples in New Zealand is projected to increase at an average annual rate of 2.54 percent.

A similar approach can be adopted to project total demand for processed apple products in New Zealand - the only additional data required would be an estimate of the income elasticity of demand for processed apple products. Unfortunately, such estimates could not be obtained from the available data, nor could similar measures, relating to other countries, be found. However, income elasticities of demand for other processed fruit products have been estimated for some overseas countries, and are generally higher than the corresponding income elasticity for fresh fruit. For example, an income elasticity of demand for fruit juices of 1.07 has been estimated from United Kingdom data, in comparison with a coefficient of 0.55 for fresh fruit;[3] and an income elasticity of demand for 'frozen

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1 See Agricultural Commodity Projections: 1970-1980, vol. II, F.A.O., 1971.

2 See New Zealand Official Yearbook, 1972.

3 Household Food Consumption and Expenditure: 1970 and 1971, U.K. Ministry of Agriculture, Fisheries and Food, H.M.S.O., London, 1973.

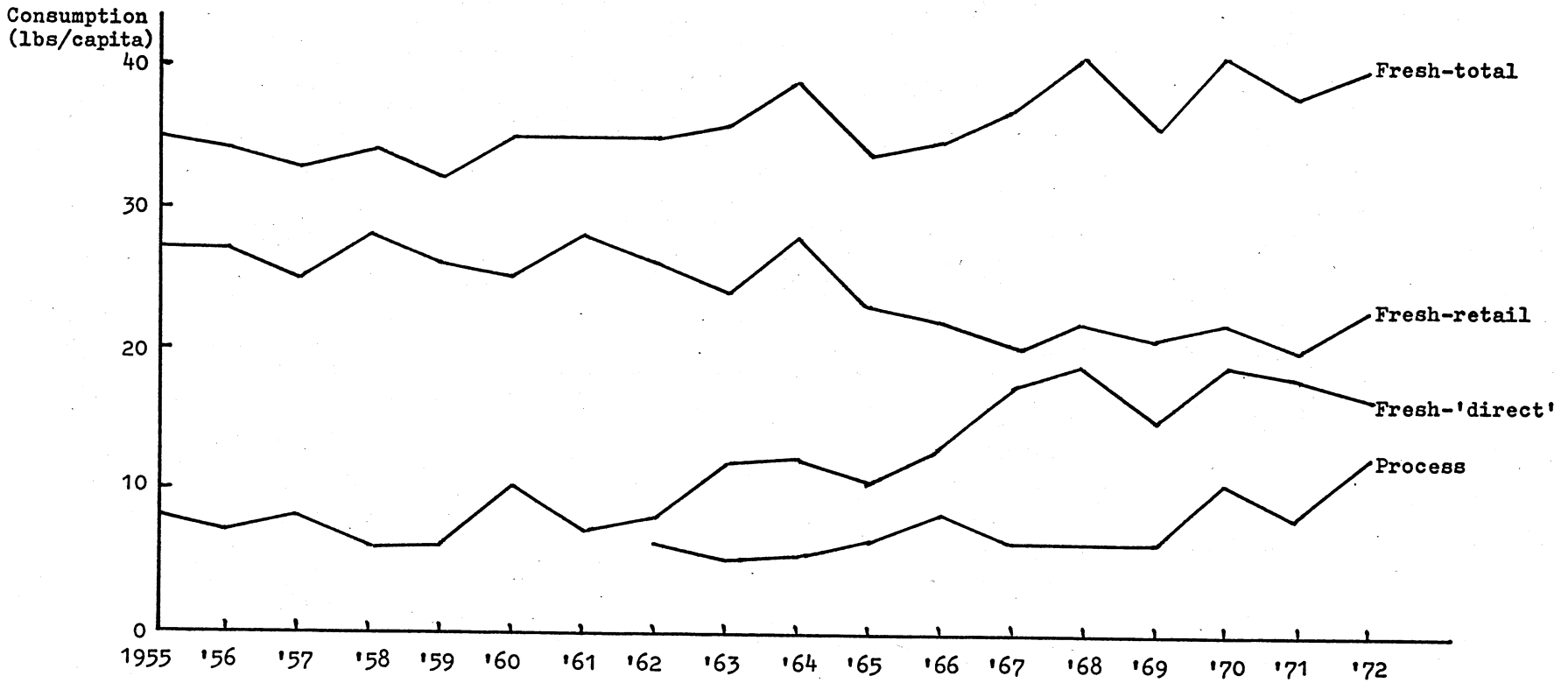


Figure 4.1: Commercial Apple Consumption in New Zealand

fruit' of 0.66 has been estimated in the U.S.A., in comparison with coefficients of 0.14 and 0.26 for fresh apples and oranges, respectively.[4] For the purposes of making a projection of processed apple consumption in New Zealand an E_I value for processed apple products of unity will be assumed. This seems reasonable in the light of the above evidence and the E_I value for fresh apple consumption of 0.29. The processed apple demand projection, then, indicates an initial, and rather crude approach, and the projected demand levels should be used with some caution.

Table 4.1 presents the demand projections. If prices of fresh apples are to remain unchanged, relative to the general level of prices in the economy, then just over 3½ million bushels is likely to be sold in 1980, rising to 4 million bushels by 1985. Likewise, the demand for processed apple products in New Zealand is projected to reach just over 1 million bushels by 1980, and almost 1½ million bushels by 1985.

Table 4.1: New Zealand Demand Projections - Constant Prices

Year	Fresh demand	Process demand b/	Total
	← (million bushels) →		
1972 a/	2.92	0.91	3.83
1973	2.99	0.94	3.93
1974	3.07	0.98	4.05
1975	3.15	1.01	4.16
1976	3.22	1.05	4.27
1977	3.31	1.09	4.40
1978	3.39	1.13	4.52
1979	3.48	1.17	4.65
1980	3.57	1.21	4.78
1981	3.66	1.25	4.91
1982	3.75	1.30	5.05
1983	3.84	1.35	5.19
1984	3.94	1.39	5.33
1985	4.04	1.45	5.49

a/ 1972 figures refer to actual consumption in that year.

b/ Process demand projections are based, in part, on the data "processing - local market" obtained from the A.P.B. Annual Reports. Since information on carry-over of stocks is not published, this has been assumed to be negligible. Also, two-thirds of private process production has been assumed to be sold on the local market.

4 George, P.S. and G.A. King, Consumer Demand for Food Commodities in the U.S. with Projections for 1980, Giannini Foundation Monograph 26, University of California, 1971.

4.2 Projections of export demand

Table 4.2 gives the average per capita consumption levels for several countries, including the New Zealand data for comparison. Consumption levels appear greatest within the major West European production region. Consumption in the United Kingdom, North America, Spain, and to a lesser extent Australia and New Zealand, is much lower than that of West Europe. Consumption levels have actually fallen in the United Kingdom, Switzerland, Sweden, Canada and the U.S.A., but growth in per capita consumption has been rapid in West Germany, France, Italy and the Netherlands. Per capita consumption of fresh apples may be nearing satiation level in Western Europe, and it is difficult to imagine the past growth in consumption continuing into the future at the same rate. It is also difficult to imagine per capita consumption levels increasing rapidly in the future for the United Kingdom and North America - although consumption levels are lower than for Europe, past growth has been either slow, or negative.

Table 4.2: Consumption of Fresh Apples - Selected Countries

Country	1955-1961 average ← (lbs per head)	1962-1968 average →
U.K.	27.0	25.1
Australia	35.6	42.7
Canada	31.4	26.7
U.S.A.	26.1	19.4
West Germany	46.1	70.7
France	27.7	56.1
Italy	50.0	75.4
Netherlands	42.4	61.0
Belgium	46.1	48.8
Switzerland	91.1	78.9
Sweden	76.0	71.9
Spain	16.4	23.3
New Zealand	34.0	36.7

Source: Fruit: A Review of Production and Trade, Commonwealth Secretariat, London (various issues).

Projections of total consumption of apples (both fresh and processed) in Europe have been made by the F.A.O., and are presented in Table 4.3. The annual (compound) growth rate has been estimated as 2.7 percent for France and 2.4 percent for the U.K. Consumption growth rates, with the exception of Turkey, are lower for the remainder of West Europe and are in fact negative for Italy and Scandanavia.

Unfortunately, no reasons are given by the F.A.O. publication for such negative growth rates. The annual rate of growth of consumption is likely to be more rapid in East Europe (3.1 percent) than in West Europe (1.8 percent), and the overall rate of growth for the region as a whole is estimated to be 2.3 percent per annum.

Table 4.3: Projected Growth in European Consumption

Region	Total consumption			Annual growth rate
	1970 (actual)	1980 (projected)	Increase	
	←('000 tons)→			
Belgium/Lux.	299	350	51	1.7%
France	1,273	1,650	377	2.7
W. Germany	2,410	2,900	490	2.0
Italy	1,747	1,650	-97	-0.6
Netherlands	438	500	62	1.4
U.K.	795	1,000	205	2.4
Scandanavia	455	400	-55	-1.4
Turkey	748	1,200	452	4.8
Other	1,498	1,850	352	2.2
WEST EUROPE	9,663	11,500	1,837	1.8
Hungary	402	500	98	2.3
Rumania	171	400	229	8.8
U.S.S.R.	2,501	3,150	649	2.4
Other	1,546	2,200	654	3.6
EAST EUROPE	4,620	6,250	1,630	3.1
REGIONAL TOTAL	14,283	17,750	3,467	2.3

Source: Monthly Bulletin of Agricultural Economics and Statistics 22 (2), F.A.O., 1973.

Because of a higher level of aggregate consumption in West than in Eastern Europe, the former region shows a greater increase in aggregate consumption, despite a lower annual growth rate. Total consumption in the region as a whole is projected to increase by 3,467,000 tons from 1970 to 1980, with just over half this increase projected for West Europe. For individual countries, the increase in aggregate consumption is projected to be greatest in the U.S.S.R., West Germany, Turkey, France, Rumania and the U.K.

Table 4.4 includes data[5] from which can be estimated the annual rates of growth of demand for apples in selected non-European countries, although the U.K. is included here to allow comparison with the F.A.O. projection of Table 4.2. The first column of figures contains F.A.O. estimates of the annual percentage increase in per capita private consumption expenditure, for the 1970-80 period. The second column contains the income elasticities and the third, the annual growth rate of population estimates. The fourth column presents the estimates of the rate of growth per annum, computed as before.

Table 4.4: Growth in Income, Population and Demand for Apples - 1970 to 1980

Country	Per capita private consumption expenditure, annual growth rate	Income elasticity	Population, annual growth rate	Demand, annual growth rate
Canada	3.5%	0.20	1.5%	2.2%
U.S.A.	3.1	0.14[a]	1.1	1.5
U.K.	2.7	0.52[b]	0.6	2.0
Israel	5.3	0.60	2.2	5.4
Mexico	3.5	0.70	3.5	6.0
Japan	8.9	0.58	1.1	6.3
Hong Kong	8.8	0.79	2.2	9.2
Indonesia	1.4	0.80	2.7	3.8
Malaysia	2.7	0.95	2.9	5.5
Singapore	5.7	0.80	1.6	6.2
U.S.S.R.	4.9	0.70	1.0	4.4

a/ This elasticity refers to fresh apples (not 'other fruit') and was taken from George and King, op. cit.

b/ This elasticity refers to fresh apples, and was taken from Household Food Consumption and Expenditure: 1970 and 1971, op. cit.

Here, a growth rate of 2.0 percent per annum has been projected for the U.K., which is somewhat similar to the F.A.O. estimate in Table 4.3 of 2.4 percent. Demand is projected to increase only slowly in North America - by 2.2 percent per annum in Canada and only 1.5 percent per annum in the U.S.A. More rapid growth

5 From Agricultural Commodity Projections, F.A.O., op. cit. Unless otherwise stated, the income elasticities of demand refer to the 'other fruit' category: i.e. all fresh fruit other than citrus and bananas. They can, however, be expected to represent a useful 'first approximation' to the income elasticity of demand for fresh apples.

rates of between 4 and 9 percent per annum have been projected for the remaining countries of Table 4.4. These are due primarily to high rates of growth of per capita private consumption expenditure (PCE) in Japan, Hong Kong, Singapore, Israel and the U.S.S.R., and more moderate growth rates of PCE but high population growth rates in Mexico, Malaysia and Indonesia. Of these high growth-rate countries, New Zealand already has a share of the market in both Hong Kong and Singapore, although quarantine regulations have so far prevented New Zealand's entry to the Japanese market.

Although countries such as Hong Kong and Singapore show high percentage growth rates of demand they are expected, because of their relatively small populations, to exhibit only moderate expansion in aggregate demand. Conversely, countries such as the U.S.S.R., Japan, Indonesia and Mexico, by reason of their large populations, can be expected to show a large increase in aggregate demand for apples by 1980.

5. The Supply/Demand Situation

5.1 Projected supply and demand on the domestic market

The projected supply of fruit not suitable for export in the fresh form (see Appendix B), is compared in Table 5.1 with the projected demand for both process and fresh apples on the New Zealand market. The situation is also depicted graphically in Figures 5.1 and 5.2. If prices paid by consumers for both fresh and processed products are not to change relative to the general level of prices in the economy, then the excess must be either destroyed, or processed and sold overseas. (Alternatively, the excess supply could be prevented from occurring through production control). The destruction of fruit to maintain the existing level of prices is not likely to be acceptable to Government or consumer groups, so the likelihood of excess supplies of fruit being exported as processed products must be examined. The matter of production control will be discussed later.

Table 5.1: Supply/Demand Projection - Domestic Market

Year	Supply non-export apples		Total demand, process and fresh	Supply excess to local market requirements at constant prices	
	"high" projection	"low" projection		"high" projection	"low" projection
	← (million bushels) →				
1973	4.08	4.00	3.93	0.15	0.07
1974	4.69	4.57	4.05	0.64	0.52
1975	4.59	4.44	4.16	0.43	0.28
1976	5.43	5.19	4.27	1.16	0.92
1977	5.48	5.15	4.40	1.08	0.75
1978	6.49	6.01	4.52	1.97	1.49
1979	6.43	5.89	4.65	1.78	1.24
1980	7.55	6.81	4.78	2.77	2.03
1981	7.44	6.64	4.91	2.53	1.73
1982	8.64	7.62	5.05	3.59	2.57
1983	8.48	7.40	5.19	3.29	2.21
1984	9.76	8.42	5.33	4.43	3.09
1985	9.49	8.13	5.49	4.00	2.64

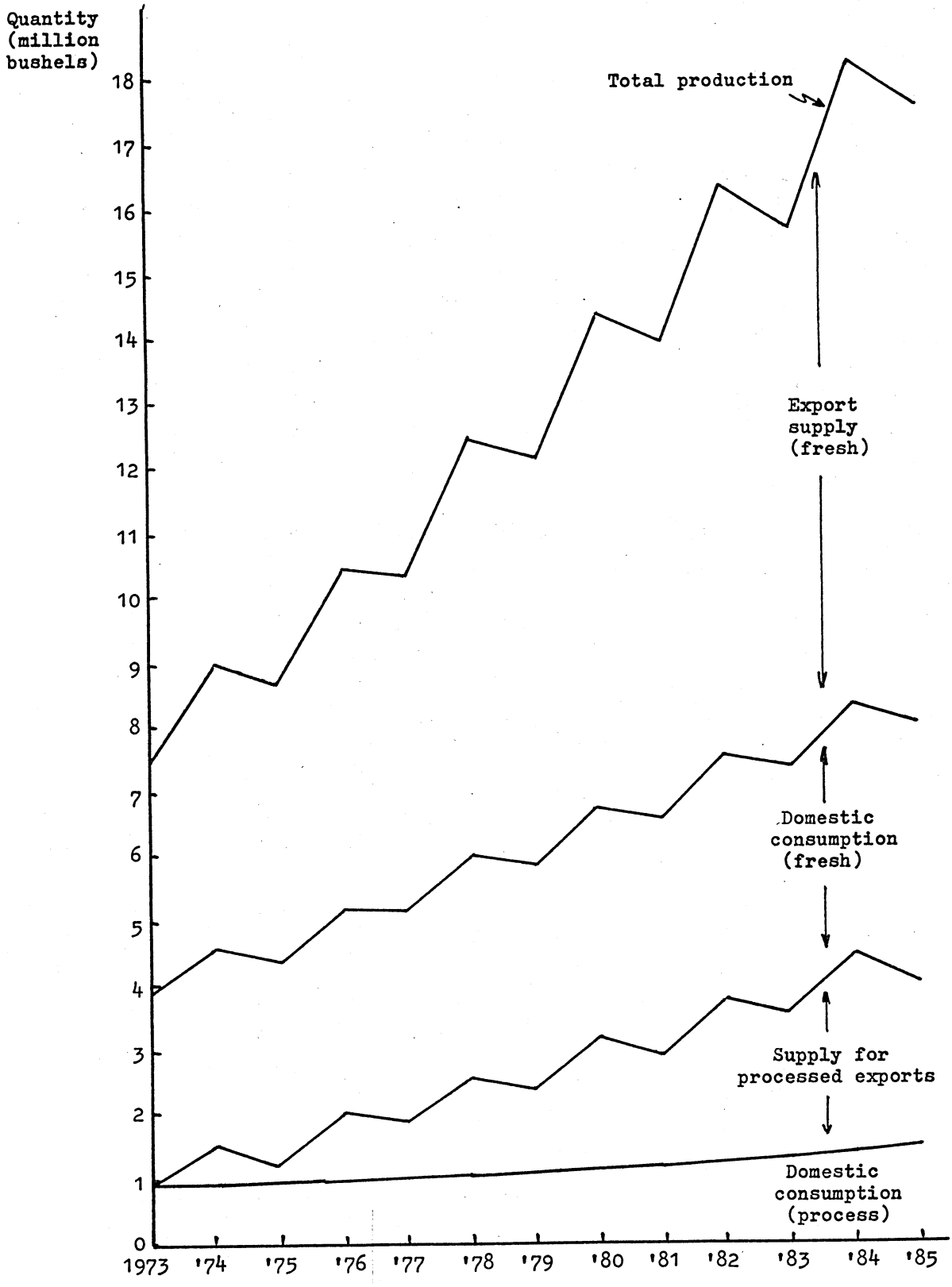
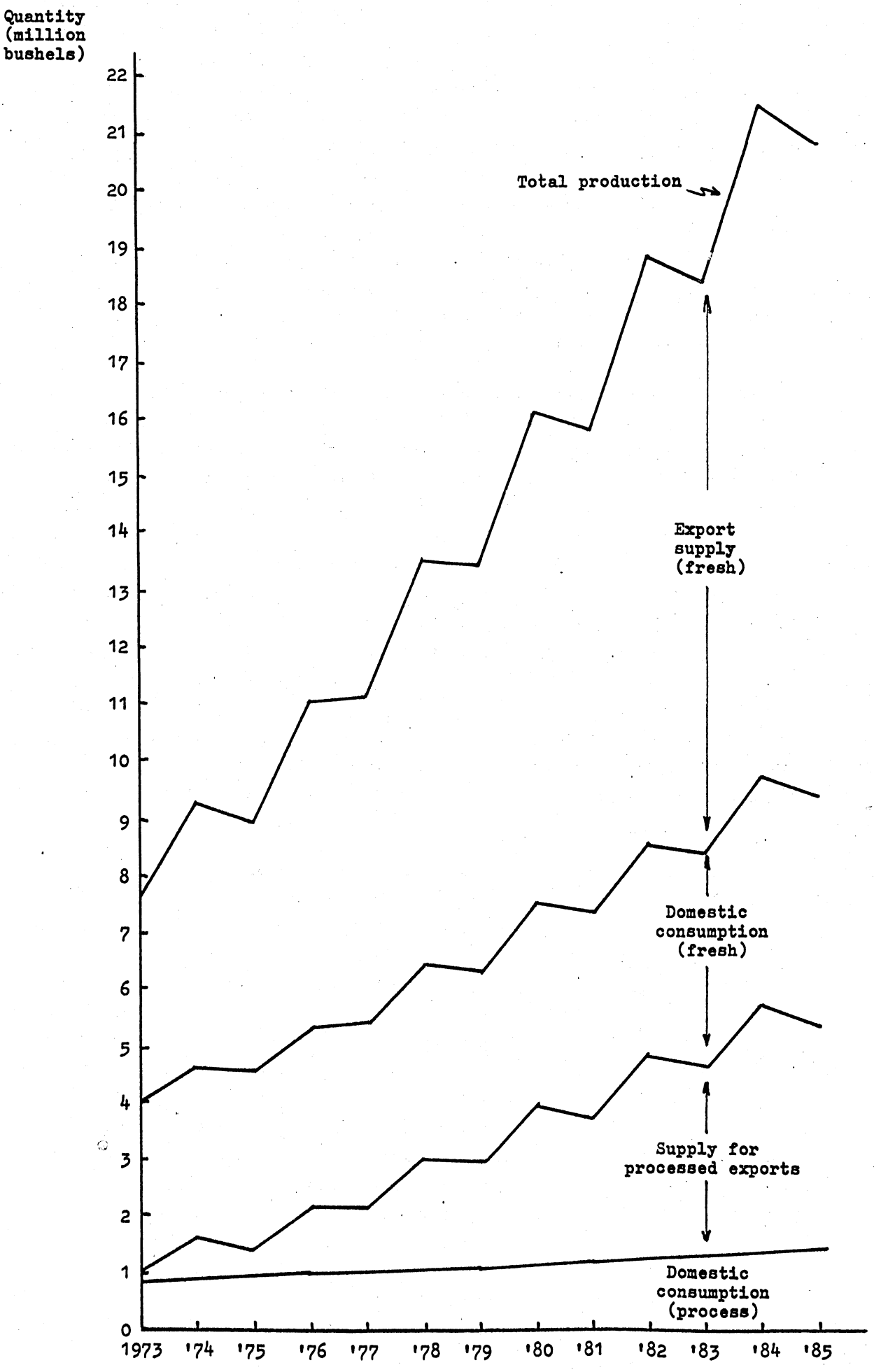


Figure 5.1: Projected Supply-Demand Situation - "Low" Projection


Quantity (million bushels)
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Total production
Export supply (fresh)
Domestic consumption (fresh)
Supply for processed exports
Domestic consumption (process)
1973
'74
'75
'76
'77
'78
'79
'80
'81
'82
'83
'84
'85

The quantity of processed apple products exported by the A.P.B. in 1972 totalled 0.16 million bushels fresh equivalent, with an estimated 0.09 bushels exported by private processors, giving a total export quantity of 0.25 million bushels fresh equivalent. The record export quantity was achieved in 1970, of 0.46 million bushels. It is doubtful that New Zealand will be able to expand her exports of processed apples at the rate required to completely absorb the projected excess supply. To do so, exports would have to rise from 0.25 million bushels in 1972, to between 2.0 and 2.8 million by 1980, and to between 2.6 and 4.0 million bushels fresh equivalent by 1985. Furthermore, the large quantities processed in North America gives these countries the opportunity to realise economies of size in their processing operations, and hence conduct these operations at lower average cost than can be achieved in New Zealand. Thus New Zealand may experience difficulty competing with lower-cost suppliers on overseas markets.

Since processed exports are not likely to completely absorb the excess supply of non-export-quality fruit, Table 5.2 illustrates the supply situation that could quite likely develop on the local market. Table 5.2 (a) contains projections conditional on the 'low' supply projection, and Table 5.2 (b), those for the 'high' supply projection. The first column of data gives the projected supply of non-export-quality fruit, as in Table 5.1. The second column of data gives estimates of the total quantity of fruit that is likely to be processed in each year (see Appendix B). This projection is taken from Table 3.2. The third column gives the local market 'demand for fresh fruit' projection, from Table 4.1 of the previous section. The supply of fresh non-export-quality fruit in excess of local (fresh) market and process requirements is estimated in the fourth column, and for any year is equal to column [1] less the sum of columns [2] and [3]. The projected level of local demand for processed apple products, again taken from Table 4.1, is given in the fifth column, and by deduction from the total process supplies of column [2], the supply of processed goods in excess of local market requirements at constant prices are given in column [6].

An evaluation of the price situation likely to develop in the domestic market can now be made. That the export of processed products (see column [6] of the tables) must reach around 0.7 million bushels by 1977, or 52 percent greater than the level achieved in 1970, does not seem an unrealistic target. However, it is more doubtful that processed exports could reach the required level of about 1.5 million bushels in the early 1980's to completely dispose of the likely supply of processed apples. Thus it would appear that from the late 1970's - early 1980's, problems can be expected in selling overseas, at prices acceptable to New Zealand manufacturers, the quantity of processed apple products that are likely to be available. As a result, increased quantities could be offered for sale on the domestic market, but since such action would increase total supplies beyond those required to satisfy projected demand at constant prices, then prices paid by consumers would need to be lowered in order to clear the market.

An excess supply situation also appears likely to develop for fresh fruit on the local market at about the same time as process products. Such excess supplies (see column [4] of the tables) could be sold as fresh fruit, and hence result in a fall in price on the local market, or they could be processed. However, it has been suggested that process supplies are likely to be in excess supply, and manufacturers may not be willing to increase production in a situation of falling prices. The extent of the problem is better illustrated in Table 5.3, where the data of column [4] in Tables 5.2 (a) and (b) have been converted to a per capita basis. If none of the excess (fresh) supply is processed, per capita consumption levels in New Zealand will need to increase by 2-3 lbs by 1977, by around 10 lbs by 1980, and perhaps by 15 lbs by 1985. If consumers are to be persuaded to increase their consumption of fresh fruit over and above the level to be expected at present prices, then adequate and successful promotion must take place. Unless this happens, prices must fall relative to present prices. It would appear that the possible fall in prices by the late 1970's could be quite significant. Remember too, that the excess supply of either fresh or processed fruit (or both) on the New Zealand market will be even greater than the levels indicated above in the quite likely event that not all the export supply of processed products (see column [6] of Table 5.2) will, in fact, be exported.

Hence, if production of apples in New Zealand expands under no form of control, local market prices for fresh and processed products are likely to fall, with price reductions becoming greater over time, especially during and after the late 1970's. A number of factors makes the estimation of the size of any reduction in prices rather difficult. First, as prices of fresh fruit change relative to those of processed fruit, there is likely to be some substitution by consumers of the relatively-cheaper form for the other in their consumption. To estimate the response of price to the marketed supply then, knowledge is required of the cross-elasticity of demand[1] between fresh and processed apples on the New Zealand market. Unfortunately, data that would allow its estimation could not be obtained. Second, it is necessary to know the price-elasticity of demand[2] for both processed and fresh apples to estimate how quantities demanded will respond to price changes. Again, it was not possible to obtain an estimate of this elasticity for processed apple products. From wholesale and retail sales data, however, an estimate was obtained of the sensitivity of wholesale and retail prices to the quantity of fresh fruit marketed through this channel by the A.P.B. A third problem, though, is the (significant) portion of local fresh purchases that are made direct from orchards -

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1 The cross-elasticity of demand between any pair of products measures the percentage change in quantity demanded of one product that would result from a 1 percent change in the price of the other product.

2 The price-elasticity of demand for a product measures the percentage change in the quantity demanded in response to a 1 percent change in the product's price.

Table 5.2 (a): "Low" Projections of Supplies in Excess of Local Market Requirements at Constant Prices

Year	Supply non-export apples [1]	Supply for processing [2]	Demand, fresh [3]	Excess supply fresh fruit [4]	Demand, process [5]	Export supply process fruit [6]
	← (million bushels) →					
1973	4.00	1.12	2.99	-0.11	0.94	0.18 - 0.11 = 0.07
1974	4.57	1.41	3.07	0.09	0.98	0.43
1975	4.44	1.34	3.15	-0.05	1.01	0.33 - 0.05 = 0.28
1976	5.19	1.72	3.22	0.25	1.05	0.67
1977	5.15	1.70	3.31	0.14	1.09	0.61
1978	6.01	2.14	3.39	0.48	1.13	1.01
1979	5.89	2.08	3.48	0.33	1.17	0.91
1980	6.81	2.54	3.57	0.70	1.21	1.33
1981	6.64	2.46	3.66	0.52	1.25	1.21
1982	7.62	2.95	3.75	0.92	1.30	1.65
1983	7.40	2.84	3.84	0.72	1.35	1.49
1984	8.42	3.36	3.94	1.12	1.39	1.97
1985	8.13	3.21	4.04	0.88	1.45	1.76

Table 5.2 (b): "High" Projections of Supplies in Excess of Local Market Requirements at Constant Prices

Year	Supply non-export apples [1]	Supply for processing [2]	Demand, fresh [3]	Excess supply fresh fruit [4]	Demand, process [5]	Export supply process fruit [6]
	← (million bushels) →					
1973	4.08	1.15	2.99	-0.06	0.94	0.21 - 0.06 = 0.15
1974	4.69	1.47	3.07	0.15	0.98	0.49
1975	4.59	1.42	3.15	0.02	1.01	0.41
1976	5.43	1.84	3.22	0.37	1.05	0.79
1977	5.48	1.87	3.31	0.30	1.09	0.78
1978	6.49	2.38	3.39	0.72	1.13	1.25
1979	6.43	2.35	3.48	0.60	1.17	1.18
1980	7.55	2.92	3.57	1.06	1.21	1.71
1981	7.44	2.87	3.66	0.91	1.25	1.62
1982	8.64	3.48	3.75	1.41	1.30	2.18
1983	8.48	3.39	3.84	1.25	1.35	2.04
1984	9.76	4.04	3.94	1.78	1.39	2.65
1985	9.49	3.91	4.04	1.54	1.45	2.46

Table 5.3: Projected Per Capita Supply of Fresh Fruit

Year	Demand projection ←	Excess supplies "low" supply projection (lbs per capita)	Excess supplies "high" supply projection →
1973	39.7	-	-
1974	40.1	1.2	2.0
1975	40.4	-	0.3
1976	40.6	3.2	4.7
1977	40.9	1.7	3.7
1978	41.1	5.8	8.7
1979	41.5	3.9	7.1
1980	41.7	8.2	12.4
1981	42.0	6.0	10.4
1982	42.2	10.4	15.9
1983	42.4	8.0	13.8
1984	42.7	12.1	19.3
1985	43.0	9.4	16.4

no reliable data is available on average prices charged.[3] The information obtained from the wholesale-retail sales data will be discussed, mainly to indicate the research that could be implemented if more complete data relating to purchases and prices paid, could be obtained.

A series of annual average retail prices of apples is published by the Department of Statistics. These prices were converted to a wholesale basis through application of the appropriate formula[4] and an assumed average wholesale-to-retail mark-up of 50 percent. Quantities sold through retail outlets, via wholesalers, were obtained from A.P.B. data on the local marketing of apples, from various copies

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3 An attempt was made to collect a time series of representative prices for 'direct' sales from various newspapers. However, the wide range of both qualities, varieties and prices mentioned made compilation of a reliable price series practically impossible.

4 The formula is

$$P_r = \frac{P_w + 10¢ + (40\% \text{ of } P_w)}{38}$$

where P_r = retail price, \$/lb

P_w = wholesale price, \$/bushel, and the margin of 40% is that generally agreed to by the A.P.B. and the retailers, although a margin of 50 percent was believed to be nearer that actually charged by retailers.

of their Annual Reports. A relationship between the average wholesale price (deflated to remove the effects of inflation)[5] and total sales per head of population was estimated (see Appendix C), the hypothesis being that the higher the quantity offered for sale, other things being equal, the lower would be the wholesale price. The estimated equation explained 70 percent of the year-to-year variation in wholesale prices over the period 1955-72. Figure 5.3 suggests the substantiation of this hypothesis. Also, the demand curve[6] appeared to have moved to the left over time - a possible reason might have been the significant trend away from retail purchasing, to purchasing direct from growers. Thus we see from Figure 5.3 that in 1955, retail sales amounted to 27.0 lbs per capita, sold at an average (deflated) wholesale price of 7.8¢ per lb. Over the 1969-72 period however, both real price and per capita consumption averaged a lower level than in 1955 - average (deflated) wholesale price was 7.2¢ per lb, and average consumption was 21.5 lbs per capita.

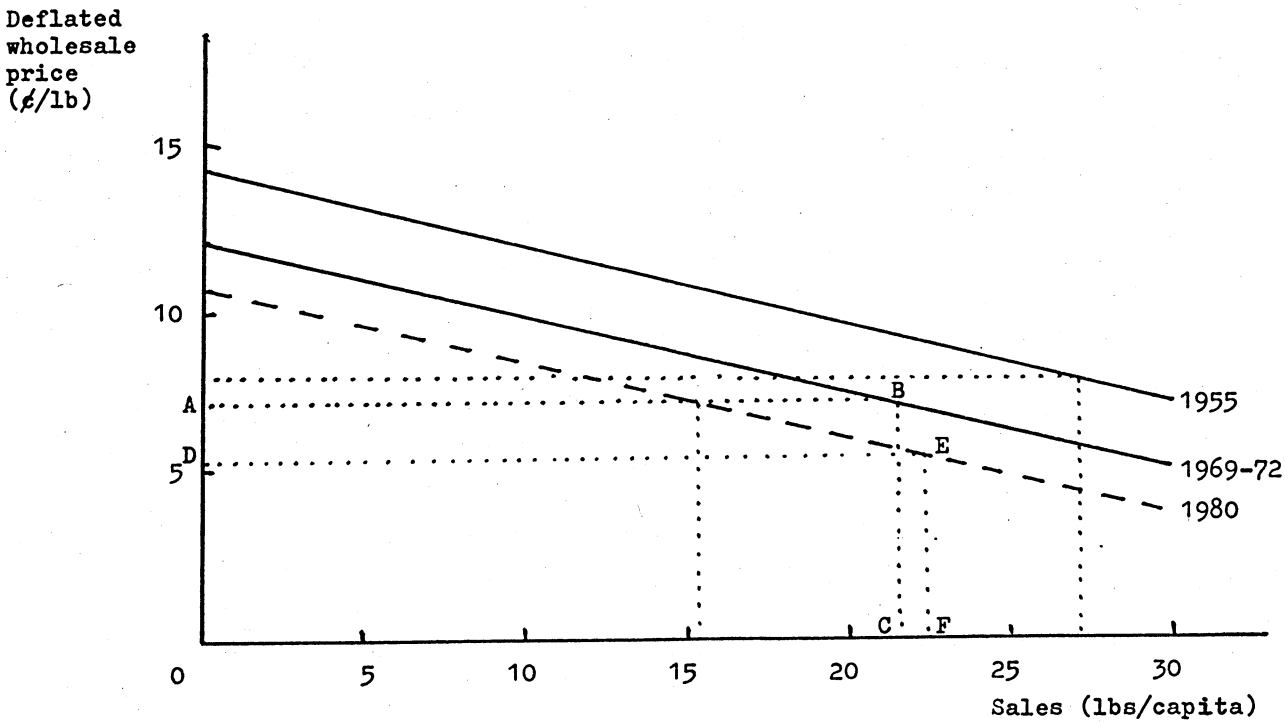

Figure 5.3: Wholesale Price-Sales Relationship

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5 Both retail and wholesale prices were deflated by the 'consumer price index', which has a value of 1000 in the base year, 1965. Thus the actual retail prices in 1965 and 1972, for example, were 12.21¢ per lb and 16.51¢ per lb, respectively. Part of this increase of about 4¢ per lb will be due to a rising level of prices in general - hence the 1972 price, when divided by the consumer price index value for that year, is only 11.01¢ per lb. The retail price of apples in 1972, therefore, was in fact lower, when measured in terms of real purchasing power, than the price of 1965.

6 The relationship between prices charged and quantities sold, when graphed, is known as a demand curve.

If the influences that caused the demand curve to shift to the left over the 1955-72 period, such as changes in purchasing habits, continue to show similar trends over the next several years, then the dashed line in Figure 5.3 is the estimated demand curve for 1980. It shows that if wholesale prices are to be kept at the same level, in real terms, as in 1969-72, then sales through retail outlets cannot be greater than 15.2 lbs per capita. Multiplying by the expected population in 1980 gives a total sales figure of 1.30 million bushels. Total demand (for both retail and 'direct' purchases) was projected to reach 3.57 million bushels by 1980. Thus 2.27 million bushels would be sold direct to consumers which amounts to 64 percent of the total demand - the comparable proportion sold 'direct' over the 1969-72 period was 44 percent.

An advantage of knowing the relationship between prices and sales is that the level of sales that maximises total (or net) revenue can be calculated. If sales were around 22 lbs per capita in 1980, rather than 15.2 lbs, the estimated demand curve suggests that the wholesale price (in real terms) would need to be 5.5¢ per lb if this quantity was to be sold, and total revenue received by the A.P.B. from its local market operations would be maximised. However, even if the A.P.B. attempts such revenue-maximisation, it's total revenue would still be less than that earned over the 1969-72 period. This is shown by the comparative areas of the two rectangles, OABC and ODEF, in Figure 5.3. The excess supply of fresh non-export-quality fruit likely to exist at that time could well aggravate this situation further.

The above analysis is primarily intended to present an illustration of the sort of market research that can be attempted given adequate data. Although the wholesale price data could be improved by using information collected by the A.P.B. rather than the Department of Statistics, the biggest problem is the lack of knowledge about the 'direct' price - 'direct' sales relationship. This knowledge is really necessary even to make projections of prices and sales at the wholesale level - for example, a lowering of the wholesale (and hence retail) price as a deliberate policy of the A.P.B. to increase consumption and total revenue, could presumably result in some consumers buying from retail outlets when they may have originally intended to buy direct from growers. In other words, there probably exists an inter-relationship between both markets (retail and 'direct') for fresh apples. If so, it is impossible to make pricing decisions that would maximise revenue earned in one market without taking into account the aspects of such pricing decisions on sales and prices in the other market.

5.2 Projected supply and demand on export markets

To introduce this section, Table 5.4 outlines the quantities of apples that will likely be available for export, if no controls or limitations are placed on the future expansion of the New Zealand apple industry. The process supply projections are taken from Table 5.2, while the projected supplies of fresh apples for export are obtained by subtracting the projected supply of non-export apples (Table 5.1) from the total supply projections made in Section 3, and illustrated in Figures 5.1 and 5.2.

Table 5.4: Projected Export Supplies

Year	Supplies of process fruit "low"	Supplies of process fruit "high"	Supplies of fresh fruit "low"	Supplies of fresh fruit "high"
	← (million bushels) →			
1972[a/]	0.16		3.96	
1973	0.07	0.15	3.61	3.71
1974	0.43	0.49	4.42	4.59
1975	0.28	0.41	4.24	4.45
1976	0.67	0.79	5.29	5.65
1977	0.61	0.78	5.25	5.71
1978	1.01	1.25	6.46	7.14
1979	0.91	1.18	6.29	7.07
1980	1.33	1.71	7.60	8.65
1981	1.21	1.62	7.36	8.50
1982	1.65	2.18	8.74	10.21
1983	1.49	2.04	8.44	9.97
1984	1.97	2.65	9.90	11.79
1985	1.76	2.46	9.47	11.41

a/ Actual values for the 1972 export season.

It would appear that by 1980, over one million bushels of processed fruit (fresh equivalent) and around eight million bushels of fresh fruit will be available for export. By 1985, these figures should have increased to about two million and 10 million bushels, respectively.[7] In comparison, actual exports of processed

7 These projections are made on the assumption that trends in the proportion of the crop processed, the proportion not suitable for export, and therefore the proportion that is suitable for export, continue to behave in the future as in the recent past. Hence, the "high" projections, for example, indicate that 53 percent of the total crop will be exported in 1980 and 55 percent, in 1985; the proportion of the crop actually exported in 1972 was 49 percent. However, with the recent emphasis on planting varieties suited to export markets and with a high export grade-out, the export supply projections could be somewhat too low, and therefore the process projections, too high.

apples in 1972 amounted to 0.16 million bushels, and of fresh apples, 3.96 million bushels. Thus the task of selling such quantities in overseas markets could be a considerable one.

In order to make comparisons between projected rates of growth of demand and supply in various export markets, it is necessary to make some inferences about the future levels of production and exports from countries which are current or potential competitors with New Zealand on these markets, and in particular, on the U.K. market. Australia and South Africa will continue to compete with New Zealand on the U.K. market, but with the lifting of quota restrictions by the U.K. on imports from E.E.C. and all third-country suppliers, European and Argentinian producers could well be major competitors also.

The downward trends in production in West Germany, France and Italy over the recent past would suggest that climatic conditions are only part of the reason. The low prices earned in 1969 and 1970, plus financial assistance for the removal of old orchards, could well have brought about a rationalisation of production in these countries. The F.A.O. suggests, however, that European production potential is still larger than present consumption possibilities at reasonable prices to producers. Their projections indicate further reduction in the rate of growth of output in E.E.C., due to the falling profitability of apple production in this region and the policy measures that have been implemented in some countries to adjust supplies to marketing possibilities at reasonable producer prices. Table 5.5 presents the F.A.O. supply projections for Europe, to 1980. It also presents the net trade situation, computed as the difference between the production projections, and the demand projections given earlier in Table 4.3.

The F.A.O. projections indicate that output in the whole of Europe could increase from 13.9 to 17.2 million tons by 1980. Output is expected to rise faster in eastern than in western Europe where growth should be moderate, reflecting the impact of policy measures already introduced, plus the recent downward trend in profitability. If Turkey (which up to the present time has produced exclusively for her domestic market) would be excluded, the increase in western Europe could be even more limited.

The trade balance of the region at present shows a net import requirement from outside Europe of 425,000 tons. The E.E.C. showed a slight export surplus but the rest of western Europe is a net importer. Also, the enlarged E.E.C. will also be a net importer by virtue of the U.K.'s requirements. Given the attempts made at production adjustment, the projections indicate the trade deficit in western Europe could show some increase by the end of the decade. Eastern Europe is at present a net importer only because of the large import requirements of the U.S.S.R. This zone is likely to become a net exporter to an increasing extent during the present decade, due primarily to production expansion in Hungary. It is likely that part of this increase could be used to cover western European requirements.

Table 5.5: Production and Net Trade in Europe, 1970-80

Region	1970 (actual)[a]		1975 (projected)		1980 (projected)	
	Production	Net trade[c]	Production	Net trade	Production	Net trade
	('000 tons)					
Belgium/Lux.	261	+38	300	-	350	-
France	1,710	-437	2,000	-500	2,000	-350
W. Germany	1,777	+633	2,300	+500	2,200	+700
Italy	2,062	-315	1,800	-200	1,750	-100
Netherlands	450	-12	450	-	500	-
U.K.	547	+248	450	+400	400	+600
Scandanavia	338	+117	300	+150	250	+150
Turkey	748	-	1,000	-	1,200	-
Other	1,384	+114	1,550	+150	1,650	+200
WEST EUROPE	9,277	+386	10,150	+500	10,300	+1,200
Hungary	661	-259	900	-400	1,150	-650
Rumania	176	-5	400	-	500	-100
U.S.S.R.[b]	2,250	+251	2,500	+350	2,750	+400
Other	1,494	+52	2,200	-50	2,500	-300
EAST EUROPE	4,581	+39	6,000	-100	6,900	-650
REGIONAL TOTAL	13,858	+425	16,150	+400	17,200	+550

a/ These production levels may differ somewhat from those given earlier due to discrepancies between different sources of data on actual production levels.

b/ An estimate from Fruit: A Review of Production and Trade, 1972, based on past trends in production. (Official statistics for U.S.S.R. production are not available).

c/ Minus sign indicates surplus of production over consumption (net exports), and positive sign indicates surplus of consumption over production (net imports).

Source: Monthly Bulletin of Agricultural Economics and Statistics 22 (2), F.A.O., 1973.

The trade deficit for the whole of Europe could widen from 425,000 to 550,000 tons by the end of the present decade. As a result, increased levels of marketings of non-European supplies could be possible. However, whether such increased sales can be realised will depend to a large extent on the patterns of trade that evolve in Europe, and market accessability. The enlargement of the E.E.C. is likely to be particularly beneficial to French and Italian exporters. If these countries supply greater quantities than previously to the U.K., suppliers such

as South Africa, Australia and New Zealand could see their outlets reduced. The major threat to these latter countries is the development of controlled-atmosphere storage of fruit in France and Italy, allowing good quality fruit to be supplied ex-store, in competition with southern hemisphere fruit on the U.K. market. Further, an increased level of supply in the U.K. during her production season could, through higher levels of consumption and lower prices, have a 'carry over' effect on deman and price during the U.K. 'off-season' when southern hemisphere fruit is marketed. If such changes in European trade patterns were to reduce New Zealand's share of the U.K. market, Table 5.5 suggests, however, that New Zealand could still be able to supply increasing quantities elsewhere in Europe.

In addition to the broad situation described above, will be the effects in the markets of Europe of perhaps greatly increasing levels of supplies from the southern hemisphere within only a five or six month period. Although the broad picture seems promising, it could still contain a period of over-supply and low prices. To demonstrate this possibility, data relating to southern hemisphere production and exports to the U.K. are presented in Table 5.6. The first column of data gives the actual production of apples in various countries in 1970, whilst the next two columns contain production projections for 1976 and 1980. South African[8] and Argentinian[9] output has been projected to increase at annual (compound) growth rates of 3.5 and 1.0 percent respectively. It has been estimated[10] that Australian production will increase 13 percent between 1970 and 1976, or by an annual compound rate of 2.0 percent. Projections of New Zealand production are taken from Table 3.1. If these countries export the same proportion of their total crop to the U.K. in 1976 as they did in 1970, then their total supply to that market during March-August would have increased between these years at the rate of 5 percent per annum. A cautious projection to 1980 gives a similar rate of growth.

In 1970, southern hemisphere suppliers accounted for 87 percent of total U.K. supplies between March and August of 191,000 tons - the only other major supplying region was Europe, with 16,000 tons. It can therefore be estimated, on the initial assumption that European supplies to the U.K. show no increase (pro rata) on 1970 levels, that total U.K. supplies over New Zealand's marketing period are likely to increase by around 4.5 percent per annum. This growth rate could be exceeded if E.E.C. producing-countries, such as France and Italy, take advantage of the new trading regulations within the E.E.C. Such a growth rate is in excess of the estimated growth rate of demand of 2.0-2.4 percent. As a result, present supply expansion in the southern hemisphere suggests a future reduction in prices received by these countries unless they can reduce their dependence on the U.K. market.

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8 Walker, W.F., A Report on the Apple and Pear Industry of the Republic of South Africa, Dept. of Agriculture, Tasmania, 1968.

9 Roberts, I.M. and A.G. Cuthbertson, "The Market for Australian Apples in the United Kingdom", Qtly. Rev. of Agric. Econ. 25 (2): 131-146, 1972.

10 The Australian Apple and Pear Growing Industry, B.A.E., Canberra, 1973.

Table 5.6: Projected Southern Hemisphere Supplies to U.K.

Country	Total production			Exports to U.K.		
	1970 (actual)	1976	1980	1970 (actual)	1976	1980
	('000 tons)					
South Africa	205	250	281	65	80	90
Australia	418	472	511	69	80	87
New Zealand	128	205	268	32	51	67
Argentina	424	450	468	-	10?	20?
Total exports				166	221	264
Annual growth rate					5%	5%

Sources: Fruit: A Review of Production and Trade, 1972, for 1970 production and export data.
The Australian Apple and Pear Growing Industry, B.A.E., Canberra, 1973.
Quarterly Review of Agricultural Economics 25 (2), B.A.E., 1972.

The impact of supply growth, and hence its control, on both prices and revenues received by exporters can be gauged from the price elasticity of demand coefficient. The U.K. retail price elasticity has been estimated[11] as -0.68 for the March-July period over the years 1960-1966. Exporters, though, will more likely be interested in wholesale, rather than retail, prices. Hocking (op. cit.) found that the margin between wholesale and retail prices in the U.K. tended to be a constant sum, rather than a percentage of either wholesale or retail price. This suggests that the wholesale price elasticity of demand is less than 0.68 (ignoring the negative sign).

The inverse of the price elasticity is known as the coefficient of price flexibility. It measures the percentage change in price, other things being equal, that would result from a 1 percent increase in the quantity supplied. Hence the wholesale price flexibility is likely to be greater than 1/0.68, or 1.47, and a 1 percent increase in supplies is likely to depress prices by at least 1.47 percent. Since the price reduction exceeds the increase in supplies, then total revenue earned by suppliers would be less than if supply had not changed.

The supply and demand growth rate projections, plus the estimated price flexibility, suggest that southern hemisphere suppliers of apples to the U.K. will receive a smaller total revenue than they would if the rate of supply expansion could

11 Hocking, A., The United Kingdom Demand for Southern Hemisphere Apples, University of Tasmania, Hobart, 1969.

be reduced. In this situation, it would be interesting to know the extent to which a contraction of New Zealand supplies can be expected to raise prices. In 1970, this country's share of total U.K. imports over the March-August period was 16 percent. The flexibility of wholesale price in response to changes in New Zealand supplies will therefore be 16 percent of (at least) 1.47, or at least 0.24. This means that if New Zealand alone was to reduce supplies to the U.K. by say 1 percent, the price received by all suppliers would increase by a minimum of 0.24 percent. Total revenue earned by New Zealand from her U.K. sales would be less than with no supply control (since the price increase is likely to be less, in percentage terms, than the reduction in supplies), but other suppliers who did not reduce supplies would receive higher total revenues as a result of New Zealand's action.

However, a co-ordinated approach to supply reduction could be of mutual benefit to all suppliers. Australia and South Africa, who between them supplied about 70 percent of total U.K. imports during March-August in 1970, could by working together increase wholesale prices by at least 1.03 percent from a 1 percent reduction in supplies. Since the price increase exceeds the quantity reduction, total revenue earned by these countries, as well as New Zealand, would increase. Clearly, co-operation by all three countries in reducing supplies to the U.K. market would also be beneficial to all.

It might appear that South Africa through her freight cost advantage, could benefit from an attempt to capture the U.K. market by unloading very heavy supplies and thus depressing prices below Australian and New Zealand costs of production. Although this could (theoretically) happen, Hocking (op. cit.) demonstrates that such action would not even be in the best interests of South Africa. In fact, he shows how market and cost data can be used to determine how these three countries could co-operate to derive an optimal marketing policy that would, by reducing total supplies, raise total revenue earned by all.

When interpreting the comments made above, the reader should remember the implications of the new E.E.C. trading regulations. If France and Italy increase their share of the U.K. market between March and August, then the total quantity supplied will be greater than suggested in Table 5.6, and hence price reductions will also be more serious. Since the share of the market held by southern hemisphere suppliers would therefore be less, the revenue-raising implications of a co-ordinated supply control scheme would be less than suggested. Also, the new tariff regulations are likely to have a greater impact on South African revenues, than on those earned in the E.E.C. by Australia and New Zealand.

Whether or not French and Italian suppliers do increase their share of the U.K. market, and the size of such an increase, will depend upon a number of factors. Of these, the profitability of apple storage vis-a-vis the earlier sale of non-stored apples, supply expansion in France and Italy, and the manner in which intra-European trade develops, will be important. Little can be said at this stage, but Table 5.5

suggests that problems of overproduction in Europe, which could have led to the storage of large quantities of apples, appear to be less-serious now than was the case a few years ago. In fact, a reduction in the quantities of French and Italian apples likely to be available for export has been projected over the 1970-1980 period.

6. Policy Alternatives and Conclusions

6.1 Summary of preceding sections

A number of points emerge from the preceding sections. They may be briefly summarised as follows:

(i) The situation of chronic overproduction in Europe that seemed likely in the late 1960's has, at least temporarily, eased somewhat. As a result, world prices are now higher than they were a few years ago. Such countries still possess the capacity for over-production, however, and the situation that emerges up to the 1980's will depend primarily on the success, or otherwise, of the adjustment policies that are being implemented in that region.

(ii) New Zealand's competitors in world trade are likely to remain the same as at present, with the possible addition of Argentina and (via controlled-atmosphere storage of apples) France and Italy.

(iii) As a result of the developments indicated above, New Zealand's share of the European market is expected to fall only slightly from its present level but, because of supply expansion in the southern hemisphere, and the inevitable increase in freight costs, the profitability of New Zealand's apple sales in Europe could fall appreciably.

(iv) New Zealand pip-fruit producers had, up to 1970, earned above-normal profits.[1] The escalation in costs since then could have reduced profit margins, in common with the effect of cost increases in many industries in New Zealand. The expected result of the 1973 trading year should place the A.P.B. in a breakeven situation as regards the Apple and Pear Industry Reserve Account.

(v) The New Zealand supply projections indicate that, by 1980, the quantity of fresh apples available for export would be double the quantity exported in 1972. For processed apples, the quantity available for export in 1980 would be about six times as great as the quantity exported in 1972.

(vi) Even if the quantities indicated in (v) are exported, a surplus of fresh fruit, equivalent to around 10 lbs per capita (or 25 percent

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1 In this context, the term 'above-normal' is purely one of economics, and carries no moral, ethical or political overtones. It means simply that orchardists, on average, earned more from their labour and capital in fruitgrowing than they would have if their resources of labour and capital had been employed elsewhere in the economy.

of 1972 per capita consumption) will exist on the local market by 1980, leading to a reduction in prices.

(vii) Because of the likelihood of a reduction in profitability on both export and domestic markets, it is in the interests of the industry to achieve reductions in production and marketing costs. The former can be achieved through a re-structuring of the production industry in favour of the semi-intensive method of apple production. Because of the increased supplies to be marketed in the future, size considerations may lead to cost savings in handling and marketing as well.

(viii) The projected supply expansion will require further, and significant, investment in handling and storage facilities. The A.P.B. does not appear, at the present time, to be able to provide the necessary investment finance.

Given the problems likely to exist at the end of the present decade, the following sections discuss various means by which these problems might be overcome.

6.2 Policy and costs

If the industry can lower its cost structure as regards the production and marketing of its output, then whether or not prices fall in the future the industry will be earning a higher level of profit than if such cost reductions had not taken place. Given that price reductions on both the domestic and export markets seem likely in the future, the industry will remain viable, and therefore without the need for financial assistance, for longer than if such cost reductions did not take place. It is therefore considered vital that any policy measures that might be adopted by the industry do not place barriers in the way of the adoption of cost-saving methods of production or marketing.

It was shown in Section 2 that the semi-intensive system of apple production was capable of producing any given level of output at a lower cost per bushel of fruit than was the traditional method of production. The re-structuring of the apple industry in New Zealand to one based on semi-intensive production methods is believed to be of the utmost importance. Such re-structuring should not be hindered by policy-makers - rather, it should be encouraged. However, if maximum gains are to be realized from the adoption of the more productive orcharding system, it is important that some existing resources used in apple production are released to produce other goods and services elsewhere in the economy. If this does not occur, adoption of semi-intensive methods could lead simply to a higher-than-desired level of output and falling prices. Owners of small, standard orchards should be

encouraged to amalgamate their properties if it can be shown that per unit production costs are likely to be lower for large, rather than small, holdings. Thus a research effort aimed at detecting economies of size in apple production should be actively pursued.

Cost-saving innovations in handling, storing and marketing fruit might also exist. Co-operative packhouses, for example, may lead to lower packing costs than would be achieved with each grower doing his own packing with his own facilities. The A.P.B. might also find considerable scope for lowering its handling and marketing costs per bushel of fruit. With its total receipts of apples likely to double by 1980, the A.P.B. should be actively researching the possible existence of economies of size in its handling and marketing operations. It is possible that methods used at present to handle around six million bushels of apples may not be the cheapest methods of handling the 12 million bushels expected in 1980. Thus an active research effort in this area is also considered vital to the future prosperity of the industry.

6.3 Policy and marketing investments

It is suggested that any need for further investment by the A.P.B. in crop handling and storage facilities due to an expected increase in output, should be financed by those growers responsible for the increase in output. Thus a levy should be imposed on any increase in an individual orchard's production potential, sufficient to cover the expected cost of marketing that increased output over the expected life of the orchard. The amount of such a levy could be easily calculated. The A.P.B. could estimate the necessary outlays to provide all facilities, plus their annual operation and maintenance, to handle say X,000 bushels of apples. The present value of such outlays, computed say over a 30-year period, divided by X would give the levy, in dollars per 1000 bushels, that must be paid by the individual grower on any increased production potential to cover all costs that the A.P.B. expects to make as regards the handling and storage of that production. Since yields per acre vary between localities, it is necessary that the levy be expressed on a fruit-quantity, rather than an acreage, basis. However, this would require the estimation, at the time of planting (or perhaps beforehand) of the new orchard's production potential. Since such a procedure would no doubt lead to some argument, the problem could be overcome by either applying the levy initially to (say) 50 percent of the estimated production potential, or estimating the production potential on the basis of yields that are somewhat conservative. Then, once the orchard reaches the level of production on which the levy had already been paid, additional levies would fall due on any increments in total production that may be revealed from year to year.

The levy, which would probably exceed the present levy of $6 per acre for

new plantings, should not be refundable on the sale of an orchard, since the benefits that a grower obtains from the operations of the A.P.B. are presumably reflected in the value of his orchard. To this extent, he will be recompensed for his levy payments from his selling price. However, the benefits of the A.P.B. operations to its suppliers will also be reflected in the value of non-suppliers' orchards, since the buyer of such a property could supply fruit to the A.P.B. if he wished. Thus it would seem equitable that any levy used to finance A.P.B. investments should be paid for by all growers who are making new plantings or otherwise expanding output, and not just those growers who choose to make use of the A.P.B.'s facilities.

As at present, the above levy system could operate on a two-tiered system: the flat levy would provide finance for handling the level of production expected from new plantings given the level of existing technology, and a further component, based on any future yield increases from existing plantings, could provide the necessary finance to handle the extra output.

Finally, a substantial levy on new orchards or extensions to existing orchards would represent a further fixed cost of production. Thus, it would tend to lower profit expectations and perhaps reduce the amount of new planting and orchard expansion that takes place.

6.4 Policy and speculative orchard development

The New Zealand Fruitgrowers' Federation, in support of proposals to regulate new plantings of pip-fruit orchards, has been especially critical of speculators who buy land, plant it and then sell it purely for a capital gain.[2] If the behaviour of speculators is the major motive behind the Federation's control proposals, then maybe all that is required is the abolition of the tax legislation that makes such speculative behaviour profitable.[3] Present tax incentives for orchard development provide a mechanism whereby the speculator can convert ordinary income to non-taxable capital gains. Successful conversion depends on recovering a high proportion of the establishment costs (which would have been previously deducted from other income as a current expense) when the property is sold.

It has been estimated that a speculator (in the 50 percent tax bracket) who purchased land for apple orchard development at say $2000 per acre, and who sold the orchard five years later at say $4500 per acre,[4] would receive a capital gain of $734 per acre. Note that this return is for establishing the orchard and includes no

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2 The New Zealand Herald, 1 September 1973.

3 Carman, H.F., "Tax Incentives in Orchard Development", New Zealand Journal of Agriculture (forthcoming).

4 Based on recent sales in Hastings.

increase in land values. For example, land which was valued at $2000 per acre in this analysis likely sold for around $1400 per acre when the young orchard valued at $3500 per acre was planted. This gain of $600 per acre in land values would be added to returns for establishing the orchard to calculate total returns from the investment.

An estimate of the per acre tax incentive accruing to the speculative developer can be made by comparing the above results with a case where all costs of planting, development and establishment are deductible over the bearing life of the orchard. If planting costs and net costs of establishment for three years were placed in an account to be depreciated uniformly over a bearing life of 30 years, then the net gain to the speculator would be only $82 per acre, disregarding any increase in land values. Thus reduction of the speculator's margin from $734 to $82 per acre on the modification of the tax legislation demonstrates that most of the returns from speculative orchard development come from the income tax incentives that permit premature deduction of what are essentially capital costs. However, such modification would also have to apply to genuine orchardists and as a result, an orchardist in the 50 percent tax bracket would have to meet an additional cost on the establishment of new plantings of $365 per acre.[5]

It appears that speculative orchard development could be effectively curbed through termination of the tax incentives. This could be done by either capitalising all net costs of planting, development and establishment and charging them as depreciation over the bearing life of the orchard, or by recapturing development and establishment costs as ordinary taxable income upon sale of the orchard. Termination of the tax incentives would also increase establishment costs of bona fide orchardists and thus slow their rate of new planting. This impact would probably not be substantial however, since the increase in costs is a very small proportion of total expected revenue over the bearing life of the orchard and existing producers might absorb some establishment costs in the accounts for other enterprises.

6.5 Policy and supply control

6.5.1 The basis for supply control

A theoretical basis for supply control, from the point of view of the producer, exists under certain conditions. If it can be shown that future expansion of output would lead to lower prices and lower revenues, then by restricting output, revenues earned by producers would be raised.

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5 This cost would be smaller for orchardists whose incomes place them in a lower percentage tax bracket.

Since the proportion of export quality and non-export-quality apples in the total New Zealand apple crop is only partly under the control of producers, then a restriction of output would result in a reduction in supply of both quality groups. If control of supply is to be justified, then its net effect on both domestic and export market operations must be to raise expected revenues.

For a reduction in the quantity of apples supplied to a market to raise producers' revenues, then the price elasticity of demand for apples in that market must be inelastic.[6] In Section 5 it was shown that the A.P.B. could maximise its sales revenue on the local market by selling the equivalent of 22 lbs of apples per capita in 1980. However, it was also shown that the total supply of fresh fruit for sale on the local market could be at least 50 lb per capita. Of this, A.P.B. sales could account for perhaps 30 lbs, (or at least, something greater than 22 lbs), with the result that their sales revenue would be less than the maximum, and demand would be inelastic. A similar situation could well exist for 'gate' sales. Thus it is suggested that supply controls that affected output levels by the late-1970's would raise sales revenue on the local market.

Such a conclusion cannot be reached as regards the export market, however. It was shown in Section 5 that, because of the small share of New Zealand in the United Kingdom market, a reduction in supplies to that market would not raise price sufficiently to more than compensate for the reduction in quantity. Because of New Zealand's small share in all her export markets, it is suggested that a reduction in the total quantity available for export would reduce total export receipts below what they would have been in the absence of the supply reduction.

Hence no definite conclusion can be reached on the merits of supply control on the basis of increasing revenue. The net effect of a supply control programme would depend on the increase in revenue due to the reduction of local market sales in comparison with the decrease in revenue likely from the reduction of export market sales. Only if the former was expected to exceed the latter would a policy of supply control be justified on grounds of raising industry revenue.

The general uncertainty of future export market prospects could provide an argument in favour of supply control. E.E.C. developments could reduce New Zealand's market share in that region and, along with future increases in freight costs, could reduce the profitability of European sales. General uncertainty also surrounds the degree of success that will be achieved in the search for new (and profitable) export markets. The industry as a whole should make a choice between the uncertainty involved in selling a large future output at a profit, and the less-risky prospect of selling a smaller level of output at a profit. The investment of

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6 Under such a condition, any reduction in supply would raise prices by a proportionally greater amount, giving rise to an increase in total revenue earned from the sale of the produce.

considerable sums of money in the facilities required for handling the projected increases in supply, too, can certainly be described as 'risky'. Whether the growers responsible for the expansion in output are prepared to make such a risky investment is a good question. However, it is suggested that this question might be best answered by such growers themselves - by imposing the full cost of the investments on these growers, they must in fact decide whether or not the risk is worth taking when they decide whether or not to expand their output.

6.5.2 Supply control by reducing profit expectations

Normal market operations can solve an 'overproduction' problem. Prices will eventually fall to such a level that some producers earn less than normal profits - these growers will then sell their properties, supply will be reduced, and prices and profits will rise. As a result, a classical price cycle emerges. With annual crops, such market operations may work well in returning an industry to equilibrium. Whether or not such a solution would be acceptable with perennial cropping is doubtful. First, a single cycle could be 10-20 years duration, during which time many individual producers would suffer. Second, experience suggests that the outward-movement of producers from the industry would not be very great during a period of falling prices due to the high proportion of total costs that are considered as fixed costs.

An interesting point for discussion is the following: given the future outlook for apple production in New Zealand, why are individuals still prepared to invest heavily in new apple orchards? Such individuals must feel they are making a sound investment - if they are correct, then no justification exists for supply control. If their profit expectations are incorrect (too optimistic) however, future expansion of apple production could be controlled to some extent by learning why individuals form such incorrect profit expectations. For example, they probably make their planting decisions with only sketchy knowledge of what acreages are being planted elsewhere in New Zealand, of production trends in competing countries, and of consumption and price trends in our major markets.

It is proposed that the industry should ensure that sufficient factual data are available to prospective apple producers, to allow them to form realistic expectations as regards the future profitability of apple production in New Zealand. Such information would include up-to-date reports on acreages planted and production projections in this, and other, countries, and projections of trends in supply in relation to likely demand levels, and hence price prospects.

Finally two suggestions already made, regarding levies to finance handling facilities and the removal of tax incentives, would appear to the new planter as extra costs that must be paid, and hence would play a part in reducing his profit expectations.

6.5.3 Supply control through production factors

It has been suggested in the past that one way of exerting control over the quantity grown of a crop is to exert control over the total quantity used of a factor of production, generally land. American experience, however, shows programmes such as 'acreage allotments' to be only partially successful, simply because producers can increase yields by substituting other factors for land, say by using more fertiliser or irrigation. For example, the deliberate reduction in U.S. wheat acreage between 1952 and 1960 of from 78.6 to 54.9 million acres was accompanied by an increase in output, of from 1.31 to 1.35 billion bushels. Thus if supply is to be controlled to a satisfactory extent through controlling the quantity of land in production, any reduction in acreage must be sufficient to compensate for the effects on output of factor substitution.

One way, then, of controlling the future expansion of the New Zealand apple industry is to control the net increase in acreage from year to year. Since the net increase is equal to new plantings less removals, then recommendations on the desired level of new plantings can only be made once the number of acres to be removed in a particular year has been estimated. Thus information must be collected on acres removed as well as acres planted. To decide on a desired level of new plantings also requires that the desired level of total acres is known, which in turn requires the estimation of desired output, since in the final analysis it is the growth in output rather than acres, that is to be controlled. Information will also be required, then, on yields for various localities, and on the type of tree (semi-intensive or standard) that is to be planted.

Two schemes will be discussed. The first involves control over all new plantings, whether they be new orchards or replacements, and the second involves control over the planting of only new orchards.

It has already been argued that any control policy should not inhibit the restructuring of the industry to a lower-cost basis. Unless it was administered very efficiently, a policy of imposing controls on all new plantings is likely to make just such a barrier, and be contrary to the long-term interests of the industry. For example, a grower who wished to re-structure his orchard, or amalgamate with other orchardists, perhaps in a more suitable location, would have to obtain permission to carry out such action. Such bureaucratic 'red tape' is, in itself, likely to persuade some growers to maintain their status quo, and also imposes a restriction upon their freedom of action, a restriction that will no doubt be unpalatable to many. The authority that issues permits would have to examine each application, in itself a time-consuming task, and estimate the level of the acreage permit that would allow the re-structured orchard to produce at the same level of output as the applicant's existing orchard.

Supply control through acreage manipulation might also have undesirable

effects on the rate of adoption of new technologies, or such adoption could disrupt the supply control programme. New techniques that are cost-reducing, but which have little or no effect on output, such as methods of mechanical harvesting, could be adopted at a slower rate than might otherwise be the case if orchard size is vital to their successful adoption. Mechanical harvesters, say, may not be profitable on orchards below a certain size. Orchardists, though, would not be free to expand the scale of their operations unless they could obtain permission to make new plantings. Too, new techniques (other than new methods of planting) that were cost-reducing through raising output, such as improved fertilisers or spray materials, could be adopted with the result that output would increase even though new plantings were controlled. Thus, the controls would perhaps require continuing adjustment and tightening.

It is concluded that although control over total acreage and the level of all new planting would no doubt slow down the rate of output expansion, it possesses several undesirable features. The most important of these are the temporal, bureaucratic and psychological barriers to orchard reconstruction and re-location, that would arise. Control over new plantings of low-cost semi-intensive orchards would not be in the interests of the industry, since such plantings would obtain the appearance of being discouraged by Authority. The system is also likely to suffer administration difficulties. Since all applications to plant or re-plant would require approval, considerable delays could result which would add an aspect of uncertainty to orchard management that does not exist at present. Account must be kept of the acreage of apple trees removed each year and of yield estimates for different localities.

The above disadvantages could be overcome, although at the cost of weakening control over output, by controlling the net increase in acreage by a scheme of negotiable acreage permits. Existing growers would receive a permit to produce apples from their existing acreage of land, and the authority could decide on the desirable net increase in acreage for any year, and sell the appropriate number of permits to the highest bidders. Now if growers were free to produce apples in any way they liked, provided that they did not exceed their acreage permit, then re-planting and/or orchard re-location could proceed without the need of obtaining permission from the authority. Negotiability of the permits would ensure the continuance of the forces of competition within the industry - growers who possessed cost advantages over less-efficient producers could use their cost advantages to bid permits away from the latter growers. Growers who wished to go out of apple production could sell their permits to the highest bidder and use their properties for other production, or sell the property as well. Re-location of orchards would be achieved more efficiently than if permits were not negotiable. Hence the expansion of production by efficient growers, and the entry to the industry of new, efficient producers, need not be impaired. The obvious disadvantage of this scheme, however, is that total output could be increased considerably from the existing

acreage of land simply by adopting yield-increasing methods. For example, a grower with a 20 acre standard-type orchard would be free to re-plant his property on the semi-intensive system, with the result that his production potential might be two or three times the level of output from his standard orchard.

Note that the acreage permits could still be negotiable under the first scheme. However, either before or after purchasing a permit from another grower, permission would have to be obtained before any re-planting or re-location could be carried out.

The second acreage licensing scheme would be preferred to the first if yields per acre were believed to increase only slowly in the future. With the availability of the semi-intensive planting system, this is obviously unrealistic. Thus the first scheme, with control over all new plantings (and negotiability of acreage permits) would be more effective in controlling output. However, it is likely to run contrary to the interests of the industry unless it can be administered so that requests to re-structure and/or re-locate existing orchards can be dealt with in a most rapid and efficient manner.

6.5.4 Control on physical output

One of the above negotiable acreage-permit schemes allowed growers the freedom of action as regards re-structuring and re-location, but would not be effective in controlling output, whilst the other scheme reduced such freedom of action (against the interests of the industry) but would be more efficient in terms of controlling output. It is possible that a scheme which places control directly on the level of output could provide effective supply control, while at the same time providing minimum interference with growers' freedom of decision-making.

Instead of issuing acreage-permits, the authority would issue negotiable quantity-permits to growers, allowing them to produce at the maximum potential of their existing orchards. Growers would then be completely free to re-locate, re-structure or amalgamate their orchards in any way they pleased, provided that the production potential of their holdings did not exceed their permit. Growers would possess a considerably greater degree of freedom than under a system of acreage licensing, and no permission need be sought to make new plantings unless an extension to the permit was required. It is believed that such a system would tend towards a more rapid re-structuring of the industry than could ever be hoped for under acreage licensing.

There is no doubt that some degree of 'leeway' would need to be allowed in the administration of a quantity-permit scheme, to allow for the pattern of biennial bearing and the occasional year of very heavy cropping. The permit might allow the

production each year of at most X bushels plus Y% to allow for biennial bearing. However, the adoption of new techniques that lower per unit costs by increasing output need not have the effect of increasing total production. If the grower wished to adopt such a technique, he might have to reduce the level of some factor of production, such as land, to keep within his permitted level of output. Also, it would be essential that the permits be negotiable, for the same reasons as given when acreage-permits were discussed.

Although the administration of a negotiable quantity-permit scheme would be simpler than one involving acreage-permits, in that the growers themselves, and not the authority, would estimate how many acres of any chosen planting system would be required to produce the permitted quantity, policing of the scheme would pose problems. An acreage-permit scheme could be policed simply by measuring land areas, whereas the measurement of total orchard production, where more than one sales outlet exists, will always be open to doubt. Although a competent inspector might have a good idea whether or not a grower was developing his orchard, or already producing, beyond his permitted quota, the proof necessary to impose a penalty on such a grower may be impossible to obtain unless the onus of proof (of innocence) is placed on the grower.

Thus the authority would either need to feel that policing would be adequately-achieved through the issue of warnings to growers suspected of over-producing, or else the marketing system could be changed to allow the measurement of total orchard output to be possible in practice. Two possibilities exist. The first would involve the total acquisition, by the A.P.B., of the apple crop, making sales direct from growers to the public, or processors, illegal. Such a scheme is not likely to be popular with growers and would no doubt lead to 'black marketing' arrangements. However, the A.P.B. could refuse to purchase, or purchase only at a penalised price, any fruit over-and-above an individual's permit. The second possibility, which could be worked within the existing Contract to Supply scheme, would involve the issue of marketing certificates to growers, indicating the maximum quantity of fruit that the A.P.B. would accept in a given season. Production in excess of the permitted quota would have to be sold 'at the gate', or perhaps to the A.P.B. at penalty prices. The A.P.B. could also specify varieties and grades on the marketing certificates, and it would probably be desirable that the certificates be non-negotiable, allowing the A.P.B. to exercise control over the identities of its suppliers. Growers (or potential growers) may not be keen to expand output unless they can obtain a marketing certificate from the A.P.B. to cover the expected increase in output. Such a scheme could thus provide an effective control over the growth of output, and the A.P.B. would have knowledge, perhaps for some years into the future, of their expected receipts of apples. Thus market planning can be effectively implemented.

6.5.5 Grubbing grants to reduce supply

Grubbing grants have been used in parts of Europe as a means of assisting producers to remove unwanted orchards, and hence reduce output. European experience suggests, however, that the scheme has not had quite the effect that was hoped for.

It is believed that grubbing grants are not justified for the New Zealand industry, and that even if they were their impact on total production would be small indeed. Growers would tend to remove only the oldest trees, whose yields may be very low. Also, how can the payment of public monies to growers for the removal of trees be justified when such growers are earning above-normal profits and where the removal of trees could be of immediate benefit to the growers? Trees that provide poor yields and/or produce non-preferred varieties are quite likely producing at a loss. Advisory officers can help growers identify such trees, and hence their removal (even if they are not replaced) would provide extra income to the grower. Since grubbing grants would probably be used to remove such trees, the financing of such a scheme by the nation cannot be justified.

6.6 Product and market research

Previous sections have indicated a large increase by 1980 in the projected supply of fruit that will be suited only to processing. Production and market research will be required to allow the diversification of New Zealand processing operations into new products that will be acceptable to consumers. The failure, to date, of the apple wine venture would suggest that adequate product-testing and consumer-acceptance studies were not carried out. Market research can also be useful in the development of new markets, for both existing products and new products. An active research effort will also be required to allow the further diversification of fresh fruit markets.

Since the industry's problems could arise on the local (rather than the export) market, the industry should endeavour to collect such data relating to the marketing of apples in New Zealand as might be required by the A.P.B. in its attempts to obtain a reasonable level of revenue from this market. For example, a greater knowledge of quantities sold, and (especially) prices charged for 'gate' sales could help the A.P.B. in devising its own marketing strategy. A suitably-designed sample survey of growers who sell 'direct' could provide such information, which in the long run would be of benefit to the entire industry.

Co-operation in market development and supply planning between New Zealand and her main competitors, Australia and South Africa, could benefit all three countries. By taking into consideration existing market shares and quantities supplied, estimated changes in consumer demand for apples in export markets, changes

in the relative economic efficiency of the S.A.N.Z.A. countries, and current production forecasts for each country, Hocking[7] suggests that a formula could be derived to determine an optimal collective marketing policy. The aggregate quantity supplied to any market, and each nation's share of that quantity, could be varied in response to production and market conditions. For example, the application of such a formula might lead to an increase in the total quantity supplied to the United Kingdom either from an anticipated increase in demand in that country, or from a reduction in European cool-store supplies. Or, a forecasted crop failure in South Africa could lead to Australia and New Zealand increasing their shares of the total marketed quantity.

6.7 Conclusions

(i) In view of a likely future reduction in the revenue earned by New Zealand apple producers, it is important that cost reductions in production and marketing be implemented wherever possible. This will include the reconstruction of the industry to the semi-intensive method of production, and the possible realisation of economies of size in the production, harvesting, packing, handling and marketing of the apple crop. It is also important that any policies adopted by the industry should not hinder the rapid adoption of such cost-saving methods.

(ii) A non-refundable levy, sufficient to completely finance any additional capital investment that may be required in fruit handling and storage facilities, should be imposed on planned expansions of output. The levy should be based on fruit quantity, rather than acres of new plantings.

(iii) If speculative orchard development is a problem, removal of the tax incentives that makes such behaviour profitable should remove the problem.

(iv) Adequate production and market data should be made easily available to existing and potential apple producers, to allow decisions regarding new apple plantings to be made in a rational manner, and in recognition of likely future developments.

(v) A scheme of supply control would be justified if it was believed that the increase in revenue from local market sales as a result of supply controls would more than compensate for the reduction in

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7 Hocking, A., op. cit.

export revenues that would also result, and administration costs. However, supply control might also be justified on the basis of the considerable degree of uncertainty surrounding future market prospects.

(vi) If the industry feels that the projected supply of fruit over the 1980-85 period is likely to pose problems and that removal of tax incentives, imposition of considerable levies on new plantings and provision of adequate information to existing and potential apple growers would not lead to a sufficient reduction in new plantings, then a supply control scheme might be warranted. Any system of supply control tends to protect the inefficient producer, to prevent desirable developments such as the reconstruction and re-location of the industry, and to be costly to administer. However, it is felt that a scheme based on negotiable quantity-permits would be preferable to an acreage-licensing scheme. If policing such a scheme was considered to be impossible, then the use of marketing certificates issued by the A.P.B. could effectively curb the over-expansion of the apple industry.

(vii) Grubbing grants would not appear to be justified in New Zealand at the present time.

(viii) Emphasis in extension should be placed on identifying low-profit trees and varieties, and demonstrating to growers that net incomes could be increased on their removal, and perhaps replacement with more-preferred varieties. Emphasis should also be placed on the planting of varieties, or reworking of existing trees to varieties that are suitable for export and provide a high export grade-out. In this way, any expansion in supply should have as little effect as possible on the supplies of non-export-quality fruit.

(ix) Research should continue to be conducted, or be implemented, in the following areas:

- new processed product development;
- consumer testing of new processed products;
- export market development;
- the determination of optimal marketing strategies;
- the identification of economies of size in apple production, packing, handling, processing and marketing;
- the provision of production and market forecasting in relation to the New Zealand and export markets, and important competitors in supply.

APPENDICES

A. Preparation of tree numbers and acreage data

Data came from two sources, these being the official five-yearly Surveys of the Fruitgrowing Industry, and sample data collected annually by the M.A.F. Results given by the surveys included total apple tree numbers by age group (and in 1967 only, total acreage) as at the end of the years 1953, 1957, 1962 and 1967. Information on tree numbers and acreages for all years since 1957, but not covered by the surveys, was derived from M.A.F. sample statistics on total tree numbers and acreage, and the numbers of trees planted and removed. Since such data were collected from only a sample of growers rather than all growers, and are intended only to show trends rather than the actual situation, they required adjustment so as to be comparable with the survey results.

In each survey, the number of apple trees in the '1/5 year' age group gives, on the reasonable assumption that removals from this age group are negligible, the total number of trees planted over the previous five years. This allows an estimate to be made of the 'error' in the M.A.F. sample data on new plantings. For example, survey results indicated a total of 238,945 trees in the '1/5 year' age group as at the end of 1962, which would have been planted over the 1958-62 period. The M.A.F. data showed total new plantings of 213,547 trees over this period however. Thus multiplication of each M.A.F. annual new plantings estimate by the correction factor 238,945/213,547, or 1.119, adjusts this data so that they sum up to the survey figure. Likewise over the 1963-67 period a total of 375,451 trees were planted according to the survey, but the M.A.F. data showed a total of 343,698. In this case the correction factor is smaller than before, of 1.092.

Since the survey results for the year 1972 are not yet available, a 'corrected' estimate of the total number of trees in the '1/5 year' age group as at the end of 1972 was obtained by adjusting the total number of new trees planted over the 1968-72 period as collected by the M.A.F. Assuming that the accuracy of the M.A.F. data continues to improve at a linear rate (or the 'correction factor' continues to become smaller) then a 'correction factor' of 1.006 can be applied to the M.A.F. data. Total numbers of trees planted over the period was, from M.A.F. data, 660,484; multiplication by 1.066 gives an estimate of the total number of trees in the '1/5 year' age group at the end of 1972 as 703,970. Using these correction factors, the annual new plantings data of the M.A.F. were adjusted to give new estimates that were consistent, as described above, with the survey results.

The M.A.F. data on the numbers of trees removed each year were adjusted in somewhat similar fashion, so as to be consistent with survey results. The change in total tree numbers from one survey year to the next will be equal to the total

number of new plantings over this period less the total number of tree removals. From the survey results, it was found that the net increase in tree numbers between 1958 and 1962 was 121,185. Total plantings of 238,945 were made over this period (see above) so total tree removals must have equalled 238,945 - 121,185, or 117,760. However, M.A.F. data gave a total of 70,264 trees removed over this period - thus a 'correction factor' of 117,760/70,264, or 1.676 is required to adjust the M.A.F. data to be consistent with surveyed results. The correction factor for the next five-year period, 1963-67, was slightly smaller at 1.520 - assuming the improvement in accuracy continued during the 1968-72 period, a correction factor for this period was estimated as 1.363.

Next, the total numbers of trees in each year over the period 1957-72 were computed as the total number of trees in the previous year plus the number of trees planted in the current year less the number of trees removed in the current year. For the initial year, 1957, the total number of trees was surveyed to be 1,087,116. The 'tree numbers' data is given in Table A.1.

To convert the 'tree numbers' data to an acreage basis, information was required on the average tree density per acre for each year. The only surveyed acreage data was for 1967, from which the average tree density in that year, of 145.5 trees per acre, can be obtained by dividing total tree numbers by the total acreage. For all other years since 1957, an estimate of the average density was obtained by dividing the M.A.F. total tree numbers estimate by the M.A.F. total acreage estimate. The estimated densities increased steadily from 141.9 trees per acre in 1965 to 162.3 trees per acre in 1972, due to the steady increase in the proportion of acres planted to the semi-intensive system. It has been assumed that semi-intensive plantings prior to 1965 were negligible. Thus a constant density, equal to the average for the period 1957-64, was assumed to hold over that period. Then, using these tree density estimates, the 'total tree numbers' data of Table A.1 were converted to total acreages of apple trees, in each year. On the reasonable assumption that tree removals from semi-intensive orchards would have been negligible, the 'total trees removed' data of Table A.1 was converted to 'acres removed', upon division by the average tree density per acre over the period 1957-64. The total acreage in any year will equal the total acreage of the previous year plus the acreage of new plantings in the current year less the acres removed in the current year. All data except acres of new plantings has already been derived, allowing the estimation of the acreage of apple trees planted in each year. All acreage data are given in Table A.2.

Since yields per bearing acre required calculation, so too did the acreage of apple trees in production (that is, at least six years of age). The number of bearing acres in any year will equal the bearing acreage of the previous year plus the number of acres of new plantings made five years earlier less the number of acres removed in the current year. Since new plantings data was available only from 1958, this allowed bearing acreage to be calculated by the above formula only from 1963.

Table A.1: Derivation of Data on Tree Numbers

Year	New plantings M.A.F. data		New plantings Adjusted	Removals M.A.F. data		Removals Adjusted	Total tree numbers
	← (no's of trees)			(no's of trees)		→	
1957	..		..	..		..	1,087,116
1958	37,679		42,160	11,345		19,014	1,110,262
1959	52,755		59,029	17,511		29,348	1,139,943
1960	43,031	x1.11893	48,149	12,673	x1.67597	21,240	1,166,852
1961	34,986		39,147	16,890		28,307	1,177,692
1962	45,096		50,459	11,845		19,852	1,208,301
1963	53,716		58,679	11,491		17,461	1,249,519
1964	50,371		55,025	13,234		20,110	1,284,434
1965	73,735	x1.09239	80,547	17,813	x1.51955	27,068	1,337,913
1966	84,586		92,401	19,895		30,232	1,400,082
1967	81,290		88,800	15,480		23,523	1,465,359
1968	85,628		91,266	15,777		21,506	1,535,119
1969	111,376		118,709	21,990		29,976	1,623,852
1970	135,920	x1.06584	144,869	36,629	x1.36314	49,931	1,718,790
1971	167,487		178,514	30,512		41,592	1,855,712
1972	160,073		170,612	31,852		43,419	1,982,905

Table A.2: Apple Acreage Data

Year	New plantings	Removals	Total	Bearing
	← (acres)		→	
1957	..	..	7,725	6,432
1958	299.6	135.1	7,889	6,501
1959	419.4	208.5	8,100	6,565
1960	342.1	150.9	8,291	6,686
1961	278.2	201.1	8,368	6,757
1962	358.5	141.1	8,586	6,888
1963	416.9	124.1	8,878	7,063
1964	391.0	142.9	9,127	7,340
1965	487.7	192.3	9,422	7,490
1966	536.0	214.8	9,743	7,553
1967	494.4	167.1	10,070	7,744
1968	524.4	152.8	10,442	8,008
1969	652.8	213.0	10,882	8,186
1970	711.9	354.8	11,239	8,319
1971	824.4	295.5	11,768	8,560
1972	760.1	308.5	12,219	8,746

For years prior to 1963, bearing acreage was estimated by obtaining the total number of trees in the '6+ years' age group from the surveys of 1957 and 1963, dividing by the average tree density per acre already calculated for this period, and obtaining estimates of bearing acreage for years between 1957 and 1963 through interpolation. The bearing acreage estimates are also given in Table A.2.

B. The supply projection model

The supply projections were calculated from the equation

$$Q_t = BA^o_t . Y^o_t + BA^n_t . Y^n_t$$

where Q_t = total production of apples in year t;

BA^o_t = bearing acres of standard orchards in year t;

BA^n_t = bearing acres of semi-intensive orchards in year t;

Y^o_t = average yield (bushels per bearing acre) from standard orchards; and

Y^n_t = average yield (bushels per bearing acre) from semi-intensive orchards.

Projections of Y^o_t were based on past average yields, a time trend to allow for the gradual rise in productivity, and a 'dummy' variable that allowed recognition of the biennial-bearing habits of apple trees;

$$Y^o_t = a_o + a_1 t + a_2 D_t$$

where t = a time trend variable, t=1 for the 1959 production year; and

D_t = a dummy variable, $D_t = +1$ for t = 1960, 1962, ...

$D_t = -1$ for t = 1959, 1961, ...

Projections of average yields from semi-intensive trees were made by multiplying the projected standard-orchard yields by a constant factor, the constant being estimated from reported research work:[1]

$$Y^n_t = KY^o_t$$

where K = a constant.

Thus semi-intensive yields were projected with the same trend and biennial bearing characteristics as shown by standard-orchard yields.

Bearing acreage projections were calculated as:

$$BA^n_t = BA^n_{t-1} + N^n_{t-5} - R^n_t \text{ and}$$

$$BA^o_t = BA^o_{t-1} + N^o_{t-5} - R^o_t$$

where N^n_{t-5} = new plantings of semi-intensive orchards (acres) made in year t-5;

N^o_{t-5} = new plantings of standard orchards (acres) made in year t-5;

R^n_t = removals of semi-intensive orchards (acres) in year t; and

R^o_t = removals of standard orchards (acres) in year t.

1 See McKenzie, D., op. cit.

The total acreage of apple trees removed in any year will depend upon such factors as disease incidence, the acreage of old trees that show declining productivity, rainfall, the expected profitability of replacement apple trees, and urban expansion. Projections of removals were based only on total bearing acreage - this seemed reasonable since it is likely that the greater the bearing acreage, the greater will be the number of acres removed. Statistical problems were encountered when the other variables mentioned above were attempted to be measured and included in the projection equation. Thus,

$$R_t = b_o + b_1 BA_{t-1}$$

where R_t = total removals (acres) in year t; and

BA_{t-1} = total bearing acreage in year t-1.

Since the ratio of removals of semi-intensive orchards to total removals is likely to be somewhat similar to the ratio of the bearing acreage of semi-intensive orchards to total bearing acreage, the acreage of semi-intensive orchards removed in any year was projected as

$$R_t^n = \frac{BA_{t-1}^n}{BA_{t-1}} . R_t, \text{ and therefore}$$

$$R_t^o = R_t - R_t^n .$$

Under the hypothesis that the acreage of new plantings in any year would depend on growers' expectations of profitability, new plantings were projected from the equation

$$N_t = c_o + c_1 \left(\frac{P}{W}\right)^*_{t-4} + c_2 Y^*_{t-4}$$

where N_t = the total acreage of new plantings made in year t;

$\left(\frac{P}{W}\right)^*_{t-4}$ = the growers' expectation of price (deflated by a cost index, W) held in year t-4; and

Y^*_{t-4} = the growers' expectation of yields per acre to be obtained in the future from the new planting, held in year t-4.

The four-year time lag between a grower forming his expectations (and hence deciding whether or not to plant) and actually making the planting, represents the time between placing an order for trees, and receiving those trees. Expected prices were measured as a four-year moving average of the average payout per bushel made by the A.P.B., deflated by an index of nominal wages paid in primary industry. Expected yields would be dependent (at least in part) on past trends in yields but would also be adjusted gradually over time in response to research related to semi-intensive production methods, and other growers' experience with this system.[2]

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2 Aspects, such as these, of the supply projection model are to be discussed more fully in a forthcoming publication.

The proportion of new plantings in any year that were on the semi-intensive system were projected forward on the basis of trends in this proportion over the past. A rough estimate of the proportion of new plantings over the period 1965-72 was made by first calculating the average density of new plantings in each year (from the new plantings data of Tables A.1 and A.2). Letting d_{At} be this average density in year t, d_o be the density of standard plantings, and d_n the density of semi-intensive plantings, then r_t (the proportion of total new plantings that was of the semi-intensive type in year t) can be estimated as

$$d_{At} = r_t d_n + (1 - r_t)\, d_o, \text{ or}$$

$$r_t = \frac{d_{At} - d_o}{d_n - d_o} = \frac{N_t^n}{N_t}$$

A logistic function was employed to project the growth over time of the proportion, N_t^n/N_t, and was estimated using the values of r_t, computed above:

$$\log_e \left[\frac{S_t}{100 - S_t}\right] = k_o + k_1 t$$

where $S_t = 100 N_t^n/N_t = 100\, r_t$

The equations that required estimation by ordinary least squares to allow the construction of the supply projection model are given below. Figures in parenthesis are the standard errors of the estimated coefficients.

$$Y_t^o = \underset{(18.24)}{584.37} + \underset{(2.15)}{20.48t} + \underset{(8.65)}{49.69D_t} \qquad R^2 = 0.93$$

$$Y_t^n = 2.36\, Y_t^o \quad \text{('high' projection)}$$

$$\text{or } Y_t^n = 1.77\, Y_t^o \quad \text{('low' projection)}.$$

$$R_t = \underset{(133.58)}{-338.72} + \underset{(0.02)}{0.07}\, BA_{t-1}\ ; \qquad R^2 = 0.56$$

$$N_t = \underset{(803.42)}{-471.98} + \underset{(577.57)}{436.85} \left(\frac{P}{W}\right)^*_{t-4} + \underset{(0.04)}{0.41}\, Y^*_{t-4}\ ; \qquad R^2 = 0.90$$

$$\log_e \left[\frac{S_t}{100 - S_t}\right] = \underset{(0.19)}{-1.85} + \underset{(0.04)}{0.29}\, t\ ; \qquad R^2 = 0.91$$

Lastly, two equations were estimated to allow the supply projections to be divided into

i) that quantity suited only to local market fresh consumption or processing, and

ii) that quantity likely to be suitable only for processing.

These equations are:

$$Q_t^{l,p} = \underset{(337.64)}{858.67} + \underset{(0.06)}{0.41}\ Q_t \qquad R^2 = 0.86$$

$$Q_t^{p} = \underset{(124.03)}{-482.33} - \underset{(0.02)}{0.21}\ Q_t \qquad R^2 = 0.92$$

$$Q_t^{x} = Q_t - Q_t^{l,p}$$

where $Q_t^{l,p}$ = the quantity of fresh fruit suitable for local fresh consumption, or processing, in year t;

Q_t^{p} = the quantity of fresh fruit suitable only for processing in year t; and

Q_t^{x} = the quantity of fresh fruit available for export in year t.

C. The domestic market price-sales relationship

Section 5 discussed the use of estimated relationships between retail and wholesale prices, and between wholesale prices and sales to wholesalers by the A.P.B. The latter equation was estimated as:

$$P_w = \underset{(1.40)}{14.56} - \underset{(0.05)}{0.23}Q_w - \underset{(0.03)}{0.15}t \qquad R^2 = 0.70$$

where P_w = deflated wholesale price, cents per lb; and

Q_w = quantity sold by A.P.B. to retailers via wholesale outlets, lbs per capita.

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