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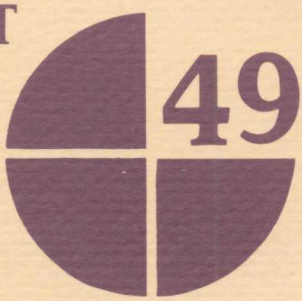

LIVESTOCK PRODUCTS IN THE THIRD WORLD: PAST TRENDS AND PROJECTIONS TO 1990 AND 2000

J. S. Sarma
Patrick Yeung

April 1985

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE 1975-85

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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FOREWORD

The International Food Policy Research Institute (IFPRI) has undertaken a series of analyses of developing-country trends in food production, consumption, and trade oriented to diagnosing the nature, magnitude, and components of the food problem. Research results indicate the possible extent and location of future critical supply-demand imbalances in the Third World and are used by IFPRI specifically to identify food policy research issues and areas. A food gap analysis of the developing-country trends in food staples will soon be published as part of this effort. The present report deals with livestock products. Both of these studies use data from the Food and Agriculture Organization of the United Nations as the basic element of analysis.

Consumption of livestock products is claiming increased shares of food budgets in developing countries, particularly in those countries with relatively high incomes. And, if per capita incomes continue to grow rapidly, these trends are likely to be intensified. Several Third World countries are meeting the increased demand for livestock products through accelerated domestic production. From an equity standpoint, the appropriate strategy to be adopted for this accelerated growth is the development of small-scale, labor-intensive rural livestock enterprises that contribute to increased rural incomes and employment. This accelerated livestock production will result in a more rapid increase in the derived demand for feedgrains, which in turn will have large implications for the food security of the developing countries.

In recognition of its important role, livestock production forms an integral part of IFPRI's food gap analyses. This research report analyzes the past trends in production, consumption, and trade in the principal livestock products—meat, milk, and eggs—in the Third World countries. Demand projections are based on the continuation of per capita income growth trends during 1966-77, which was a period of rapid income growth for the Third World countries. Questions are raised whether this assumption is realistic in view of the generally poor performance of these countries during 1980-83 and particularly in view of the slow economic growth in Sub-Saharan Africa and Latin America.

IFPRI's food gap analyses attempt to focus attention on the dynamics of the demand-supply relationships as developing countries accelerate their income growth. Thus a dynamic assumption is useful. It may also be quite realistic, keeping in mind the structural adjustments that are being undertaken in many Third World countries and continued improvement in the productivity of resources and their use. It may, however, be true that the shortfall between the projected and actual growth during 1977-83 may not be made up during 1983-90, and the projected demand estimates may not be realized until a later time. In helping to address this issue, Sarma and Yeung also project the demand for livestock products using an alternative income-growth scenario that is 25 percent less than the 1966-77 trend growth.

The projections of production and consumption and the difference between the two are not to be taken as forecasts of what will happen in 1990 and 2000. It is in the nature of projections that they rely on a number of assumptions. Nevertheless, the results of the study are thought to indicate the probable direction and the pace of future changes, though not necessarily their precise magnitudes.

The main conclusion of the report is that if per capita incomes grow rapidly in the Third World countries, even if output continues to grow at the past rate, the projected gaps between the demand and supply of meat and milk could be very large in both 1990 and 2000, in all four developing regions. Thus more intensified efforts are called for to accelerate production growth.

The trends analysis extends over production, consumption, and trade for 3 types of products, 4 regions, and 10 subregions during the period of the early 1960s and mid-1970s. It is only such detailed analysis of past trends that can throw light on prospects for the future.

John W. Mellor

Washington, D.C.
April 1985

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1

SUMMARY

As per capita incomes rise in Third World countries, the demand for livestock products—meat, milk, and eggs—not only rises faster than that for cereals in these countries but also more rapidly than demand for livestock products in the developed countries. This in turn influences the demand for cereals and other staple foods used as livestock feed. Livestock production is also an important source of income and employment in the rural sector; it helps to meet equity objectives by contributing cash income to small farmers in the Third World. Besides providing draft power and manure, livestock in developing countries convert many agricultural wastes and by-products into food. Finally, livestock products contribute to export earnings, particularly in Latin America.

The developing countries (excluding China) included in this study account for about half of the world's population, but they produce only about one-fifth of the world's meat, milk, and eggs. And the total and per capita output of these products differ widely among the different regions and countries within the Third World.

A higher percentage of the total stock is slaughtered for meat each year in the developed countries: about one-third of the stock as opposed to one-tenth in the developing countries. About 25 percent of cattle in developed countries are dairy animals, which is double the share of milch cows in developing countries. Moreover, yields tend to be smaller in developing countries. Carcass weights of slaughtered animals in the study countries are about 70-75 percent of the weights in developed countries, and milk yields are just 20 percent. Again, yields vary widely among and within regions.

This study covers 104 developing countries in Asia, North Africa/Middle East, Sub-Saharan Africa, and Latin America, and subregions of each of these regions. Data are also divided into country typologies based on per capita income and its growth. Past trends are based on averages for 1961-65 and 1973-77.

Between 1961-65 and 1973-77 production of meat in the developing countries increased at an average annual rate of 2.9 percent, milk at 2.5 percent, and eggs at 5.3 percent, while population increased at an average rate of 2.6 percent a year. The high growth rates for egg production reflect technological advances in poultry farming and the rising demand for poultry production in Third World countries. During the same period, poultry's share of total meat production nearly doubled in Latin America and increased by 75 percent in North Africa/Middle East, by 40 percent in Sub-Saharan Africa, and by 30 percent in Asia.

From the early 1960s to the mid-1970s consumption of meat increased at an average annual rate of 3.2 percent a year, milk at 2.6 percent, and eggs at 5.5 percent. During the mid-1970s beef and buffalo meat constituted nearly 50 percent of the meat consumed, and pigmeat and poultry about 18 percent each. Mutton and goat meat accounted for the remaining 14 percent.

During this time meat exports increased only slightly, while meat imports rose almost 80 percent. Consequently, the net trade surplus in meat declined from 0.8 million metric tons to 0.3 million metric tons in carcass weight. Although milk exports quadrupled, milk imports also increased dramatically. The net milk deficit of the study countries increased from 4.9 to 8.9 million metric tons in fresh whole milk equivalents. Developing countries usually do not trade in eggs, relying on local egg supplies. Nevertheless, net imports of eggs increased from 42,000 metric tons in the early 1960s to 109,000 metric tons in the mid-1970s. North Africa/Middle East accounted for nearly half of the imports in the latter period.

Projections of output to the years 1990 and 2000 are extrapolations of 1961-77 trends. Direct consumption by humans is projected using trend estimates of per capita consumption in 1977, per capita growth in income during 1966-77, income elasticities of demand, and projected populations in 1990 and 2000. The two oil shocks of 1974 and 1979-80, the ensuing recession, protectionism in developed countries, and mounting debt repayment problems slowed economic growth

in developing countries. Because of the unusually low growth that resulted during 1980-83, doubts have been expressed as to whether it is realistic to assume that 1966-77 growth rates will continue. Keeping in view the structural adjustments being undertaken in several Third World countries and improvements in the efficiency of resource allocation and use, it is equally unrealistic to assume that the slower growth of 1980-83 will continue. Moreover, the food gap analyses of the International Food Policy Research Institute are particularly concerned with the food situation if the developing countries succeed in accelerating their income growth. However, to allow for slower average growth, demand projections have also been made on an alternative assumption of per capita income growth 25 percent less than the 1966-77 trend.

If historical trends in the output of livestock products continue, the developing countries are projected to produce about 36 million metric tons of meat, 131 million metric tons of milk, and 8.4 million metric tons of eggs by the year 1990. The total requirements for livestock products in 1990, however, are projected to be about 44 million metric tons of meat, 166 million metric tons of milk, and 8.7 million metric tons of eggs, assuming that the 1966-77 trends in per capita income continue in the future. Thus the gaps between the projected output and demand in 1990 are estimated at 8 million metric tons of meat, 35 million metric tons of milk, and about 300,000 metric tons of eggs.

If these trends continue beyond 1990, the deficit in meat supplies is projected to rise to 21 million metric tons and that in milk to 64 million metric tons by the year 2000. The supply and demand of eggs should be in balance.

Except for eggs in Latin America, all the developing regions are projected to have net deficits in the major livestock products by 1990. By 2000 the projected gaps could be two to three times larger in all the regions for meat and in the regions of Asia, North Africa/Middle East, and Sub-Saharan Africa for milk. In Latin America, the projected deficit for milk in 2000 could be smaller than that in 1990.

If income growth turns out to be 25 percent slower than the 1966-77 trend but production trends remain on target, the projected gaps might be reduced to 10 million metric tons of meat and 43 million metric tons of milk, and eggs might even show a surplus in 2000. Latin America is projected to show surpluses under this assumption, whereas the three other regions would continue to be deficit in meat and milk in 2000.

These projections are not intended to serve as forecasts, but only as signals of the supply-demand imbalances possible under certain assumptions. Thus they serve as indicators of the domestic supply gap, particularly under constant prices, or alternatively as indicators of the import requirements from world markets.

A global study undertaken by the Food and Agriculture Organization of the United Nations (FAO), *Agriculture: Toward 2000,* shows net production and consumption of livestock products to be nearly balanced by the year 2000, whereas the projections in this report show a large gap. The difference arises mainly because of the downward adjustment made by FAO in the estimates of the demand for meat and milk for countries where they judged that the constant price demand estimates were unrealistic and where the income and balance of payments would not permit large-scale imports. The projections of demand here, however, are based on a constant price assumption.

Unless the large gaps projected between supply and demand in the developing countries are filled by accelerating output growth or by transferring food from the developed countries or other developing regions through trade or aid, prices will rise, possibly causing poor consumers in some of the Third World countries to suffer. In countries where large imports of livestock products are not feasible because of foreign exchange constraints, every effort must be made to accelerate domestic production. In many countries, potential for rapid growth of output exists through application of new technology and labor-intensive livestock production, especially for poultry. In those countries where land is not a constraint, large-scale development of ruminant production is feasible. Even here the productivity of existing pasture and grazing lands needs to be improved. Livestock policies need to be reoriented with a view to providing improved access to institutional credit, production inputs, veterinary and health services, marketing facilities, and appropriate input and output price policies. Allocations of resources to livestock research need to be increased. In some regions, Latin America, for example, clearer signals of strong demand for livestock products could elicit an impressive output re-

sponse. In each region appropriate programs suited to the conditions and the species of animals need to be developed.

Apart from the large investments required for these programs, the effects of accelerated livestock production on the derived demand for feedgrains should also be considered. In some countries coarse grains (including maize) are consumed by people, and their increased use as livestock feed implies a diversion from food supplies. Competition between the two uses might result in higher prices for coarse grains that could cause hardship to vulnerable sections of the population. Greater emphasis should therefore be placed on research and technology to improve yields of feedgrains and feed efficiency. In addition, the scope for substitution of noncereals such as cassava with protein supplements for cereals in concentrate feeds needs to be explored.

2

INTRODUCTION

Livestock products, such as meat (including poultry), milk, and eggs, contribute about one-sixth of the calories and one-third of the proteins in the per capita food supplies in the world; the balance comes from vegetable products. The per capita consumption of livestock products is, however, four to five times higher in the developed countries than in the developing countries.

In the developing countries the income elasticity of demand for livestock products is high compared with that of cereals. It is also high compared with that of the developed economies. This implies that with rising per capita incomes, the demand for these products would rise faster in the Third World countries, influencing in turn the demand for grains and other staple foods used as livestock feed. In 1977 nearly 60 percent of the total domestic utilization of cereals in the developed countries was for livestock feed, compared with only 18 percent in the developing countries. The rapid increase in the demand for feedgrains is likely to further aggravate the tight food supply situation in many of the Third World countries in the coming decades.

In the rural sector livestock are an important source of income and employment. They help meet the equity objective of rural development through their contribution to the cash income of small farmers in several developing countries. Besides assisting in crop production through provision of draft power and manure for improving soil fertility, some animals and birds convert waste and by-products of crop production into edible food. Livestock represent the only way in which the natural vegetation that covers large parts of the world, such as the savannas and cerrados of South America, can be converted into products that can be used by man. Because of the high quality of protein they contain, livestock products also improve the quality of the diet. Lastly, these products contribute to export earnings, particularly in Latin America. It is in this context that an analysis of production and consumption of livestock products in the Third World countries, past trends as well as future prospects, assumes significance.

This report covers 104 developing countries of which 21 are in Asia, 19 in North Africa/Middle East, 40 in Sub-Saharan Africa, and 24 in Latin America.[1] In addition to these four regions, the developing countries are divided into smaller geographical areas denoted as subregions and also into typologies based on per capita income and its growth.[2] The countries of each region, subregion, and typology and the percentage of total population covered by each are given in Appendix 1, Table 21. The livestock products include meat (beef, veal, buffalo meat, mutton, and goat, pig, and poultry meat); milk (cow, buffalo, sheep, goat, and camel) and milk products (expressed in whole milk equivalents); and eggs (hen and others).[3] Offal and slaughter fats are excluded. The bulk of the data used in this analysis is from the Food and Agriculture Organization of the United Nations (FAO).[4]

The analysis of past trends is generally based on the averages for 1961-65 and 1973-77. Projections of output to the years 1990 and 2000 are generally extrapolations of 1961-77 trends. Quantities that will be required for consumption by the human pop-

[1] The present study excludes China from its scope mainly because of data problems. According to the *FAO Production Yearbook, 1980,* China (including Taiwan) produced 21.5 million metric tons of meat, 7.2 million metric tons of milk, and 4.4 million metric tons of eggs in 1979 (Food and Agriculture Organization of the United Nations, *FAO Production Yearbook, 1980*[Rome: FAO, 1981]). But these estimates differ considerably from those published by the People's Republic of China (even after allowing for the output of Taiwan based on their official statistics). No consistent and comparable time-series data on livestock products for mainland China based on government series are yet available.

[2] In the case of meat an additional typology based on the country's net trade situation in meat in the mid-1970s is also presented.

[3] The study does not include fish.

[4] The current situation presented in Chapter 3 uses 1979 data from the *FAO Production Yearbook, 1980.*

ulation are projected for each commodity by taking into account the estimate of 1977 per capita consumption based on the trend during 1966-77, the trend growth rate of per capita incomes during the same period, and the relevant income elasticity of demand. To these estimates are added allowances for wastage and spoilage for milk and eggs, milk used as feed, and eggs required for breeding. The projections are made for each country and aggregated to obtain the totals for the subregions, the regions, and all developing countries. The details of the methodology are discussed in Appendix 2.

A word of caution is in order. The statistical basis for estimating livestock output in several of the developing countries is even less firm than the data on major staple food crops. To the extent that the estimates of past trends based on the FAO data differ from actual trends, the projections for the future are also affected. The output projections also assume that livestock feed will be available and that the appropriate government policies and institutional infrastructures will remain in position. Differences in the projections made by FAO in its *Agriculture: Toward 2000* report and those of the International Food Policy Research Institute (IFPRI) are discussed in Appendix 3.

It should be noted that the projections made in this study are not meant to be taken as forecasts of what will happen in the future. It is in the nature of projections that they rely on a number of stated assumptions. The results of this study are, however, expected to be generally indicative of the direction and the pace of future changes, though not necessarily their precise magnitudes.

A future study will consider separately the feedgrain requirements for livestock in 1990 and 2000. In particular, it is likely that as per capita incomes rise, the per capita demand for the direct consumption of grains (especially coarse grains) would eventually decrease and their indirect consumption as feedgrains would increase. The combined effect of this behavior at different income levels in developing countries needs to be studied closely.

3

PRODUCTION: CURRENT SITUATION AND PAST TRENDS

Total world production of livestock products in 1979 comprised 136 million tons of meat, 463 million tons of milk, and 27 million tons of eggs (see Table 1).[5] The developing economies, with almost three-quarters of the global population, produced about 35 percent of its meat and eggs and a little less than 23 percent of its milk (see Figure 1). Consequently, the per capita output of meat and eggs in these countries was less than one-fifth of that in the developed economies, and the per capita output of milk about one-tenth. For the 104 study countries, which account for a little more than half the world population, the total output of livestock products was about one-fifth of the global output of meat, milk, and eggs. The per capita output of meat and eggs in the study countries was less than that for all developing economies, largely because China was excluded. According to the data published by FAO the per capita output of meat and eggs for China was considerably higher than the average for the rest of the developing countries. On the other hand, the per capita output of milk in the study countries was about 38 percent higher than that in the developing economies, including China. Even at this level, it was about one-seventh of the per capita milk output in the developed economies. Total and per capita output of milk differ widely among the regions.

In 1979, Latin America, with 8 percent of the world's population, produced about 10 percent of the world's output of meat, 7 percent of milk, and 8 percent of eggs. Asia's milk output was higher than that of Latin America. Asia's production of meat was nearly one-fifth of the aggregate output of the study countries, whereas Latin America's share was more than half. Sub-Saharan Africa's output of livestock products was the lowest among the four regions. North Africa/Middle East, with about 12 percent of the aggregate population of the study countries, produced about one-sixth of the output of milk and eggs, resulting in much higher per capita output for this region. North Africa/Middle East also accounted for about one-eighth of the meat produced in the study countries.

These interregional disparities reflect production capacities and also patterns and levels of consumption, which in turn depend on income, tastes and preferences, and possibilities for trade.

Livestock Numbers

Although meat, milk, and eggs are the three most important livestock products used for human food consumption, animals have a variety of other uses also. Cattle and buffalo

Table 1—World population and output of livestock products, by country group and region, 1979

Country Group/ Region	Population	Output		
		Meat	Milk	Eggs
	(millions)	(million metric tons)		
World	4,376	136	463[a]	27.0
Developed economies[b]	1,155	88	358[a]	18.0
Developing economies[b]	3,221	48	105[a]	9.0
All study countries[c]	2,203	26	99	5.1
Asia	1,267	6	43	1.6
North Africa/ Middle East	254	3	16	0.8
Sub-Saharan Africa	330	3	6	0.5
Latin America	352	14	34	2.2

Source: Food and Agriculture Organization of the United Nations, *FAO Production Yearbook, 1980,* vol. 34 (Rome: FAO, 1981).

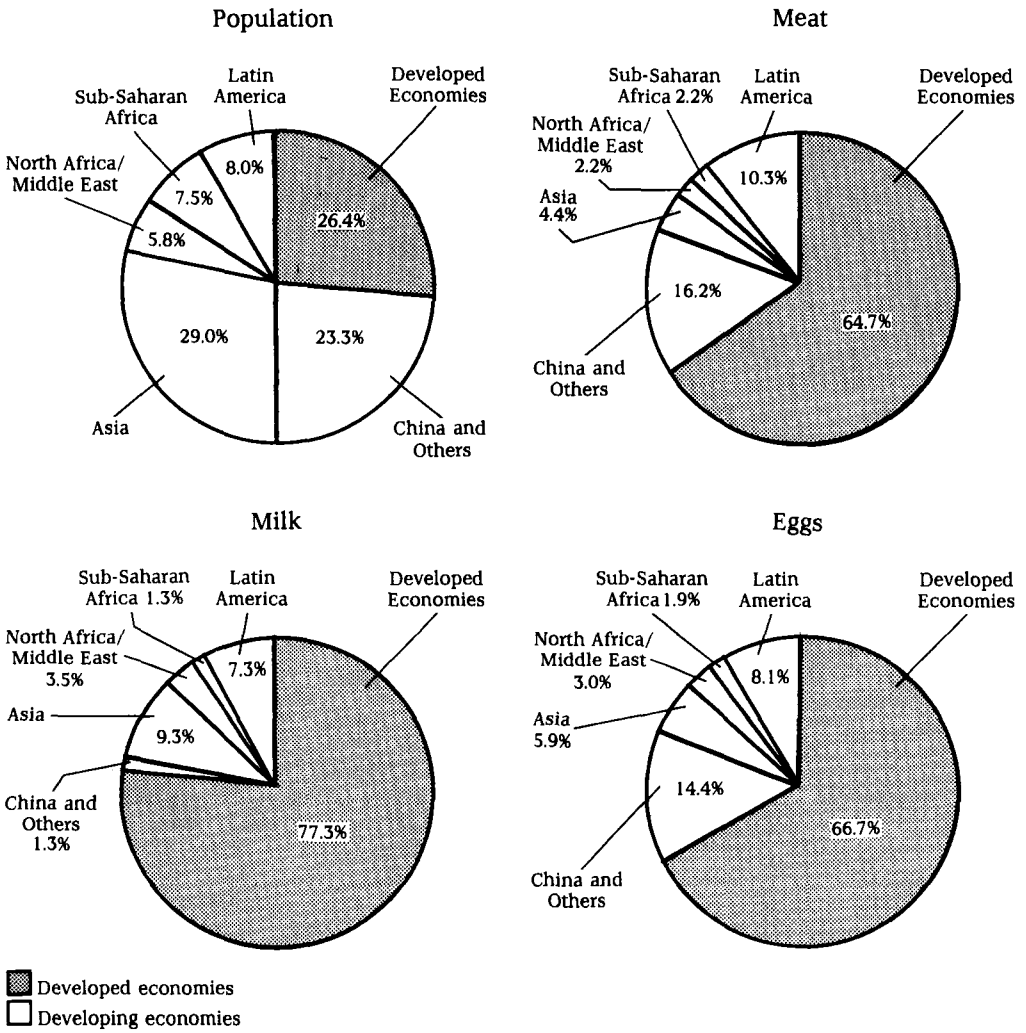
[a] Camel milk is excluded.

[b] Countries are grouped according to the classification system of the Food and Agriculture Organization of the United Nations.

[c] Countries are grouped according to the classification system of the International Food Policy Research Institute.

[5] All tons referred to in this report are metric tons.

Figure 1—Distribution of world population and output of livestock products, by region, 1979



Source: Food and Agriculture Organization of the United Nations, *FAO Production Yearbook, 1980,* vol.34 (Rome: FAO, 1981).

Note: The category China and Others includes China and a number of small developing countries that are not among the 104 study countries.

in some regions are widely used for draft power in agricultural operations and for transport;[6] hides, skins, and wool are the raw materials for the leather and woolen industries; offal is used in livestock feed, and dung is applied to the fields as manure to improve the soil fertility, or it is burned as fuel. The total number of livestock in the world indicates their importance as an economic resource. In 1979 there were 1,336 million cattle and buffalo, 1,540 million sheep and goats, 17 million camels, 762 mil-

[6] FAO reports that there were 165 million draft animals in developing countries (excluding China) in 1975 (Food and Agriculture Organization of the United Nations, *Agriculture: Toward 2000* [Rome: FAO, 1981]).

lion pigs, and 6,444 million poultry birds (including chickens, ducks, and turkeys) in the world (see Table 2).

The distribution of numbers of livestock between developed and developing countries, however, does not tell the whole story. Although more livestock are found in the Third World countries, their productivity is generally much lower than that in developed countries. The amount of concentrate feeds used in these countries is also relatively low. Nearly two-thirds of the cattle and buffalo and sheep and goats are found in developing countries, but only 32 percent of the beef and buffalo meat is produced in these countries and 54 percent of the mutton and goat meat (see Figure 2). Similarly, these countries had a 57 percent share of the pigs in the world and a 52 percent share of the poultry, but they produced only 38 percent of the pigmeat and 29 percent of the poultry meat. Almost all the camels are found in the developing countries.

The livestock resources of the study countries comprise nearly 60 percent of the world's large ruminants (cattle and buffalo) and 54 percent of its small ruminants (sheep and goats). The omission of China from the study makes a substantial difference in the number and consequently in the proportion of pigs in the developing countries, reducing their share from 57 percent to just 17 percent. With regard to poultry, the study countries account for a little less than two-fifths of the global total.

Forty-four percent of the cattle and buffalo in the study countries are in Asia, where a large number of these animals are used for draft purposes. Only 10 percent of cattle are in milk and less than 4 percent are slaughtered. Nearly two-thirds of the 360 million animals in the region are in India where most of the animals are stall fed. Next in importance is Latin America, which accounts for roughly one-third of the large ruminants. (Most of these are cattle; there are very few buffalo in Latin America, except in Brazil.) The proportion of the area under permanent pasture is about one-third of the total for the study countries. Moreover, although nearly 40 percent of the area under permanent pasture is in Sub-Saharan Africa, this region has only a quarter of the animals, as large parts of Africa cannot be used for livestock production because of disease problems. North Africa/Middle East has the smallest number of large ruminants among the regions, but it has 32 percent of the total number of sheep and goats. Asia and Sub-Saharan Africa account for a quarter each of small ruminants. Among the study countries, about 56 percent of the camels are in Sub-Saharan Africa, followed by North Africa/Middle East and Asia. As one would expect, the number of pigs in the North Africa/Middle East region is negligible. Latin America and Asia share 95 percent of the pigs. Latin America also leads in the number of poultry, closely followed by Asia. North Africa/Middle East accounts for one-seventh and Sub-Saharan Africa one-sixth of the total domesticated birds in the developing countries included in the study.

Table 2—Number of livestock in the world, by country group and region, 1979

Country Group/ Region	Cattle and Buffalo	Sheep and Goats	Camels	Pigs	Poultry
	(millions)				
World	1,336	1,540	17	762	6,444
Developed economies[a]	427	541	...	327	3,103
Developing economies[a]	909	999	16	435	3,341
All study countries[b]	814	827	16	128	2,514
Asia	361	216	3	47	827
North Africa/ Middle East	61	263	4	...	351
Sub-Saharan Africa	129	204	9	7	408
Latin America	263	144	0	74	928

Source: Food and Agriculture Organization of the United Nations, *FAO Production Yearbook, 1980*, vol. 34 (Rome: FAO, 1981).

Note: The ellipses (...) indicate a nil or negligible amount.

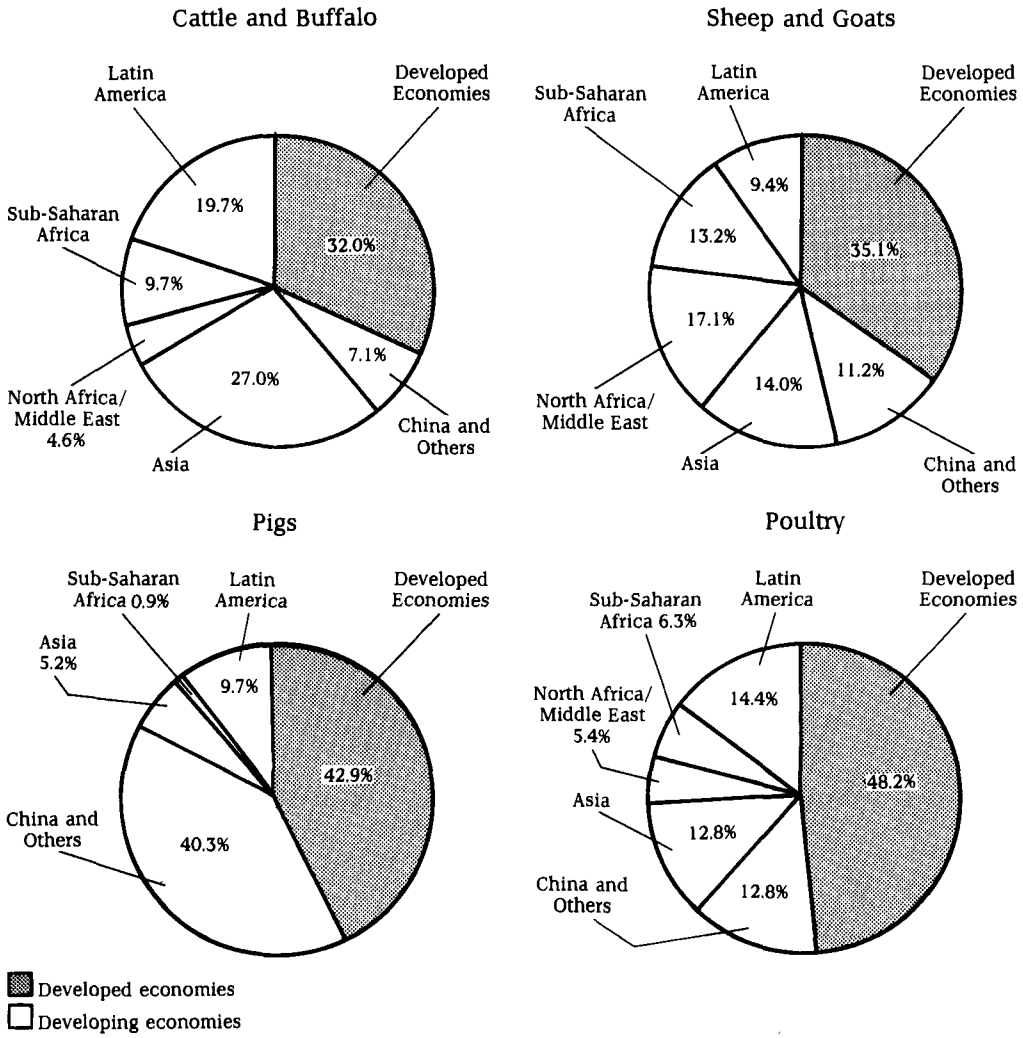
[a] Countries are grouped according to the classification system of the Food and Agriculture Organization of the United Nations.

[b] Countries are grouped according to the classification system of the International Food Policy Research Institute.

Share of Animals Slaughtered and Milch Cows in Total Stock

Comparable data on offtake percentages (that is, the ratio of indigenous animals slaughtered each year to total stock) are not available for most of the developing coun-

Figure 2—Distribution of world livestock, by region, 1979



Source: Food and Agriculture Organization of the United Nations, *FAO Production Yearbook, 1980*, vol.34 (Rome: FAO, 1981).

Note: The category China and Others includes China and a number of small developing countries that are not among the 104 study countries.

tries. However, FAO publishes data on the number of animals slaughtered, which include the net imports of live animals into the country. When these are compared to the total domestic stock plus net imports (or minus net exports) of live animals, one gets a rough idea of the slaughter percentages. These percentages reveal considerable differences among species and regions (see Table 3). Foremost among the reasons for these regional differences is the use to which the animals are put in the different countries, which in turn depends on economic, social, and religious factors. The differences among species also reflect such technical factors as the age of the animals at slaughter. The economic reasons include the lack of incentives for using concentrate feeds for

Table 3—Percentage of livestock slaughtered for meat and milch cows, by country group and region, 1973-77 averages

Country Group/Region	Livestock Slaughtered for Meat					Milch Cows
	Cattle	Buffalo	Sheep	Goats	Pigs[a]	
	(percent)					
World	18.9	5.7	34.9	34.7	95.5	17.0
Developed economies[b]	33.6	9.9	40.6	51.5	126.1	25.9
Developing economies[b]	10.3	5.7	29.1	33.6	71.0	11.9
All study countries[c]	9.7	5.3	29.1	35.5	56.8	12.2
Asia	3.3	4.5	33.9	43.2	73.7	9.8
North Africa/Middle East	15.8	27.6	34.4	32.3	99.3	25.2
Sub-Saharan Africa	10.1	...	26.9	32.1	74.9	11.4
Latin America	14.7	...	19.0	26.2	43.5	12.2

Source: Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome 1976 and 1980.

Notes: The percentage slaughtered is obtained by dividing the number of animals slaughtered (including net imports of live animals into the country) by the total of domestic stock plus net imports or minus net exports of live animals of each species and multiplying by 100. The percentage of cows in milk is obtained by dividing the number of milch animals by the total number of cattle and multiplying by 100.

[a] The percentage of pigs slaughtered exceeds 100 in some countries because more than one generation of pigs is raised and slaughtered in a year.

[b] Countries are grouped according to the classification system of the Food and Agriculture Organization of the United Nations.

[c] Countries are grouped according to the classification system of the International Food Policy Research Institute.

fattening of animals, especially in large parts of Asia.

Nearly one-fifth of the cattle in the world are slaughtered every year for meat; the proportion varies from one-third in the developed economies to one-tenth in the developing economies. The slaughter percentage for buffalo, almost all of which are in Asia and North Africa/Middle East, is 5.7 percent. Thirty-five percent of sheep and goats are slaughtered every year, although the differences between the developed and developing economies in the slaughter percentages for sheep are narrower than those for goats. In the case of pigs, the slaughter percentage is 126 percent in developed economies, indicating that more than one crop is raised and slaughtered in these countries annually. The corresponding figure for developing countries is only 71 percent.

The percentages of animals slaughtered in the study countries for different species are nearly the same as those for all developing economies, except in the case of pigs where the exclusion of China causes the slaughter percentage to fall from 71 percent to 57 percent. The higher percentage of these animals slaughtered and their large numbers in that country account for the difference.

There are considerable differences in slaughter percentages among the various regions. The percentage of cattle slaughtered in North Africa/Middle East is the highest, followed by Latin America. The lowest percentage slaughtered is in Asia where a large proportion of the cattle are used for draft purposes and for milk. Asia leads in the slaughter of goats. A larger proportion of buffalo and sheep are slaughtered in the North Africa/Middle East region. The pig slaughter ratio is lowest in Latin America.

A little more than a quarter of the total number of cattle in the developed economies are in milk annually; this proportion is more than double that for the study countries. In the world as a whole, about one-sixth of the number of cattle are in milk every year. Within the study countries, the proportion of milch cows in North Africa/Middle East is the highest, being nearly the same as the average for the developed countries. In the remaining three regions, it varies between 10 and 12 percent.

Trends in the Output of Livestock Products

World meat production increased by close to 50 percent between the early 1960s and

mid-1970s and reached about 120 million tons by the mid-1970s, increasing at an average annual rate of 3.3 percent. The developed countries produced about two-thirds of the global total. The rate of growth between the two periods was the same in both groups of countries; however, as the population growth in the developing countries was much more rapid, the increase in per capita output of meat was much slower (see Appendix 4, Table 24).

The rate of increase in the world output of milk at 1.6 percent per year was about half that of meat. The developed economies produced about four-fifths of the total during 1961-65. Their share declined over time because the Third World countries increased their milk production twice as fast as the developed economies. In the world as a whole, however, the per capita output of milk declined during this period (see Appendix 4, Table 25).

World egg production increased by about 40 percent from about 17 million tons in the early 1960s to about 24 million tons in the mid-1970s, at an average rate of about 3 percent per year. The share of developing countries in total production increased from 29 to 32 percent during this period. The rate of growth of egg production in the Third World was about 3.9 percent compared to the human population growth rate of 2.5 percent, thus signifying considerable improvement in the per capita output of developing countries (see Appendix 4, Table 26).

The difference in growth rates in livestock products in the developed and developing economies can partly be explained by demand factors. In many of the developed countries, per capita demand has nearly reached the saturation point and has tended either to level off or, more recently, to decline. Population growth is less than 1 percent per year. This has led to surpluses for which it has been difficult to find outlets on commercial terms, particularly for dairy products, and this in turn has acted as a disincentive to increasing production. On the other hand, in the developing countries population growth has been rapid, the urbanization rate has been high, and, as will be seen later, income elasticity of demand for livestock products has also been relatively high. Thus in countries where income growth was also high, the demand increased rapidly and was met in part by increased domestic production.[7]

In comparing the study countries as a group between the early 1960s and the mid-1970s, it can be seen that the output of eggs grew twice as fast as population growth (see Table 4). Meat production also grew faster than the population, but at only a slightly higher rate. For milk, however, output growth was marginally below that of population growth.

The distribution of the output increase was rather uneven among the different regions. Except in Latin America, milk production lagged behind population growth, indicating that per capita production declined during the period (see Figure 3). The decline was particularly severe in Sub-Saharan Africa where, as in many other parts of the Third World, more intensified efforts to improve dairy farming are needed. Meat production also lagged behind population growth in Sub-Saharan Africa, although in the other three regions, the former outpaced the latter. The continuing deterioration of the meat and milk situation in Sub-Saharan Africa underscores the need for special efforts to reverse the trends in that region. For eggs, output increased faster than population in all four regions, although the growth in Sub-Saharan Africa was relatively slower than in the other three. Thus in 8 out of 12 cases, output has grown faster than population. The problem areas are milk (except in Latin America) and Sub-Saharan Africa (except eggs).

The reasons for the varying performance of different regions and different types of meat can be readily explained. Over large parts of Sub-Saharan Africa and North Africa/Middle East, large and small ruminants are reared away from arable farmland by nomad tribes. In these areas, animal health is poor and mortality is high. In addition, the severe drought of the early 1970s adversely affected the livestock output in several parts of Sub-Saharan Africa. Moreover, vast areas of the continent are unsuitable for raising livestock because of trypanosomiasis, a disease carried by the tsetse fly. In other areas, ranges are degraded and pastures are badly managed, overstocked, burned over, and unfertilized. As a result of the pressure of population

[7] Food and Agriculture Organization of the United Nations, "Livestock Production: A World Perspective," in *The State of Food and Agriculture, 1982* (Rome: FAO, 1982).

Table 4—Growth of population and production of livestock products, by region, 1961-65 to 1973-77

Region	Population Growth	Production Growth		
		Meat	Milk	Eggs
	(percent/year)			
Asia	2.5	2.8	2.2	5.4
North Africa/ Middle East	2.6	3.5	2.2	6.0
Sub-Saharan Africa	2.7	2.3	1.4	3.4
Latin America	2.7	3.0	3.4	5.5
All study countries	2.6	2.9	2.5	5.3

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980; and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

growth, the area under permanent pasture is declining and the existing areas are overgrazed, which leads to low productivity.[8]

In many developing countries, on the other hand, modern, large-scale poultry and egg production enterprises have been established, largely in periurban areas. Also, there has been a decline in real prices of poultry relative to other types of meat, as a result of the increase in productivity. Cheap grain price policies have also helped in the development of the poultry industry, particularly in Latin America. Some countries in East and Southeast Asia and parts of North Africa/Middle East developed their poultry industry through imported feedgrains. The development of pig production has been similar, though the effects of technology have been smaller in pig production than in poultry.

In Asia the overall growth of meat production has been moderate, despite the rapid increase in poultry output, mainly because beef has grown slowly. As for the reasons, Lovell Jarvis notes that environmental conditions, farming systems, and consumer demand (income and cultural preferences) result in relative prices that, with the existing technology, make beef less profitable at the margin and thus limit its production.[9]

Although there are success stories in the development of milk production, such as the Operation Flood Project in India and the Integrated Dairy Project in Kenya, overall progress has been relatively slow mainly because of inadequate use of concentrate feed and the reliance on local breeds of dairy animals with low yield potential compared to the high-yielding animals raised in the developed countries. It has also been suggested that the availability of surplus dairy products in developed countries at favorable prices, either through aid or commercial imports, has had adverse effects on efforts to increase domestic milk production in some of the developing countries that have favorable ecological conditions for livestock production.[10]

In the mid-1970s Latin America had the highest per capita output of livestock products among the regions—slightly more than twice the average for the study countries for milk, two and a half times for eggs, and thrice for meat. The lowest per capita output levels were in Asia for meat and eggs and Sub-Saharan Africa for milk. The figures for Asia were largely influenced by the per capita output in India. Excluding India, the per capita output of meat in Asia was 7.4 kilograms and that of milk was 22.9 kilograms (see Figure 3).

Growth in Yield of Meat Per Animal

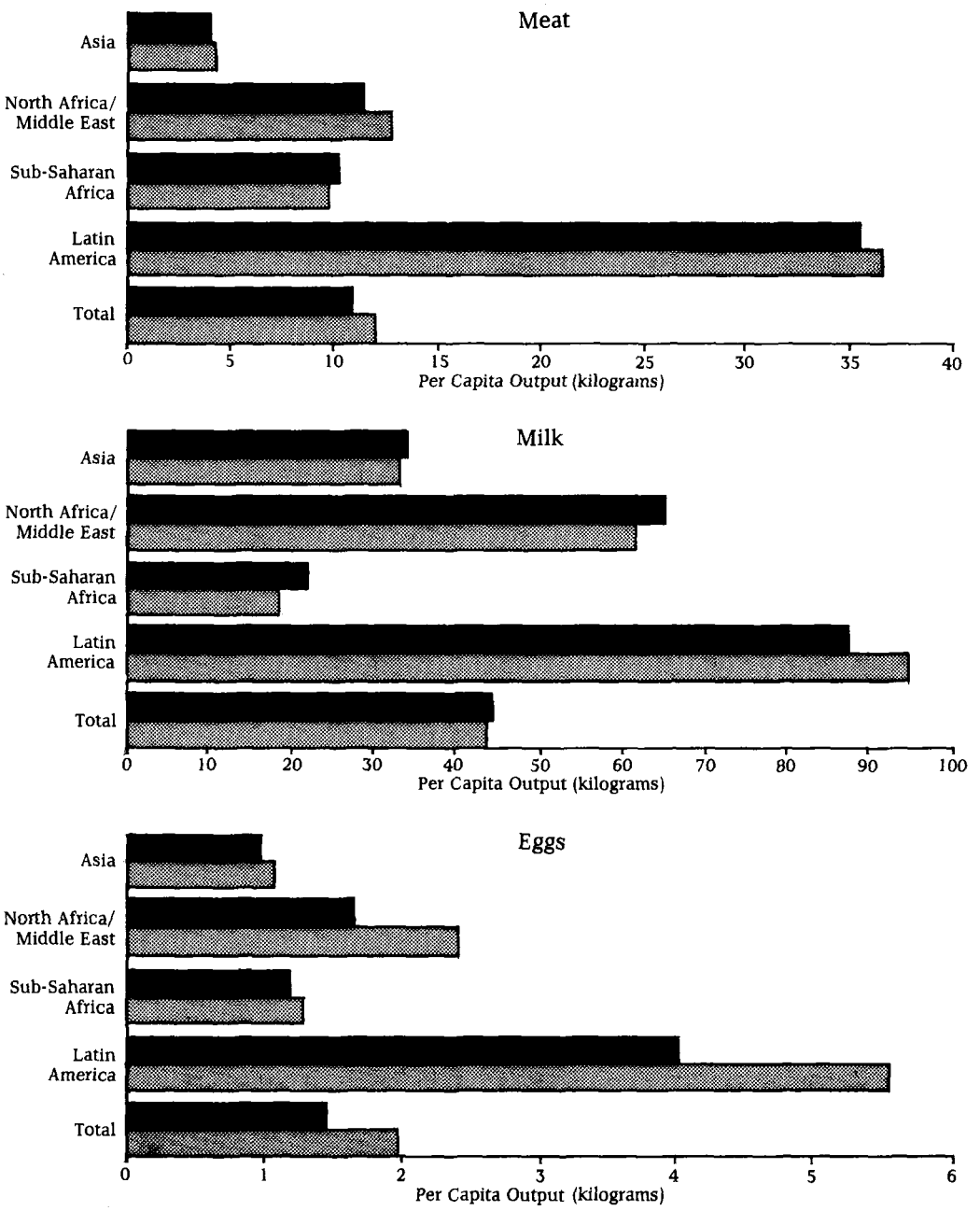
A study of the factors contributing to the growth of output of meat is not possible in the absence of data relating to the average yield of indigenous meat per animal. The available data relate to the carcass weight per animal of slaughtered livestock, including imported live animals. The estimates based on these data show that between the early 1960s and the mid-1970s, the yield of meat in the developed countries has increased by 28 percent for cattle, 45 percent for buffalo, and 12 percent for pigs. The in-

[8] FAO, *Agriculture: Toward 2000.*

[9] Lovell S. Jarvis, "To Beef or Not to Beef? Portfolio Choices of Asian Smallholder Cattle Producers," in *Livestock in Asia—Issues and Policies*, ed. Jeffrey C. Fine and Ralph G. Lattimore (Ottawa: International Development Research Centre, 1982), pp. 29-41.

[10] Addis Anteneh, "Trends in Sub-Saharan Africa's Livestock Industries," *ILCA Bulletin* 18 (April 1984): 7-15.

Figure 3—Per capita output of livestock products, by region, 1961-65 and 1973-77 averages



Sources: Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980; and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

creases for sheep and goats have been marginal (see Appendix 4, Table 27). The corresponding data for developing countries do not show any appreciable change for most of the categories of animals. Either there has been stagnation in the meat yields in these countries or, in the absence of any strong evidence to the contrary from livestock assessment surveys, the yields have been assumed constant in estimating the total output from the number of slaughtered animals.

Comparison of rates of growth in the stock and the number of slaughtered animals from 1961-65 to 1973-77 indicates that the growth in slaughtered animals generally exceeds that in stocks for all the study countries taken together. The same is true for individual regions with a few exceptions (see Appendix 4, Table 28). This trend reflects the improvement in the productivity of breeds, changes in the composition of age and sex of animals, and better management and disease control practices.

Growth in Milk Yield

The world average for annual milk yield per cow in the mid-1970s was 1,930 kilograms, an increase of 200 kilograms per animal over the early 1960s. The corresponding averages for the developed countries were 2,940 kilograms for 1973-77 and 2,480 kilograms for 1961-65. Thus the growth in milk yields in developed countries was 1.4 percent per year, the same as the growth rate in milk production, which indicates that the number of animals in milk did not increase. Milk yields in the developing countries were only one-fifth of those in the developed countries. In all developing countries yield per cow rose at a rate slightly exceeding 1 percent per year, reaching about 640 kilograms per cow in the mid-1970s. The average milk yield in the study countries was slightly higher.

Among the regions, the lowest yields were in Sub-Saharan Africa with 300 kilograms per cow. The main reasons for low yields were the poor quality of the breeds, disease, and inadequate feeding of concentrates. Latin America was the exception: yields averaged 850 kilograms during 1961-65, and they rose to 930 kilograms by 1973-77. The number of milch cows in Latin America grew twice as fast as the average for the study countries. A relatively rapid increase in yields occurred in Asia, thanks to rapid increases in India, although the overall number of animals in milk was stagnant or showed a marginal decline. Four-fifths of the milk output growth in North Africa/Middle East can be attributed to increases in the number of milch cows and the balance to rising productivity. For all the study countries taken together, increases in the number of milch cows contributed more than 60 percent of the increase in the production of milk, while the balance came from improvement in yields (Appendix 4, Table 28).

Trends in Selected Countries and Subregions

The average output of meat, milk, and eggs during 1961-65 and 1973-77 and the annual rate of change in the livestock products in the different regions, subregions, and selected countries are given in Appendix 4, Tables 29, 30, and 31.[11] Some of the highlights of these changes are discussed here.

Meat

Between the early 1960s and the mid-1970s, the output of meat in Asia rose from 3.4 to 4.8 million tons, about 40 percent. India, which was one of the larger meat-producing countries in the region, saw its share of the meat produced decline from 18.3 to 15.3 percent, because of the relatively slow growth of output of 1.2 percent per year. Meat production grew the fastest in the Republic of Korea at 7.4 percent per year, followed by Malaysia at 4.5 percent and the Philippines at 4.3 percent. In general, countries in East and Southeast Asia increased their meat output at a more rapid rate (3.3 percent) than those in South Asia (1.8 percent).

At 5.6 percent, the most rapid growth in meat output between 1961-65 and 1973-77 among the major countries in the North Africa/Middle East region was in Iran, which

[11] In each region the top 10 countries based on the average output during 1973-77 were selected, and the same 10 countries were retained for the consumption and trade tables as well.

raised its share of the regional total from 12.6 percent to 16.0 percent. In Turkey, which accounted for 28 percent of the region's production, output rose from 535,000 tons to 767,000 tons during the same period. The difference between the rates of growth in the two geographical subregions of Northern Africa and Western Asia was marginal.

In Sub-Saharan Africa the production of meat went up from 2.2 million tons in the early 1960s to 2.9 million tons in the mid-1970s. In several countries of this region, particularly in the subregion of West Africa, livestock output was adversely affected by drought in the latter period. In Ethiopia, meat output declined slightly, partly from drought and partly from the economic situation following political changes. In Nigeria, meat output growth was about 1 percent less than population growth during this period, resulting in a significant drop in per capita production. In the subregion of West Africa as a whole, the growth rate of meat output was a low 1.6 percent per year—about one-third of that in Central Africa.

Of Latin America's output of 8.1 million tons of meat in the early 1960s, Brazil and Argentina together produced 4.9 million tons, about 60 percent. By the mid-1970s, the output of the region rose to 11.5 million tons. Whereas in Brazil production rose by 4.3 percent per year to 3.6 million tons, the growth in Argentina was slower at 1.3 percent a year, with output reaching an average of 3.1 million tons during 1973-77. In both countries the share of poultry in total meat production doubled during this period. Meat output in Venezuela also grew rapidly at 6.0 percent a year. Among the subregions, meat production grew much faster in tropical Upper South America, at 4.0 percent per year, than in the temperate Lower South America subregion, at 1.4 percent. Thus there are marked differences in the output of meat between the tropical and temperate zones of Latin America. Argentina, Chile, and Uruguay, which constitute the Lower South America subregion in the IFPRI classification, accounted for 40 percent of the meat output in the mid-1970s, whereas their share of the population was 12 percent. The average productivity of cattle was higher in the temperate zone, though the number of livestock was larger in the tropical zone.[12] The growth in meat output in Central America and the Caribbean and Upper South America was much larger than that in Lower South America. Further, although per capita output increased in the tropical zone, it declined in the temperate zone during this period. Consequently, exports of meat from Lower South America also declined between 1961-65 and 1973-77.

Milk

The output of milk in Asia rose from 29.2 million tons in the early 1960s to 37.7 million tons in the mid-1970s, an increase of 30 percent. In South Asia, India's share declined from 69 percent to 67 percent, although in absolute terms milk output increased from 20.1 million tons to 25.2 million tons during the same period, largely as a result of special programs for the development of milk production. Milk production in Pakistan, which accounted for about 24.0 percent of the regional output, grew from 6.9 million tons to 9.6 million tons, 2.8 percent. The countries in the East and Southeast Asia subregion increased their milk output by 3.5 percent per year. Milk production in the Republic of Korea rose rapidly from 7,000 tons during 1961-65 to 172,000 tons in 1973-77, a staggering increase of 30.0 percent a year. Thailand also recorded an impressive 4.1 percent growth during the same period.

In the North Africa/Middle East region, four countries (Turkey, Iran, Egypt, and the Sudan) accounted for more than 70 percent of regional milk output in the early 1960s, and they maintained their share in the mid-1970s. In the early 1960s, Turkey alone held a 38 percent share of the region's milk output, but despite an increase in output, its share declined to 34 percent in the latter period. In the region as a whole the production of milk rose from 10.8 million tons to 14.0 million tons during the same period. The countries in the Northern Africa subregion had a faster rate of growth in milk output and thus increased their share from 28 percent to 32 percent.

Milk production in Sub-Saharan Africa rose from 4.6 million tons in the early 1960s to 5.5 million tons in the mid-1970s. Although

[12] Alberto Valdés and Gustavo Nores, *Growth Potential of the Beef Sector in Latin America—Survey of Issues and Policies*, paper presented at the Fourth World Conference on Animal Production, Buenos Aires, August 1978 (Washington, D.C.: International Food Policy Research Institute, 1979).

Nigeria is the most populous country in the region, with about a quarter of the region's population, its milk output was only 5.4 percent of the region's production. Nearly 60 percent of Nigeria's requirements were met from imports. Kenya, which has vast areas of highlands better suited to milk production, was the largest producer in the region with an output of 722,000 tons in 1961-65. As a result of the special efforts made to improve smallholder dairy production, output rose to 956,000 tons in 1973-77. In the West Africa subregion, milk output rose slowly at one-third the regional growth rate of 1.4 percent partly because the latter period was adversely affected by drought. In the Central Africa subregion growth was relatively more rapid at 2.2 percent per year.

In Latin America, three countries—Argentina, Brazil, and Mexico—accounted for a little more than two-thirds of the milk output in both periods. Between the two periods, however, Argentina's share declined from 21 to 18 percent, whereas Brazil's increased from 26 to 32 percent. For the region as a whole, milk production rose from 20 million tons to 30 million tons or by 50 percent. The most rapid increase in the region was in Cuba with a yearly increase of 7.4 percent. In Uruguay, however, milk output, which was the highest on a per capita basis, actually declined half a percent per year. Milk production in the Central America and the Caribbean subregion grew by 4.4 percent a year, which was faster than the regional average of 3.4 percent. As in the case of meat, countries in the temperate Lower South American subregion recorded the slowest growth, 1.7 percent, among the three subregions.

Eggs

The output of eggs in Asia rose from 0.67 million tons to 1.25 million tons or by 5.4 percent per year between the early 1960s and the mid-1970s. Countries in the East and Southeast Asia subregion doubled their output, whereas the increase in the South Asia subregion was about 31.5 percent. Pakistan and the Republic of Korea recorded high growth rates at 15.4 percent and 11.9 percent per year respectively. The growth in India was less than 0.8 percent a year, whereas in Bangladesh production of eggs declined during the period.

The production of eggs in North Africa/Middle East doubled between the early 1960s and mid-1970s. Turkey accounted for a quarter of the output during both periods, recording an annual growth of 6.6 percent; Iran's performance was even better at 9.4 percent per year. As a group, countries in the Western Asia subregion increased their output faster than those of the Northern Africa subregion, the respective growth rates being 7.0 percent and 4.3 percent.

In Latin America, Mexico recorded a rapid increase of 8.3 percent per year in the output of eggs from about 170,000 tons to 445,000 tons. The growth in the region as a whole was more moderate at 5.5 percent. The rate of growth in Argentina, at 2.0 percent per year, lagged far behind Brazil's 5.1 percent. Consequently, the growth rate in Lower South America was only 2.2 percent. In general the growth rates for the output of eggs were lower than those for poultry meat in all regions except Asia.

Composition of the Output of Meat, Milk, and Eggs

Meat

Beef and buffalo meat and pigmeat each contributed 45.2 million tons to the total output of 120 million tons in the world in the mid-1970s (Appendix 4, Table 24). Poultry accounted for 22.5 million tons of meat, while the balance of 7.2 million tons consisted of mutton and goat meat. In the early 1960s beef and buffalo meat comprised 39 percent of total meat, but this share was reduced slightly to about 38 percent in the mid-1970s, mainly because of more rapid growth in poultry and pigmeat. The developed countries held a 70 percent share of beef and buffalo meat in the mid-1970s, as compared with a 66 percent share in the early 1960s, indicating that the annual growth rate in developing countries at 2.0 percent was less than that in the developed countries at 3.3 percent. Production of pigmeat rose more rapidly in developing countries, at an annual rate of about 4.0 percent. By the mid-1970s, pigmeat's share of the total meat in developing countries had risen from 37 percent to 40 percent. In the study countries, the share of mutton and goat meat in total declined by 3 percentage points whereas that of beef and buffalo meat declined by 5 points. These reductions were balanced by an increase

of 7 percent for poultry and 1 percent for pigmeat.

Among the regions, poultry production in Asia accounted for about 13 percent of total meat in the early 1960s. This percentage increased to about 18 percent by the mid-1970s. Pigmeat gained by a little less than 1 percent, rising to 32 percent of the total during this period. The share of ruminant meats, large and small, declined from 55 to 51 percent during the same period, a decline that was experienced by other regions also.

In the North Africa/Middle East region, mutton and goat meat accounted for almost half the total meat production during 1961-65. This proportion declined to 42 percent during 1973-77. Total ruminant meat output, which was 87 percent, declined to 78 percent during 1973-77, because the share of beef and buffalo meat declined. Poultry's importance nearly doubled from 12 to 22 percent during the same period. Pigmeat was relatively unimportant in this region.

In Sub-Saharan Africa, the proportion of pig and poultry meat increased from one-sixth to a little more than one-fifth of the total meat output, with a consequent drop in other meats from 84 to 78 percent. In Latin America, poultry's share doubled from 8 to 16 percent with a sizable decrease in the proportion of large ruminant meat, down from 71 percent to 64 percent. The rising shares of pigmeat and poultry meat are the result of faster rates of growth for these animals compared to ruminants. This more rapid growth can be attributed to several factors: first, the life cycles of pigs and poultry are relatively shorter and their reproduction rates are higher; second, their production can be increased more rapidly through adoption of modern technology; and finally, more resources were moved into these industries in response to greater demand for these meats. The relative shares of different types of meat during the two periods are given in Table 5.

Table 6 gives the growth rates of output of meat by type between the early 1960s and mid-1970s. Total poultry meat output expanded by 7.5 percent per year whereas mutton and goat meat grew by 1.3 percent and beef and buffalo meat by 2.2 percent annually. The growth of output for pigmeat was also higher than that of total meat. These data indicate encouraging trends for poultry meat and pigmeat,whereas the trends for ruminant meats are disappointing. Increases in production of ruminant meats were obtained by increasing the number of animals slaughtered rather than by increasing productivity.

The structure of poultry production differed among the regions. In the higher-income and more urbanized countries of Latin America, North Africa, and Asia, 80 percent of poultry enterprise is modern. In the lower-income countries, such as Pakistan, India, Sri Lanka, Zambia, and Ghana, between one-third and two-thirds of poultry production comes from the modern commercial sector.[13]

To show how individual countries specialize in the type of meat they produce, in the mid-1970s two-thirds of the meat produced in Bangladesh was from cattle and buffalo and 58 percent of that produced in Pakistan. In the Philippines pigmeat comprised 58 percent of total meat. In Thailand, beef, buffalo meat, and pigmeat constituted 82 percent of the total. Despite the recent rise in the share of poultry meat in Latin America, beef contributed 80-82 percent of total meat in Uruguay and Argentina, 75 percent in Colombia, and 61 percent in Brazil and Chile. Pigmeat was relatively unimportant in most of the Sub-Saharan countries. In Zimbabwe, 84 percent of total meat was from cattle, whereas in Kenya, Uganda, and Tanzania cattle's share was 68-70 percent. Goat meat was important only in Somalia. In North Africa/Middle East, mutton and goat meat were the major meats produced in Afghanistan and in Turkey. Meat from large ruminants constituted 64 percent of meat production in Egypt and 55 percent in the Sudan. Poultry was important in Iran, accounting for 29 percent of total meat.

Milk

About 90 percent of all the milk produced in the world in the mid-1970s was cow milk (see Appendix 4, Table 25). Buffalo milk accounted for 6 percent of the total, the balance being distributed between sheep and goat milk. Nearly 85 percent of cow milk comes from the developed countries, which produce very little buffalo milk. On the other hand, developing countries account for nearly half of the world's sheep milk and almost three-fourths of its goat milk.

[13] FAO, *State of Food and Agriculture, 1982.*

Table 5—Shares of types of meat in total meat output, by country group and region, 1961-65 and 1973-77

Country Group/Region	1961-65				1973-77			
	Beef and Buffalo	Mutton and Goat	Pig	Poultry	Beef and Buffalo	Mutton and Goat	Pig	Poultry
	(percent)							
World	39.21	8.16	38.09	14.54	37.60	6.00	37.64	18.76
Developed economies[a]	39.25	6.61	38.63	15.51	39.62	4.44	36.18	19.76
Developing economies[a]	39.13	11.16	37.05	12.66	33.68	9.03	40.46	16.83
All study countries[b]	57.51	16.41	16.20	9.88	52.84	13.61	16.88	16.67
Asia	35.58	19.84	31.12	13.46	33.44	17.15	31.89	17.52
North Africa/Middle East	38.29	48.86	0.51	12.34	35.83	41.80	0.72	21.64
Sub-Saharan Africa	59.75	24.37	5.88	10.00	57.88	20.55	7.57	14.00
Latin America	70.76	5.08	16.43	7.74	63.85	3.37	17.04	15.74

Sources: Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.

[a] Countries are grouped according to the classification system of the Food and Agriculture Organization of the United Nations.

[b] Countries are grouped according to the classification system of the International Food Policy Research Institute.

The output of each of the four types of milk is increasing faster in the developing countries than in the developed countries. Cow milk is also the most important type of milk in the study countries. Buffalo milk constitutes about 28 percent; it is particularly important in Asia, where it constitutes nearly two-thirds of the total. In Latin America, cow milk accounts for 99 percent of the total milk output. Camel milk is important in some countries of Sub-Saharan Africa and North Africa/Middle East. With the exception of Asia, the other three regions experienced an increase in the share of cow milk in total milk production between 1961-65 and 1973-77. The ascendancy of cow milk in these regions shows the efficiency of the intensive dairy operations that are developing in many urban centers around the world. The same is true of buffalo milk operations in some Asian countries.

In Asia, Indonesia's entire milk production is from cows and 99 percent of that of the Republic of Korea (1 percent is goat milk). Buffalo milk is the most dominant type produced in Pakistan, India, and Bangladesh. In North Africa/Middle East, cow milk is more important in Afghanistan, but buffalo milk has the largest share in Egypt. In Iran, 40 percent of total milk output is from sheep and goats. In Mexico, goat milk is 5 percent of milk production. In all other countries in Latin America as well, cow milk is dominant.

In Sub-Saharan Africa the output of camel milk increased from 280,000 tons in the early 1960s to 310,000 tons in the mid-

Table 6—Growth of meat output, by type and region, 1961-65 to 1973-77 averages

Type of Meat	Asia	North Africa/ Middle East	Sub-Saharan Africa	Latin America	All Study Countries
			(percent/year)		
Beef and buffalo	2.26	2.89	1.91	2.13	2.18
Mutton and goat	1.54	2.13	0.73	-0.45	1.31
Pig	2.99	6.52	4.35	3.32	3.26
Poultry	5.07	8.42	5.08	9.29	7.49
Total	2.78	3.46	2.33	3.01	2.93

Sources: Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.

1970s, that is, at a rate of a little less than 1 percent per year. Somalia produced about 200,000 tons of camel milk in the mid-1970s followed by Ethiopia with 66,000 tons. The increase in camel milk production in North Africa/Middle East was smaller, from 110,000 tons in the early 1960s to 120,000 tons in the mid-1970s. The two most important countries producing camel milk in this region were the Sudan and Saudi Arabia.

Eggs

Almost 99 percent of total world egg output is in the form of hen eggs (Appendix 4, Table 26). Production of other eggs is relatively important only in Asia, Eastern Europe, and the U.S.S.R. The growth of egg production has been faster in the developing countries than in developed countries, and in hen eggs than in other eggs. For all the developing countries in the study taken together, the output of hen eggs has increased faster than population growth in all four regions, averaging 5.5 percent a year. Output has increased by 6.2 percent a year in Asia, 6.0 percent in North Africa/Middle East, and 5.5 percent in Latin America. At 3.4 percent, Sub-Saharan Africa recorded the lowest growth rate.

4

CONSUMPTION: CURRENT SITUATION AND PAST TRENDS

The average annual consumption[14] of livestock products during 1973-77 in the Third World countries included in this study was 22 million tons of meat, 95 million tons of milk, and 4 million tons of eggs. The distribution of this consumption among the regions roughly follows the pattern of production as modified by trade.[15] Latin America, with 16 percent of the population, consumed half of the meat, one-third of the milk, and two-fifths of the eggs in the mid-1970s. Asia consumed 42 percent of the total milk, although it had 58 percent of the population.

Per capita consumption of livestock products in the mid-1970s was highest in Latin America, followed by North Africa/Middle East. Meat intake in Latin America, at 34 kilograms per capita, was a little more than three times the average for all the study countries and about eight times that in Asia. The per capita milk consumption in Asia of 27 kilograms was less than half that of North Africa/Middle East, which was about 60 percent of that in Latin America. The lowest consumption of milk was in Sub-Saharan Africa: the average for this region was less than half that of the study countries as a whole. For consumption of eggs, the ranking among the regions was similar to that of milk (see Figure 4).

Economic Factors Affecting Growth in Consumption

The major factors influencing growth in the total domestic utilization of livestock products are growth in population; increases or decreases in per capita real incomes; income elasticity of demand; urbanization; variation in real prices; changes in tastes and preferences; and lastly, the availability of supplies.

Between the early 1960s and the mid-1970s, the population of study countries increased from 1,466 million to 1,987 million, an average rate of 2.6 percent per year. The population growth in Asia was slightly lower than this average.

Again, between 1961 and 1977 the per capita real income of the 104 countries taken together increased at a rate of 3.4 percent per year. The rate of growth in North Africa/Middle East was 4.8 percent and that of Sub-Saharan Africa was 2.1 percent, the two rates indicating the highest and lowest growth among the four regions.

The third factor influencing the domestic utilization of livestock products is the income elasticity of demand, which indicates the relationship between the rates of increase in per capita consumption and income. Coefficients of income elasticity of demand for selected livestock products and cereals for the broad regions classified by FAO are given in Appendix 4, Table 32. This table indicates that the elasticities are higher for livestock products than for cereals; the coefficients for developing economies are higher than those for developed economies; and among the livestock products, the coefficients for eggs are higher than or equal to unity for Asia and the Far East, Africa, and for the developing economies as a whole.[16] These elasticity coefficients generally explain the faster rate of growth in consumption of these products in the developing countries.

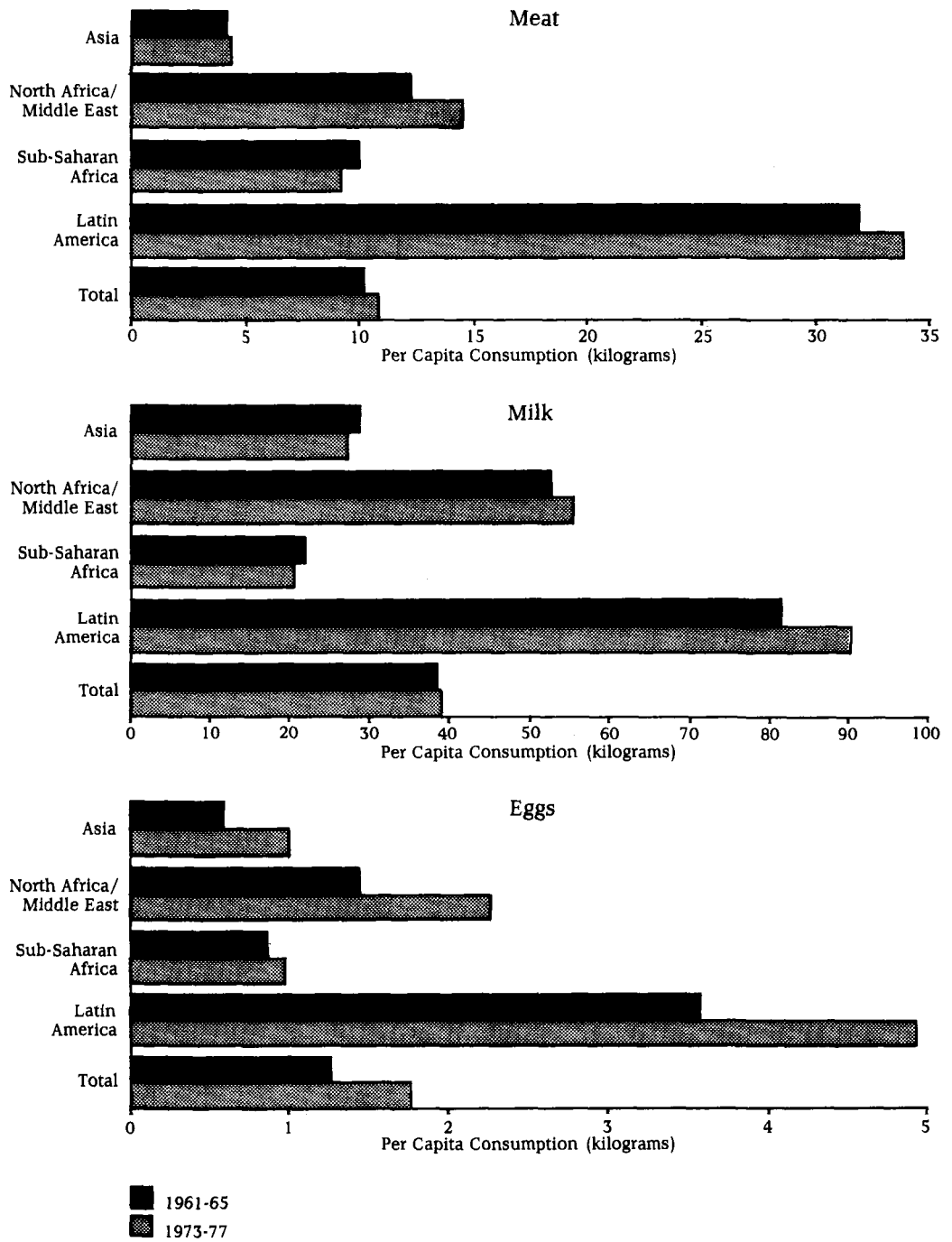
In several countries, however, supply has been a constraint, and the resulting high prices have adversely affected consumption. In the mid-1970s, net imports formed only 9.4 percent of the consumption of milk and 2.7 percent of the consumption of eggs; in the case of meat, the study countries as a whole were net exporters.

[14] Consumption refers to total domestic utilization of primary livestock products, unless otherwise specified.

[15] See Chapter 5.

[16] The names of regions are based on FAO's classification.

Figure 4—Per capita consumption of livestock products, by region, 1961-65 and 1973-77 averages



Sources: Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.
Note: Total consumption refers to total domestic utilization. Per capita consumption refers to human consumption.

Trends in Consumption of Livestock Products

Between the early 1960s and mid-1970s, growth in the aggregate domestic utilization of livestock products was most rapid in eggs, followed by meat and milk. The average annual growth rates were 5.5 percent for eggs, 3.2 percent for meat, and 2.6 percent for milk, whereas the average population growth rate was just 2.6 percent (see Table 7). There were considerable regional differences in the growth of these products. North Africa/Middle East had the fastest growth rate for consumption of meat at 4.1 percent, whereas Latin America's growth rate of 3.4 percent was the highest for milk. Egg consumption in North Africa/Middle East and Latin America rose faster than aggregate consumption for all the 104 study countries. Growth of consumption of all livestock products in Sub-Saharan Africa has been the slowest of all the regions, even lower in meat and milk than the growth of population. Consequently, per capita consumption of these products in Sub-Saharan Africa has been falling. There has also been a decline in the rate of growth of per capita consumption of milk in Asia. Elsewhere the per capita consumption of livestock products has been increasing.

Data on the average consumption of meat, milk, and eggs during 1961-65 and 1973-77 in subregions and selected countries are given in Appendix 4, Tables 29, 30, and 31. Although South Asia accounts for two-thirds of the population in Asia, its consumption of meat was less than one-third of the total for the region in the mid-1970s. India, with about half the population, consumed only one-seventh of the regional total. India and Pakistan together consumed 86 percent of the milk consumed in the region. Egg consumption in East and Southeast Asia was relatively higher; this subregion had an 84 percent share of the regional total.

Between the early 1960s and the mid-1970s, the Republic of Korea, with a per capita income growth of 7 percent per year, recorded an impressive increase of about 8 percent in consumption of meat, 19 percent in milk, and 12 percent in eggs. Although income growth in Indonesia was high at 6 percent, the growth rate in consumption of meat was less than 2 percent. Pakistan recorded the highest growth rate in consumption of eggs—17 percent. The growth rates for consumption of meat, milk, and eggs in India were relatively slow, all at about 1 percent. Consumption of eggs in Bangladesh and of milk in Burma declined during the period. In general, the growth rates in the total domestic utilization of livestock products in East and Southeast Asia were higher than those of South Asia. Religious and social aspects of consumption of particular livestock products also influenced the growth rates in individual countries.

Table 7—Growth of consumption of livestock products, by type and region, 1961-65 to 1973-77 averages

Livestock Product	Asia	North Africa/ Middle East	Sub-Saharan Africa	Latin America	All Study Countries
			(percent/year)		
Meat	2.9	4.1	2.0	3.3	3.2
Beef and buffalo	2.3	3.2	1.7	2.4	2.4
Mutton and goat	1.6	2.8	0.7	...	1.7
Pig	3.2	3.0	4.4	3.3	3.3
Poultry	5.4	9.8	4.8	9.2	7.8
Milk	2.0	2.8	2.1	3.4	2.6
Cow	2.0	3.6	2.5	3.4	3.0
Buffalo	1.9	2.5	...	...	2.0
Sheep	0.9	2.1	1.0	2.4	2.0
Goat	3.1	0.4	0.7	0.2	1.2
Camel	...	0.7	0.9	...	0.8
Eggs	5.4	6.6	3.5	5.6	5.5

Source: Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980.
Note: Consumption refers to total domestic utilization.

In North Africa/Middle East, the Western Asia subregion held a two-thirds share of meat, milk, and eggs. Meat consumption in this subregion increased at a rate higher than that in Northern Africa. The growth rate of consumption of eggs was high, about 8 percent per year, which may be directly attributed to the economic boom resulting from oil exports and remittances from workers abroad. For milk, however, consumption in the Northern Africa group of countries grew much faster than in the Western Asia subregion. Of the individual countries, Iran and Tunisia, both of which had fast income growth, each recorded annual increases in meat consumption of about 7.0 percent between the early 1960s and the mid-1970s. Milk consumption in Algeria nearly doubled during the same period, and it grew even faster in Tunisia—6.5 percent per year. Growth of egg consumption in Iraq and Iran exceeded 10.0 percent a year.

Nigeria, with 25 percent of Sub-Saharan Africa's population, consumed only one-sixth of the meat in the region. The major milk-consuming countries in the region were Ethiopia, Tanzania, Somalia, Kenya, and Nigeria. These countries accounted for more than half of the region's total milk consumption. Nigeria alone consumed about 30 percent of the eggs in the region.

Consumption of meat in Ethiopia declined between 1961-65 and 1973-77, as a result of a fall in output, but consumption of milk increased by 120,000 tons. At 5.5 percent, Zimbabwe recorded the highest growth rate in meat consumption in the region. Nigeria exhibited a 6.6 percent annual increase in milk intake, mostly because of imports, which increased nearly sixfold during the period. Annual increases exceeding 7.0 percent were recorded in the consumption of eggs in several countries. Central Africa recorded higher growth rates in consumption of all three livestock products than the other two subregions.

In Latin America the Upper South America subregion accounted for 56 percent of the regional population, 50 percent each of meat and milk consumption, and 43 percent of eggs. Between the early 1960s and the mid-1970s, Venezuela recorded the most impressive increase in the consumption of meat (6.5 percent) in the region. Milk consumption in Cuba rose at an annual rate of 7.7 percent. In eggs, four countries—Mexico, Peru, Cuba, and Venezuela—had growth rates higher than the average regional growth rate of 5.6 percent. In Uruguay the consumption of both milk and eggs declined. The rate of growth in the consumption of livestock products in Central America and the Caribbean subregion was higher than that in the other two subregions in Latin America.

Composition of Consumption

The composition of meat and milk consumption roughly follows the regional patterns of production. During the mid-1970s, beef and buffalo meat constituted 50 percent of the meat consumed in the study countries as a whole, followed by pigmeat and poultry meat at about 18 percent each. Mutton and goat meat accounted for the balance of 14 percent. Cow milk constituted nearly two-thirds of total milk consumption, and buffalo milk a little less than a quarter. The pattern of consumption has shifted somewhat since the early 1960s, with poultry meat and cow milk gaining in popularity. These changes are the results of changes in taste and increased urbanization, but they also reflect the adoption of improved production technologies in dairy and poultry farming. Table 7 gives the average rates of growth of consumption of different types of meat and milk by region. In general, the growth rates of poultry and pigmeat consumption were relatively higher than those of other meats. The fastest growth was in poultry in North Africa/Middle East, followed by Latin America. Similarly, consumption of cow milk grew relatively faster than other types of milk in all regions, with the exception of goat milk in Asia.

Beef and pigmeat each accounted for a third of total meat consumption in Asia in the mid-1970s; the remaining third was shared almost equally by small ruminants and poultry. The share of ruminant meat decreased from 55 to 49 percent between the early 1960s and the mid-1970s; poultry and pigmeat constituted the major share of meat consumption in the latter period. In Asia, buffalo milk was more important than cow milk, and there was no significant change in the ratios between the two periods.

In Latin America and Sub-Saharan Africa, beef was most important and contributed 47 percent of the total increase in meat consumption between the early 1960s and the mid-1970s. However, by the mid-1970s, poul-

try consumption was increasing rapidly, and the shares of beef and mutton and goat meat were decreasing. Cow milk constituted 99 percent of milk consumption in Latin America; this share represented a slight increase over the early 1960s and was accompanied by a corresponding decrease in the share of goat milk.

In the North Africa/Middle East region in the early 1960s, mutton and goat meat were the most important meats, followed by beef and buffalo meat. But by the mid-1970s, poultry consumption had doubled, rising from nearly one-eighth of the meat consumed to one-fourth; the share of mutton and goat meat declined to 40 percent and that of beef and buffalo meat declined to 36 percent. Consumption of pigmeat in this region was negligible. Cow milk constituted 62 percent of total milk consumed in the mid-1970s, which was an increase of 6 percent over the early 1960s. The shares of all other types of milk declined; that of goat milk falling from 15 percent to 11 percent.

Relationship of Per Capita Income to Per Capita Consumption

There is generally a positive relationship between per capita consumption of livestock products and per capita incomes, though this may not be true for every country.[17] At the regional level, when the countries are grouped according to per capita income, the relationship generally seems to hold. Appendix 4, Table 33 gives the relevant data for meat, milk, and eggs. The countries are grouped according to the level of annual per capita income.

Group	Annual Income (U.S. $/capita)
Very low income	Less than $250
Low income	$250–499
Middle income	$500–1,249
High income	$1,250 or more

For all the study countries taken together, per capita consumption of meat varied from 4.0 kilograms in the very low-income countries to 35.0 kilograms in countries with high incomes. The same is generally true at the regional level. The largest difference is in Asia where the range is from 2.8 kilograms of meat in the very low-income countries to 56.8 kilograms in the high-income countries (Fiji, Hong Kong, and Singapore). The smallest difference is in North Africa/Middle East, where per capita meat consumption ranged from 8.9 kilograms to 18.3 kilograms. In Latin America even the very low-income countries consumed 10.6 kilograms of meat per capita, which is 3.8 times the amount in Asia's very low-income countries.

The per capita consumption of milk in India, which is a very low-income country, was high. Because India's population is large, this high per capita consumption influenced the average milk consumption for all of the very low-income countries of Asia. Nigeria, which falls in the low-income group of countries, has a low per capita domestic utilization of milk (9.3 kilograms), and this influenced the average for this group in Sub-Saharan Africa. With these exceptions, the positive relationship between per capita consumption and per capita income holds good for milk also. In North Africa/Middle East, there is only one country in the very low-income group—Afghanistan—and its milk consumption per capita was high.

This relationship between income and consumption seems to be true for eggs also. The consumption of eggs ranged from 0.6 kilograms per capita in very low-income countries to 5.5 kilograms in high-income countries, as compared to the overall average of 2.0 kilograms. The highest per capita consumption of eggs was in the high-income countries of Asia, averaging 12.5 kilograms. On the other hand, the 10 very low-income countries of this region had an average intake of only 0.5 kilograms, as against 1.8 kilograms for similarly situated countries in Latin America.

Relationship of Growth Rates in Aggregate Consumption to Per Capita Income

The relationship between the growth rates in total domestic utilization of livestock products between the early 1960s and the

[17] Per capita income and per capita consumption of livestock products refer to the estimates at the country and not the household level.

mid-1970s and the growth in per capita incomes (1966-77) is also examined. The relevant data are given in Appendix 4, Table 34. Again the relationship at the regional level is generally positive although there are exceptions. In the case of meat consumption, the growth rate in countries with income growth greater than 5 percent per year is more than double that in the countries with income growth slower than 1 percent a year, for all the study countries taken together.

In the case of milk, the rate of increase in consumption in the slow-growth countries in the North Africa/Middle East region is based on only one country, the Sudan. In Latin America, milk consumption increased more rapidly in the slowest-growth countries than in the rapid-growth countries. But the figures are based on only three countries in the former group (Cuba, Honduras, and Chile) and two countries in the latter (Brazil and the Dominican Republic).

Growth in the consumption of eggs ranged from 4.0 percent in the slowest-growth countries to 6.2 percent in the rapid-growth group. Within each region, the average rate of increase in egg consumption rose consistently, with the exception of the rapid-growth countries of Sub-Saharan Africa and Latin America. In Latin America, the rate of increase in the slow-growth countries was higher than those with the slowest growth, but the growth rates in the medium- and rapid-growth groups were lower than in the two slower groups. In North Africa/Middle East, however, the rate of increase in the consumption of eggs in the rapid-growth countries was double that of the slow-growth countries.

5

INTERNATIONAL TRADE IN LIVESTOCK PRODUCTS

In the mid-1970s the study countries as a whole were net exporters of meat: their aggregate exports exceeded imports by about 300,000 tons, but their net exports declined by about 450,000 tons from the early 1960s. These countries imported nearly 9.5 million tons of milk and milk products, and they exported only about 600,000 tons, resulting in a net import of 8.9 million tons. These represent an increase of 4 million tons over the 1961-65 level. In eggs, imports were higher than exports by about 110,000 tons. Regional details of exports, imports, and net trade in meat, milk, and eggs are given in Appendix 4, Tables 35, 36, and 37.

Meat Trade

The average annual exports of meat from the study countries in 1973-77 were 1.6 million tons compared to 1.5 million tons in 1961-65, which represents only an 8.3 percent increase over the early 1960s. With imports of meat rising by nearly 80 percent during the same period, net exports declined by 60 percent. Latin America was a major net exporter of meat in the mid-1970s followed distantly by Sub-Saharan Africa. The two other regions, Asia and North Africa/Middle East, were net importers (see Table 8).

Between the early 1960s and the mid-1970s, exports of meat from Latin America increased slightly. Within Latin America, the countries in the Upper South America subregion increased their exports by 200,000 tons to 340,000 tons in the mid-1970s. The increase in the Central America and the Caribbean subregion was small at about 40,000 tons. On the other hand, meat exports from Lower South America declined by 180,000 tons mainly because consumption grew faster than production. In Argentina, meat exports declined by 30 percent from the early 1960s. Three countries—Argentina, Brazil, and Uruguay—shared nearly 70 percent of the total exports from Latin America; their share in the early 1960s was 77 percent.

The exports of meat from Sub-Saharan Africa were nearly 300,000 tons in the mid-1970s, representing an increase of more than 14 percent over the early 1960s. Two-thirds of these exports were from the Eastern and Southern Africa subregion. Namibia, Botswana, and Somalia were the principal exporters in this subregion, which contributed nearly 60,000 tons to the increase in exports. To some extent, this increase compensated for the decline in the meat exports from the West Africa subregion.

Nearly half of the meat exports from Asia in the mid-1970s were from Mongolia. In general, the exports from Asia were mostly from the East and Southeast Asia subregion.

Exports of meat from North Africa/Middle East declined from 43,000 tons in the early 1960s to 38,000 tons in the mid-1970s. Declines in Turkey, Syria, and Iran were partly offset by increases in exports from the Sudan and Lebanon. The orders of magnitude involved were small, however.

Imports of meat into the study countries increased from 0.74 million tons in 1961-65 to 1.32 million tons in 1973-77. Imports rose in all four regions, the largest increase being in North Africa/Middle East where they rose 2.8 times. In Asia, meat imports more than doubled to 422,000 tons. These two regions shared four-fifths of the increase of meat imports in all the study countries. Of the remaining increase, Latin America accounted for 93,000 tons, less than half of what it imported in the early 1960s, and Sub-Saharan Africa accounted for 14,000 tons.

In North Africa/Middle East, Iran and Saudi Arabia, which imported relatively small quantities of meat in the early 1960s, were the largest importers in the mid-1970s. Increased oil revenues made these larger imports possible. Imports of meat also increased in other oil-exporting countries in the region, namely Libya, Iraq, and Kuwait. Meat imports into Egypt were also higher in the mid-1970s. Algeria, however, reported a decline in meat imports during the period.

Hong Kong alone accounted for 70 percent of the meat imports into Asia in the mid-1970s. Four other countries—the Republic of Korea, Papua New Guinea, Singapore, and Malaysia—also increased their imports dur-

Table 8—Meat trade by region, 1961-65 and 1973-77 averages

Region	Exports		Imports		Net Trade	
	1961-65	1973-77	1961-65	1973-77	1961-65	1973-77
	(1,000 metric tons)					
Asia	100.9	135.5	204.7	421.8	-103.8	-286.3
North Africa/Middle East	42.8	37.9	142.1	397.9	-99.3	-360.0
Sub-Saharan Africa	263.5	301.2	195.2	209.2	68.3	92.0
Latin America	1,088.4	1,144.8	193.3	286.2	895.1	858.6
All study countries	1,495.6	1,619.4	735.3	1,315.1	760.3	304.3

Source: Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980.
Notes: Export and import figures include the carcass weight equivalent of traded live animals. Net trade is exports minus imports. Figures with minus signs represent net imports.

ing this period to meet an increase in demand. In the Philippines, however, imports of meat declined by more than half because increased consumption was met from increased production.

Venezuela, Brazil, and Jamaica accounted for more than half of the total imports of meat into Latin America. Their share in the early 1960s was a little more than a quarter. Imports into Chile, however, declined by nearly half, most of the increased consumption being met by higher domestic production. Of the three subregions in Latin America, only Lower South America experienced a decline in meat imports during the period.

Nigeria's imports of meat in the mid-1970s were only marginally higher than in the early 1960s. The other large meat importers in the Sub-Saharan region were the Ivory Coast, which nearly doubled its meat imports during the period, and Zaire. In the West Africa subregion as a whole, the imports of meat remained steady.

Thus, although the study countries taken together were net exporters of meat in the mid-1970s, Asia and North Africa/Middle East were net importers. Their imports, which were about 100,000 tons in each region in the early 1960s, increased to 286,000 tons in Asia and 360,000 tons in North Africa/Middle East in the mid-1970s. In Latin America, the leading exporting region, net exports of meat declined by 37,000 tons. This was partially offset by Sub-Saharan Africa, where net exports rose by 24,000 tons to 92,000 tons in the latter period.

Net exports of meat from Latin America in the mid-1970s were 7.5 percent of meat output, whereas in Sub-Saharan Africa the proportion was about 3.2 percent. Again, net imports of meat into North Africa/Middle East were about 11 percent of aggregate consumption, whereas for Asia it was 5.7 percent. For all the study countries taken together the net surplus represented less than 1.4 percent of meat output in the mid-1970s.

Milk Trade

Average milk imports increased 87 percent in the study countries between the early 1960s and the mid-1970s. In Latin America alone milk imports rose from 1.9 million tons to 3.1 million tons. During the same period exports of milk from the study countries quadrupled, though from a smaller base. Thus net imports of milk increased by 81 percent. In the mid-1970s Latin America was a major exporter, accounting for nearly two-thirds of the aggregate exports of the study countries. The level of exports in the mid-1970s was almost six times that in the early 1960s. Net imports increased 50 percent—from 1.8 million to 2.7 million tons. Exports of milk also rose rapidly in Asia, increasing 3.6 times. Exports from Sub-Saharan Africa and North Africa/Middle East were small, though they increased moderately compared to the early 1960s (see Table 9).

In Latin America more than 80 percent of the total milk exports in the mid-1970s was from Argentina. Exports from this country increased sixfold over those of the early 1960s. Almost all the exports of milk from Asia in the mid-1970s were from East and Southeast Asia. Hong Kong and Singapore together exported 65,000 tons of milk, but the bulk of it represented re-exports. Most of the exports of North Africa/Middle East were from the Western Asia subregion. These

Table 9—Milk trade by region, 1961-65 and 1973-77 averages

Region	Exports		Imports		Net Trade	
	1961-65	1973-77	1961-65	1973-77	1961-65	1973-77
			(1,000 metric tons)			
Asia	39.1	140.5	2,010.1	3,081.8	-1,971.0	-2,941.3
North Africa/Middle East	12.4	21.1	678.9	2,033.1	-666.5	-2,012.0
Sub-Saharan Africa	33.0	52.6	488.5	1,254.1	-455.5	-1,201.5
Latin America	60.8	362.3	1,871.0	3,091.1	-1,810.2	-2,728.8
All study countries	145.3	576.5	5,048.5	9,460.1	-4,903.2	-8,883.6

Source: Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980.

Notes: Export and import figures include milk and milk products (other than butter) expressed in whole milk equivalents. Net trade is exports minus imports. Figures with minus signs represent net imports.

doubled from 10,000 tons in the early 1960s to 21,000 tons in the mid-1970s.

Kenya's exports of nearly 50,000 tons of milk in the mid-1970s not only represented the largest quantity exported from Sub-Saharan Africa, but they were more than double the milk exports of the early 1960s. Total exports of milk from Sub-Saharan Africa increased by 60 percent to 53,000 tons.

With regard to milk imports, Latin America's 3.1 million tons accounted for nearly one-third of the milk imported by the study countries in the mid-1970s; milk imports into Asia accounted for another third. The share of North Africa/Middle East was 22 percent and that of Sub-Saharan Africa was 13 percent. Latin America's milk imports rose by two-thirds and Asia's by more than half between the two periods. The increases in the other two regions were more spectacular. Milk imports increased threefold in North Africa/Middle East and two-and-a-half times in Sub-Saharan Africa.

The largest importers of milk in Latin America in the mid-1970s were Mexico and Cuba; imports into Mexico increased more than two-and-a-half times over the early 1960s, while those of Cuba more than tripled. The average yearly imports of the Central America and the Caribbean subregion more than doubled. In the Upper South America subregion, milk imports into Peru rose by 200,000 tons and those into Brazil by about 100,000 tons. On the other hand, Colombia's imports declined by 63,000 tons as a result of increases in milk output in the country. In the Lower South America subregion, imports into Chile rose from 137,000 tons in the early 1960s to 216,000 tons in the mid-1970s.

In East and Southeast Asia, the Philippines imported the most milk and milk products—22 percent of the total milk imports in Asia. The other large importers were Malaysia, Thailand, Indonesia, Singapore, and Hong Kong. In the subregion as a whole, milk imports increased by 87 percent between the early 1960s and the mid-1970s. In the South Asia subregion, imports into India decreased by 175,000 tons, declining to 308,000 tons partly as a result of programs of increased milk production. However, when imports were reduced, per capita consumption declined. Imports of milk into Sri Lanka and Burma also declined during the period.

In North Africa/Middle East, Algeria's imports of milk were nearly half of those of the Northern Africa subregion, 22 percent of the regional total, and two-and-a-half times the 1961-65 level. Several countries in the region recorded substantial increases in imports of milk to meet the increased demand induced by increases in per capita incomes from higher oil revenues. For example, relative to 1961-65, milk imports in 1973-77 were eight times larger in Libya; five-to-six times larger in Saudi Arabia, Iran, and Oman; and three-to-four times larger in Syria, Tunisia, Iraq, and Kuwait. In no country in the region have imports of milk declined. These trends are expected to continue as long as the favorable foreign exchange earnings in this region continue.

The picture in Sub-Saharan Africa is similar. Nigeria alone imported nearly 400,000 tons of milk in the mid-1970s compared to 70,000 tons in the early 1960s; imports into the Ivory Coast rose four-and-a-half times to 86,000 tons. For the West Africa subregion as a whole, milk imports rose more than three-and-a-half times to 724,000 tons. The imports in the two other subregions also were impressive: 2.3 times in Central Africa

and 1.7 times in Eastern and Southern Africa.

Net imports of milk made up 9.4 percent of the total milk consumption in the developing countries. The shortages in Sub-Saharan Africa and the North Africa/Middle East regions were higher at 18.0 and 12.4 percent respectively. In Latin America the deficit was 8.4 percent and in Asia, 7.4 percent.

Egg Trade

Because of the difficulty in transporting this commodity, developing countries traditionally rely on local supplies of eggs to satisfy local demand. Thus the total egg trade for all the study countries is relatively small—a net trade deficit of about 110,000 tons in the mid-1970s. Compared to the early 1960s, average annual egg exports in 1973-77 were 10,000 tons lower, while imports were almost double the 1961-65 level of 69,000 tons (see Table 10). Imports of eggs into Asia increased slightly, while those into North Africa/Middle East, rose sharply to about 60,000 tons. Half of the net imports of eggs into the study countries were accounted for by this region in the mid-1970s. In the other two regions, imports and exports were less than 10,000 tons. In Asia, the major importer was Hong Kong. The major importers of eggs in North Africa/Middle East were Iraq, Iran, Kuwait, and Saudi Arabia; together they imported about 72 percent of the regional total.

The worsening trade position of the developing countries in livestock products is the direct result of the increasing demand for these commodities arising from higher per capita incomes and rapid population growth, despite a large increase in production of some of these products in some countries.

Composition of Meat Trade

As the demand for different types of meat and the production patterns changed, the composition of international trade in meat also changed. The composition of consumption by type of meat is sometimes influenced by the availability of imported meat.

Beef and buffalo meat constituted about 85 percent of the total meat exported from the study countries and about half of the total meat imported in the mid-1970s. In the early 1960s beef and buffalo meat held a two-thirds share of meat imports. Imports of mutton and goat meat and poultry meat increased during the period. Although the share of exports of beef and buffalo meat declined only slightly, this fall and the increase in the share of poultry meat were experienced in all regions, although the size of the changes varied from region to region.

The pattern of meat trade underwent major changes in some regions between the early 1960s and the mid-1970s. In North Africa/Middle East, for example, imports of poultry meat increased almost 10 times, but imports of beef and buffalo meat increased only 1.7 times and those of mutton and goat meat increased only 3.1 times. In Asia, imports of beef and buffalo meat declined as a percentage of total meat imports, though in absolute quantities they increased from 80,000 tons to 124,000 tons. Mutton and goat meat imports nearly tripled and pigmeat imports doubled. Imports of pigmeat into Latin America declined, while those of poultry meat increased two-and-a-half times.

Latin America continues to enjoy a comparative advantage among the developing regions in meat exports, especially beef production, because of its vast open ranges. Asia seems to have a comparative advantage in pigmeat production, though exports of pigmeat from Asia as a whole declined by 3,000 tons, falling to 10,000 tons, and imports into Asia almost doubled to 162,000 tons between 1961-65 and 1973-77. There is scope for developing export markets for mutton and goat meat in the North Africa/Middle East region, particularly in Turkey, where beef exports declined by nearly 7,000 tons, while those of sheep and goat meat increased from 10,000 tons to 13,000 tons during the period. Perhaps the investment strategy should be shifted from large ruminants to small ruminants and poultry in this region.

Meat Imports Relative to Income Growth

Sixty-two percent of total imports of meat went to developing countries with average per capita incomes of U.S. $1,250 or more in the mid-1970s, while countries with average incomes less than U.S.$250 imported only 5 percent. In Asia, Latin America, and North Africa/Middle East, the percentages of imports by high-income countries were even higher, between 69 and 75 percent of the regional totals (see Appendix 4, Table 38).

Table 10—Egg trade by region, 1961-65 and 1973-77 averages

Region	Exports		Imports		Net Trade	
	1961-65	1973-77	1961-65	1973-77	1961-65	1973-77
	(1,000 metric tons)					
Asia	14.6	5.3	48.8	56.6	-34.2	-51.3
North Africa/Middle East	4.2	10.7	10.7	61.2	-6.5	-50.5
Sub-Saharan Africa	1.1	0.6	1.2	2.3	-0.1	-1.7
Latin America	7.8	1.3	8.7	6.9	-0.9	-5.6
All study countries	27.7	17.9	69.4	127.0	-41.7	-109.1

Source: Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980.
Notes: Net trade is exports minus imports. Figures with minus signs represent net imports.

Eighty percent of the meat exports from Latin America were from countries with high incomes. As more than 70 percent of the developing-country exports were from Latin America, high-income countries held a 58 percent share of total meat exports and a 41 percent share of net exports.

When countries are grouped according to income growth, the rapid-growth countries had a 50 percent share of the aggregate meat imports, whereas the share of the slowest-growth countries was about 11 percent. Among the regions, rapid-growth countries in Asia imported nearly 80 percent of the region's meat imports. The corresponding percentage for North Africa/Middle East was 58 percent in the mid-1970s. Two-thirds of the exports from Latin America were from countries with income growth between 1 and 3 percent (see Appendix 4, Table 39).

Net Importers and Exporters

If the 104 developing countries are grouped into meat importers or exporters according to each country's net trade status during 1973-77, the growth rates of meat output between the early 1960s and mid-1970s in the importing countries are consistently higher than those in the exporting countries in each of the four regions, as well as for the Third World countries as a whole. Similarly, the growth rates of consumption are higher in the importing countries (see Appendix 4, Table 40). Self-sufficiency ratios, defined as the ratio of average production to consumption of meat in each of the two groups of countries within a region, indicate that between the two periods, the situation generally worsened in both groups for all the study countries. The positions of both groups of Sub-Saharan Africa, meat exporters of North Africa/Middle East, and meat importers of Latin America have slightly improved. For all the study countries taken together, there has been no significant difference in the per capita consumption of meat between the importing and exporting countries. At the regional level, however, except in Asia, the per capita consumption in meat-exporting countries is higher than that in meat-importing countries.

6

PROJECTIONS OF OUTPUT OF LIVESTOCK PRODUCTS, 1990 AND 2000

The outputs of meat, milk, and eggs are projected to 1990 and 2000 for each country separately, using the trend growth rates based on the annual data for 1961-77.[18] The projected outputs for each country are then aggregated for subregions, regions, and for all the study countries. In making the projections, the total output of the different types of meat for each country is considered because the growth rate of production for all the meats combined tends to be more stable than the growth rates for individual meats. The projections for milk and eggs are also based on total milk and total eggs.

If the historical trends in production of livestock products continue in the future, the 104 developing countries are projected to produce 36 million tons of meat, 131 million tons of milk, and 8.4 million tons of eggs in the year 1990 (see Table 11). Growth in the output of eggs could be most rapid, the projected level in 1990 being almost double that in 1977.[19] The increase in meat is projected at 52 percent and in milk at 44 percent.

If these trends continue to the end of the century, the study countries could produce 51 million tons of meat, 178 million tons of milk, and 15 million tons of eggs. Based on past trends, the output of eggs in 2000 could be three-and-a-half times the level in 1977, whereas the estimated output of milk could be almost double the 1977 level. The increase in the production of meat could be between these levels.

The share of different regions in the projected output of livestock products in 1990 and 2000 and the implied growth rates are given in Table 12. The distribution of meat output among the different regions is not projected to change much, although by 2000 the share of North Africa/Middle East could go up slightly at the expense of Asia and Sub-Saharan Africa. For milk, however, Latin America's share is projected to rise from 35 percent to 43 percent of the total between 1977 and 2000, whereas that of Asia could decline from 43 percent to 36 percent, because the projected growth rate of milk output in Asia between 1977 and 2000 is only 58 percent of that in Latin America. If past trends for eggs continue, the share of North Africa/Middle East could increase by 4 percent by 2000 at the expense of Sub-Saharan Africa as a result of the projected difference in the growth rates—6.7 percent and 3.9 percent in the two regions respectively.

Projected outputs of meat, milk, and eggs by regions and subregions in 1990 and 2000 are given in Appendix 4, Tables 41, 42, and 43. Latin America is projected to contribute the largest share and Sub-Saharan Africa the smallest share to the increased output of livestock products by 1990. Fifty percent of the increase in meat output over the 1977 trend estimate is projected to be in Latin America and about 20 percent in Asia. Fifty percent of the increase in milk output is also projected to be in Latin America and 32 percent in Asia. Milk production in North Africa/Middle East could go up by 6 million tons between 1977 and 1990. The projected increase in milk output in Sub-Saharan Africa could be the smallest. Latin America is projected to contribute 44 percent and Asia 32 percent to the total increase in the output of eggs between 1977 and 1990. The remaining 24 percent could be shared by North Africa/Middle East and Sub-Saharan Africa.

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[18] Trended by the formula $\ln Y_t = a + bt$ from 1961-77 data where Y_t represents the estimate of the total output in year t, a is the constant term, that is, the logarithm of the estimate in the year t = 0, and b is the logarithm of the value 1 plus the annual rate of change in the variable. Where data are incomplete, the trends were based on 1966-77 or 1970-77 data, particularly in the case of milk. An alternative method of projection would have been to project separately the number of animals and birds, the offtake ratios, and the yield per animal or bird and multiply the three to obtain projected output. The available data did not permit such refinement for most of the developing countries. The projection of total output on the basis of past trends assumes continuity of these trends, slower growth in one of the component factors being compensated for by faster growth in one or both of the other two factors and vice versa.

[19] The data for 1977 given in Chapter 6 refer to trend estimates for the year.

Table 11—Trend and projected production and growth rates of livestock products, all study countries, 1977, 1990, and 2000

Livestock Product	Trend Output 1977	Projected Output 1990	Projected Output 2000	Annual Growth Rate 1961-77	Annual Growth Rate 1977-90	Annual Growth Rate 1977-2000
	(million metric tons)			(percent)		
Meat	23.5	35.8	50.9	2.9	3.3	3.4
Milk	91.3	131.1	177.6	2.5	2.8	2.9
Eggs	4.3	8.4	14.7	4.8	5.3	5.5

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.

The data in Table 12 indicate that the most rapid rates of growth in meat and eggs between 1977 and 1990 are projected to occur in North Africa/Middle East, whereas in milk the growth rates in Latin America could be the highest.

Of the projected increase of 2.5 million tons of meat in Asia between 1977 and 1990, the East and Southeast Asia subregion could contribute as much as 2.0 million tons. The increase in output in this subregion is estimated to average 3.6 percent per year as compared to 2.0 percent in the South Asia subregion. In the North Africa/Middle East region, Iran and Turkey are projected to contribute nearly half to the increase of about 2.0 million tons of meat. The growth rates in the subregion of Northern Africa and Western Asia could be nearly the same. Brazil alone is projected to contribute 45.0 percent of the 6.5 million ton increase in meat output in the Latin America region. In Sub-Saharan Africa, the share of Nigeria in the total production of meat is projected to decline from 12.6 percent in 1977 to 11.0 percent in 1990 due to the slow growth rate projected for this country. In Ethiopia, another large producer of meat in this region, it is assumed that output will not decline below the 1977 production levels. The projected output in 1990 is represented by the 1977 trend estimate of 405,000 tons. The same assumption is made for the projected production for Chad and Niger.

Table 12—Trend and projected distribution of production of livestock products, 1977, 1990, and 2000, and projected growth rates, 1977-90 and 1977-2000, by region

Livestock Product/ Region	Region's Share of Production 1977[a]	1990	2000	Growth Rate of Projected Production 1977-1990	1977-2000
			(percent)		
Meat					
Asia	22	21	21	3.08	3.24
North Africa/ Middle East	13	14	15	3.84	3.96
Sub-Saharan Africa	13	13	12	2.94	3.11
Latin America	52	52	52	3.32	3.43
Milk					
Asia	43	39	36	2.22	2.26
North Africa/ Middle East	16	16	16	2.67	2.78
Sub-Saharan Africa	6	5	5	1.53	1.58
Latin America	35	39	43	3.76	3.88
Eggs					
Asia	32	32	32	5.32	5.45
North Africa/ Middle East	14	16	18	6.51	6.71
Sub-Saharan Africa	10	8	7	3.71	3.95
Latin America	44	44	43	5.21	5.35

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.

Notes: The projected production growth rates for country groups differ from the historical trend rates due to differences in the rates of growth of output among countries. For those countries whose past production trends are negative, 1977 trend estimates of production are used for both 1990 and 2000.

[a] Refers to trend estimates for 1977.

Most of the projected increase of 12.9 million tons in milk production in Asia is expected to come from countries in South Asia. Even among these countries, India and Pakistan together account for 90 percent of the projected increase in Asia. The milk output of these two countries together is projected to comprise nearly 92 percent of Asia's production in 1990 and 36 percent of the projected output of all the study countries in that year. The Republic of Korea and the Democratic People's Republic of Korea had

very high annual growth rates between 1961 and 1977, as both started from relatively low bases. In these two cases, a limit on growth of 8 percent per year is set for projections to 1990.

Similarly, in North Africa/Middle East the projected increase is held at 8 percent in Saudi Arabia. The output of milk is also projected to grow rapidly in Cyprus, Kuwait, and Tunisia where milk production in 1990 could be more than double that in 1977. Moreover, the Western Asia subregion could account for two-thirds of the estimated output of milk (20.7 million tons) in this region.

In Sub-Saharan Africa, countries in the Eastern and Southern Africa subregion are projected to increase their milk output by about 1 million tons between 1977 and 1990—three-fourths of the total increase in the region during this period. In Kenya, milk production is projected to rise by about a quarter of a million tons to 1.3 million tons during the same period; the increases in Tanzania and Uganda could also be large. In several countries of the region the output of milk declined during the study period, and hence the projected levels in 1990 were held at the 1977 trend levels.

Of the 20 million tons of increased milk production in Latin America, about 57 percent is projected to be from the countries of the Upper South America subregion, 33 percent from Central America and the Caribbean, and the balance from Lower South America. Five countries—Argentina, Brazil, Cuba, Mexico, and Venezuela—could share 80 percent of the total increase in the region. The most rapid increase is projected for Cuba on the basis of past trends. The other countries where milk output in 1990 is projected to be more than double that in 1977 are Costa Rica, Ecuador, Jamaica, and Venezuela.

In view of the consistently high growth rates in the output of eggs between 1961 and 1977, the projected output in 1990 is expected to be more than double the 1977 trend level in several subregions (that is, the annual rate of growth is projected to exceed 5.4 percent). These are the subregions of East and Southeast Asia, Western Asia, Central America and the Caribbean, and Upper South America. At the country level, the projected growth is also held to 8 percent per year in Pakistan and Zambia because their earlier growth was extremely rapid. The countries producing at least 100,000 tons of eggs, and where the annual increase is projected at 5.4 percent or more, are Indonesia, the Republic of Korea, Malaysia, and the Philippines in Asia; Iran and Turkey in North Africa/Middle East; Cuba,[20] Colombia, and Venezuela in Latin America.

[20] The 1977 trend level of production for Cuba was 98,000 tons.

7

PROJECTED CONSUMPTION OF LIVESTOCK PRODUCTS, 1990 AND 2000, AND PROJECTED SURPLUSES AND DEFICITS

The demand for direct human consumption of each of the livestock products—meat, milk, and eggs—is first projected for each country using the trend estimate of per capita consumption in 1977, per capita growth in income, and projected population. To these estimates are added the milk required for feed, eggs for breeding, and allowances for waste (see Appendix 2 for details). The country estimates are aggregated to give the projected consumption of each subregion, region, and the total for the 104 study countries. Before reviewing the results of these projections, the estimates of population and per capita income growth rates used in this study are discussed.

Population Growth

The population of the 104 developing countries, based on the United Nations' medium variant population projections for individual countries, is estimated to increase from 2.1 billion in 1977 to 2.9 billion by 1990. This represents an annual compound growth rate of about 2.6 percent, an average annual increase of 63 million people. Among the different regions, the slowest growth of 2.4 percent is projected for Asia, which with an estimated population in 1990 of 1.6 billion would account for 56 percent of the total population of the countries covered by the study. Half of the projected total annual increase in the Third World population would be from Asia. The population of North Africa/Middle East is projected to increase from 240 million to 345 million between 1977 and 1990, an annual growth rate of 2.9 percent. Sub-Saharan Africa is expected to have the highest population growth among the regions, nearly 3.1 percent, with a projected population of 461 million. Latin America's population is expected to show an average annual increase of 10.5 million, bringing it to 470 million by 1990. Latin America and Sub-Saharan Africa could account for about 16 percent each of the Third World population in 1990.

By the end of the century, the total population of the study countries is projected to reach 3.6 billion, an average compound growth rate of 2.4 percent per year over 1977. The growth rates between 1990 and 2000 could be lower than those between 1977 and 1990 in all the regions, although in some countries, particularly in Sub-Saharan Africa, they may still be rising. The share of Sub-Saharan Africa in the Third World population is projected to increase to about 17 percent in 2000.

Per Capita GNP Growth

If the 1966-77 growth rates in GNP in the individual countries continue to 1990, the resulting overall growth rate of GNP for all the study countries taken together during the period 1977-90 could be 6.7 percent per year. The fastest growth in GNP is projected to be in North Africa/Middle East at 7.5 percent, followed by Sub-Saharan Africa at 7.0 percent. The slowest growth, 5.7 percent, is projected for Asia. In Latin America, the GNP could grow by 6.8 percent per year during this period, if past trends continue. The growth in per capita income of the study countries taken together is projected at about 4.0 percent. Here again the growth rate in per capita income in North Africa/Middle East could be the highest (4.5 percent) and that of Asia the lowest (3.3 percent). At 4.0 percent, the growth rate of per capita income in Latin America is projected to be slightly higher than that in Sub-Saharan Africa.

If the growth rates of GNP are extended to 2000, the overall per capita income growth during the 1977-2000 period is projected at 4.3 percent per year. The distribution of the projected growth rates of per capita income among the regions during the three periods 1966-77, 1977-90, and 1977-2000 is given in Table 13.

Table 13—Growth of per capita income, 1966-77, and projected growth rates, 1977-90 and 1977-2000, by region

Region	Growth Rates of Per Capita Income		
	1966-77	1977-90	1977-2000
	(percent/year)		
Asia	3.30	3.30	3.76
North Africa/ Middle East	4.66	4.52	4.65
Sub-Saharan Africa	3.13	3.85	4.16
Latin America	3.51	4.05	4.24
All study countries	3.70	4.03	4.30

Sources: Calculated from basic data in World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); World Bank, *1979 World Bank Atlas* (Washington, D.C.: World Bank, 1979); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

The 1966-77 reference period for the growth in per capita income was chosen to synchronize with the period for which consumption was trended. Further, maximum and minimum limits on annual per capita income growth rates were set at 6.0 percent and 0.5 percent respectively. In projecting consumption, the per capita income growth rate for each country is utilized. However, the rates for the average per capita growth of income presented in Table 13 are computed using the trend estimates of per capita income weighted by the projected population in the first and last years of the relevant period. Because of the weights adopted, the average growth rates for the periods 1977-90 and 1977-2000 generally show faster growth than during the period 1966-77.[21]

The income growth rates for Sub-Saharan Africa and Latin America may appear to be too high if the more recent trends in income are considered. The rates in Sub-Saharan Africa are influenced by the projected growth for Nigeria, which is constrained at 6 percent per year. Excluding Nigeria, the growth rates of per capita income in the rest of Sub-Saharan Africa are projected to be 1.6 percent per year during 1977-90 and 1.7 percent during 1977-2000. In Latin America, in light of the mounting debt repayment problems faced by many of these countries, assuming that past trends will continue in the future may not be realistic.

Even in the other regions, doubts have been expressed as to whether the high growth rates in per capita income during 1966-77 are likely to continue in the future. As the result of improvements in agricultural technologies and institutions, increasing adoption of outward-looking industrial policies, and favorable external conditions, the 1966-73 period witnessed extraordinarily high economic growth among developing countries. Subsequently, however, the two oil shocks of 1974 and 1979-80, the ensuing recession and protectionism in the countries belonging to the Organization for Economic Cooperation and Development (OECD), and mounting debt repayment problems slowed economic growth in developing countries.

At the present time, structural adjustments are being undertaken in several developing countries that promise improvements in the efficiency with which resources are allocated and used, enhancing the prospects of better economic performance in the future. Economic recovery and a retreat from protectionist policies in the OECD countries would reinforce the capacity of developing countries to raise their economic growth rates above the unusually low levels of 1980-83. Thus, although the assumption that 1966-77 growth will continue to 1990 and 2000 may not appear realistic at present, it is equally unrealistic to assume that the slower growth rate of 1980-83 will continue. Moreover, IFPRI's food gap analyses are done with particular concern for the food situation as it may be at such time as the developing countries succeed in accelerating their economic growth. However, the likely demand if per capita incomes grow more slowly, say, 25 percent less rapidly than the 1966-77 trend, is also presented as an alternative scenario. Estimates of future consumption requirements based on 1977 per capita consumption (trend), that is, only taking into

[21] Without the imposition of upper and lower limits on the per capita income growth at the country level, the overall average per capita income growth between 1977 and 2000 for all the study countries taken together would have been 5.3 percent per year.

account the effects of rising population, are also given.

For Latin America and Sub-Saharan Africa, the slower growth scenario may be more relevant, especially for the 1977-90 period. In any case, demand projections based on trend income growth could serve as a benchmark against which those projections based on lower income growth could be measured.[22]

Income Elasticity of Demand

The income-elasticity coefficients used in the study are based on those available from FAO, which give estimated values of coefficients for each of the quinquennial years 1975 to 2000.[23] These have been used separately for cattle and buffalo meat, mutton and goat meat, pigmeat, poultry meat, milk, and eggs for each country.

IFPRI's projections of demand and supply assume constant relative prices. Objections to this procedure may be raised on the grounds that if such projections show a widening gap between demand and supply, prices might actually rise, resulting in constrained demand and augmented supplies. Eventually the gap would disappear and the projections would be wrong. The extent to which the demand is constrained and supplies are augmented depends upon the availability of substitutes and on the potential for increased production. Alternatively, the gap may be bridged through imports if foreign exchange and foreign supplies are not constraints. Thus it is difficult to forecast the price level at which demand and supply would balance. As will be explained later, IFPRI projections are not intended to serve as forecasts but only as pointers of possible supply-demand imbalances under certain assumptions. Thus they serve as indicators of the domestic supply gaps, under constant prices or alternatively as import requirements from the global market. Further, in the case of livestock products, data on the price elasticities of demand and supply are only available for some developing countries in some regions. In this context, constant price projections may be more defensible than those based on assumed (uncertain) prices and price elasticities.

Projections of Consumption of Livestock Products

Projections of production and consumption and surpluses and deficits of meat, milk, and eggs for 1990 and 2000 together with corresponding trend estimates for 1977 by subregion and region are given in Appendix 4, Tables 41, 42, and 43.

Meat

Based on the assumptions regarding population growth, trends in per capita income, and income elasticity of demand, the projected consumption of meat in 1990 is estimated at 43.8 million tons for the 104 study countries taken together, compared to 23.2 million tons in 1977.[24] Forty-three percent of this increase of 20.6 million tons is contributed by growth in population and the balance by growth in per capita income. At 5.0 percent, the annual compound growth rate of meat consumption is nearly double the projected population growth and one-and-a-half times that of the projected production growth. As the output of meat in 1990 is projected to be 35.8 million tons, the Third World study countries could experience a deficit of 8.0 million tons or a little less than one-fifth of projected consumption (see Table 14). Their average per capita consumption of meat could increase by 2.4 percent per year.

If these trends continue beyond 1990, the total consumption of meat is projected to reach 71.8 million tons by the end of the century—an increase of 48.6 million tons above 1977. Of this quantity, one-third could be due to the increase in population and two-thirds to the effect of increases in per capita income. The corresponding output projection for 2000 is 50.9 million tons. The resulting gap between projected production and demand in 2000 could widen to 20.9 million

[22] One must also remember that the projected trend income growth rates cover the periods 1977-90 and 1977-2000; thus any slackening of growth during 1980-83 will have to be made up during the remainder of the projection periods.

[23] See Food and Agriculture Organization of the United Nations, "Parameters of the Demand Functions," fifth run, April 1978 (computer printout).

[24] The data for 1977 refer to trend estimates for the year.

Table 14—Projected consumption and net surplus or deficit of meat, under alternative assumptions, all study countries, 1990 and 2000

Assumption	Projected Consumption		Net Surplus/ Deficit	
	1990	2000	1990	2000
	(million metric tons)			
At 1977 per capita trend levels	32.1	40.1	3.7	10.8
Trend income growth	43.8	71.8	-8.0	-20.9
Lower income growth	39.7	61.2	-3.9	-10.2

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Parameters of Demand Functions, Fifth Run," Rome, April 1978 (computer printout); World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

Notes: Consumption refers to total domestic utilization. Deficit refers to the gap between projected production and consumption. For estimates of projected production, see Table 11. A minus sign indicates a net deficit.

tons, which is 30 percent of the projected consumption and about two-and-a-half times the deficit projected for 1990 under the trend income growth assumption.

If the Third World countries experience slower growth, say, 25 percent less than the 1966-77 trend, the total consumption of meat in 1990 is projected to be 39.7 million tons for the 104 study countries. If the 1961-77 trends in meat output continue, the gap between the projected demand and supply could be 3.9 million tons, which is nearly half that under the trend income growth assumption. Under the lower income growth assumption this gap could widen to 10.2 million tons by 2000, the projected demand for meat in that year being 61.2 million tons and that for output, 50.9 million tons.

Estimates of aggregate meat consumption are 32.1 million tons in 1990 and 40.1 million tons in 2000 computed at the 1977 trend estimates of per capita consumption. Thus projected production is expected to exceed projected consumption by 3.7 million tons in 1990 and 10.8 million tons in 2000. Because the income elasticity of demand for meat is relatively high, the projected gaps between the meat supply and demand in 1990 and 2000 are sensitive to the assumed rates of per capita income growth. By 2000, even under the lower income growth assumption, the projected deficit would amount to 16 percent of the estimated consumption. Thus, if Third World countries are to achieve self-sufficiency in meat, the growth in meat output has to be accelerated from a projected 3.4 percent a year to 4.3 percent a year under the low income growth assumption and to 5 percent a year under the trend income growth assumption.

This is not meant to suggest, however, that trade balance at the regional level or for all the study countries is the ultimate goal. Until the mid-1970s developing countries were exporters of meat; now they have become net importers. Further, newly industrialized countries like the Republic of Korea have met their increased meat demand through domestic production. In fact, whether increased demand should be met from imports or domestic production depends on a variety of factors, including the landed cost of imports, availability of foreign exchange, potential for production, and domestic prices.

Projections of production, consumption, and net surpluses and deficits of meat under alternative assumptions are given in Appendix 4, Table 41. A broad picture of regional and subregional production and consumption in 1990 and 2000 is presented here.

Latin America could retain the largest share—45 percent—in the projected consumption of meat in the Third World in 1990, although it may account for only one-sixth of the population. The increase in meat consumption in this region is about 40 percent of the total increase in all the study countries. North Africa/Middle East and Sub-Saharan Africa together could account for one-third of the Third World consumption of meat. Their share of the population is 28 percent.

In Latin America, where per capita consumption of meat is high, the projected growth rate is expected to be the lowest among the regions at 4.2 percent per year during the period 1977-90. This exceeds the projected production growth by 0.9 percent and is 1.5

percent per year higher than the population growth. The most rapid growth in meat consumption would be in North Africa/Middle East: it would be 50 percent higher than that in Latin America. The contribution of population to this growth would be 36 percent. Although production is also projected to grow rapidly in the North Africa/Middle East region, consumption growth may be even more rapid; thus, the projected deficit in this region could increase to 3.0 million tons by 1990.

Consumption growth in Sub-Saharan Africa is projected at 5.7 percent per year between 1977 and 1990 if the most populous country, Nigeria, again reaches 6.0 percent annual per capita income growth. The projected growth in population is 3.1 percent in this region. Production growth is projected to be lower than population growth and is nearly half the consumption growth. Hence the pace of increase in production would need to double to match consumption growth. In Asia, consumption of meat is projected to grow at 5.3 percent per year. This exceeds the annual rate of increase in production by 2.2 percent. Thus, if the 1966-77 income growth rates continue, consumption is projected to grow faster than both production and population in all the regions.

A country is classified as surplus or deficit depending on whether its projected production exceeds or is exceeded by its projected consumption. The sum of all surpluses is the gross surplus and the sum of all deficits is the gross deficit for each group of countries; the difference between these gross sums gives the net surplus or deficit, as the case may be, for a subregion or region. The same procedure is applied to all the Third World countries taken together. The net deficit of 8.0 million tons of meat projected for 1990 for all the study countries is the difference between the gross deficit of 9.8 million tons and the gross surplus of 1.8 million tons. This compares with a net surplus of 0.3 million tons in the mid-1970s, which represents 1.6 million tons of exports and 1.3 million tons of imports.

In South Asia, the growth in meat consumption is projected to exceed that in output by 2.5 percent per year; the corresponding difference in the East and Southeast Asia subregion is 2 percent. Although the rate of growth in consumption in the latter subregion is projected to be higher, the output growth projection is also higher. The net deficit in East and Southeast Asia is projected to be 1.9 million tons, the projected consumption of 7.3 million tons exceeding the estimated production of 5.4 million tons. The aggregate net deficit in the South Asia subregion could be 800,000 tons.

Nearly three-fourths of the projected net deficit of 3.0 million tons of meat in the North Africa/Middle East region is accounted for by Western Asia, where the estimated consumption of 5.4 million tons could exceed the projected output by 2.3 million tons. The net deficit in the Northern Africa subregion could be smaller at 720,000 tons of meat.

In the Sub-Saharan Africa region, Nigeria is projected to have the largest meat deficit, with an estimated shortfall of more than 1.0 million tons out of a total regional net deficit of 1.4 million tons in 1990. Thus if per capita income in Nigeria grows at an average rate of 6 percent per year, the projected consumption of 1.6 million tons would be more than three times the projected production of 0.5 million tons. By excluding Nigeria, the gap in Sub-Saharan Africa could be reduced to 0.3 million tons. In the Eastern and Southern Africa subregion, meat surpluses are likely in some countries, although the subregion is projected to have a deficit of more than 100,000 tons. Though the growth rate in production would be higher than that in consumption in Central Africa, the subregion will probably have a small deficit of less than 50,000 tons.

Latin America, which was a net exporter of meat in the mid-1970s with net exports of 0.9 million tons, is projected to have a deficit in 1990: the estimated production of 18.7 million tons falling short of projected consumption by 0.9 million tons. This deficit is less than 5 percent of the projected 1990 production. In the Central America and the Caribbean subregion, both production and consumption are projected to grow about 4 percent per year, with consumption having an edge over production. The subregion may continue to show a surplus, though the size of the surplus could be quite small. Lower South America, which is in the temperate region, may show a surplus, mainly because Argentina and Uruguay both have large surpluses projected. The main deficit is projected for Upper South America, which might have a shortfall of 1.6 million tons, of which Brazil alone could account for 1.1 million tons, the estimated consumption of 8.0 million tons exceeding the projected production of 6.9 million tons. Colombia is another country in this region that is projected to have a large meat deficit in 1990, if past trends continue.

The current concern in Latin America, however, is where and how to find a more stable, faster-growing market outlet for livestock products. Clear signals of a strong demand would elicit an impressive output response for livestock products in most of Latin America.

The estimated consumption of meat in Latin America in 2000, based on the trend income growth assumption, could be nearly 40 percent of the total for study countries, whereas Asia's share could be 24 percent and that of North Africa/Middle East, 20 percent. All four developing regions are projected to have a meat deficit in the last decade of the century. The net deficit in meat in Asia in 2000 could be about two-and-a-half times larger than in 1990, while that of Latin America could be three times larger and that of Sub-Saharan Africa could be three-and-a-half times larger. Moreover, the gaps between projected production and consumption of meat in 2000 are projected to be particularly large in Asia and North Africa/Middle East, each amounting to about one-third of the aggregate deficit for all the study countries. Again, if the projected trend income growth fails to materialize in Latin America and Sub-Saharan Africa, the projected deficits could be lower.

An analysis similar to that in Chapter 4, showing the relationship between per capita income and per capita consumption, is done for projected production, consumption, and net surplus or deficit of meat in 1990. The projections classified by 1977 per capita income and the trend growth rate of income are given in Appendix 4, Table 44.

Countries with per capita income exceeding $1,250 account for nearly half of the projected production and 44 percent of the projected consumption of meat, though their share of the population would be barely 15 percent. At the other end, countries with incomes below $250 per capita, accounting for more than half of the population, have only a one-sixth share of projected production and consumption of meat. When grouped according to per capita income growth rates, nearly half of the population is in the 1-3 percent range. Their share of total production of meat is about 38 percent and of consumption about 32 percent. The countries with rapid income growth share one-fifth of the population. They account for 30 percent of meat output and 36 percent of total domestic utilization. Nearly two-thirds of the net deficit is from this group of countries. In the countries with very slow growth, the projected output and demand almost balance.

Milk

Assuming that past trends in per capita income continue, the consumption of milk in 1990 in the 104 study countries is projected at 166 million tons compared to 100 million tons in 1977, showing an increase of 66 percent in 13 years or an annual increase of about 4 percent.[25] This rate is 1 percent lower than the growth in meat consumption. Of the increase in milk consumption, 37.4 million tons are contributed by the increase in population and the balance by the increase in incomes. The growth of milk consumption is roughly one-and-a-half times that of population. During the same period, milk output is projected to grow 2.8 percent per year, slightly more than the population growth but 1.2 percent per year less than the consumption growth. Thus the Third World countries in the study are projected to have a milk deficit of about 35 million tons (in whole milk equivalents) in 1990 (Table 15). This is about 21 percent of the projected consumption of milk and relatively higher than the projected deficit for meat. At the aggregate level, the per capita total domestic utilization of milk is expected to grow at an annual rate of about 1.4 percent between 1977 and 1990.

By 2000, if these trends continue, the total demand for milk is projected to reach 242 million tons or a little less than two-and-a-half times the 1977 level. About 57 percent of this increase is from population growth and the balance from income growth. The corresponding output projection for 2000 is placed at 177.6 million tons of milk, widening the gap between the projected production and consumption to 64.4 million tons, which is more than six times the shortfall in 1977. Thus the deficit in milk is projected to increase from 9 percent in 1977 to 27 percent of the estimated consumption in 2000 if past income trends continue.

Under the slower income growth assumption, the total consumption of milk in 1990 is projected at 158.3 million tons for the study countries. If the 1961-77 milk output trends continue, the gap between the projected

[25] Consumption denotes total domestic utilization of milk and milk products expressed in whole milk equivalents.

Table 15—Projected consumption and net surplus or deficit of milk, under alternative assumptions, all study countries, 1990 and 2000

Assumption	Projected Consumption		Net Surplus/ Deficit	
	1990	2000	1990	2000
	(million metric tons)			
At 1977 per capita trend levels	137.4	173.6	-6.3	4.0
Trend income growth	166.1	242.0	-35.0	-64.4
Lower income growth	158.3	220.5	-27.2	-43.0

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Parameters of Demand Functions, Fifth Run," Rome, April 1978 (computer printout); World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

Notes: Consumption refers to total domestic utilization. Deficit refers to the gap between projected production and consumption. For estimates of projected production, see Table 11. A minus sign indicates a net deficit.

demand and supply could be 27.2 million tons compared to the deficit of 35 million tons under the trend income growth assumption. By 2000, this gap could widen to 43 million tons, the projected demand for 220.5 million tons exceeding the projected output of 177.6 million tons. Thus even under this alternative assumption the projected gap is about five times the net deficit in 1977.

Basing the consumption requirements on the 1977 per capita level, the aggregate demand for milk is projected at 137.4 million tons in 1990 and 173.6 million tons in 2000. Subtracting the demand from the projected production leaves a milk deficit of 6.3 million tons in 1990 for the study countries as a whole. By 2000, however, the projected production would exceed the projected demand by nearly 4 million tons. This shows that if past output trends continue, there could be enough milk to just maintain 1977 levels of per capita consumption. If income effects are also taken into account, growth in milk output would need to accelerate to 4.3 percent per year. Projections of production and consumption and net surplus and deficits of milk under alternative assumptions are given in Appendix 4, Table 42.

Among the regions, the highest growth rate in milk consumption between 1977 and 1990 is projected to be in Sub-Saharan Africa where current consumption is low. The lowest growth rate could be in Asia. The growth rate in Latin America might be on a par with the rate for all the study countries taken together. The gap between the growth rates in consumption and production of milk would be largest in Sub-Saharan Africa and smallest in Latin America.

Projected consumption of milk in Asia in 1990 is about 65 million tons or 40 percent of the total for all the study countries. Of this, South Asia accounts for 57 million tons, two-thirds of which is projected to be in India. If past trends continue, the gap between projected production and consumption in India could be 5.6 million tons out of a projected deficit of 7.4 million tons in the South Asia subregion. In the East and Southeast Asia subregion, the gap is projected to be 6 million tons. Thus the net deficit in Asia adds up to 13.4 million tons. The estimated demand for milk in 1990 in Asia at the 1977 per capita trend level is 55 million tons. Even at this level, and if the projected production materializes there could be a net deficit of 3.3 million tons.

The consumption of milk in Latin America in 1990 is projected at 57 million tons, a little more than half of which is accounted for by the tropical and heavily populated Upper South America subregion. Even though production in Latin America is projected to grow by 3.8 percent, it falls short of consumption growth, which is estimated at 4.0 percent. Thus the net deficit of 2.5 million tons in the mid-1970s could rise to 5.4 million tons by 1990. The temperate Lower South America subregion, however, could have a surplus of 600,000 tons, largely because of the projected surpluses in Argentina.

Two-thirds of the 30.8 million tons of milk consumed in North Africa/Middle East could be accounted for by the Western Asia subregion in 1990. The projected growth in consumption in the Northern Africa subregion is faster than that in Western Asia by about 0.9 percent per year. The net deficit in the latter subregion is projected at 6.1 million tons, whereas that in the Northern African

subregion amounts to 3.9 million tons, making a total deficit of 10 million tons in the region. This is nearly one-third of the projected consumption in 1990.

The most rapid growth in milk consumption among the subregions is projected in West Africa, where the total domestic utilization is expected to rise from 2.2 million tons to 5.2 million tons, an annual rate of 6.7 percent. On the other hand, the production of milk is projected to grow at the lowest rate among the subregions—about 1 percent per year. Thus the deficit is projected to grow from about 753,000 tons in the mid-1970s to 3.6 million tons in 1990 in West Africa. Of this, Nigeria alone could have a deficit of 2.6 million tons. In the Eastern and Southern Africa subregion, the projected consumption of 7.2 million tons could exceed the projected production by 2.1 million tons. The projected net deficit in Central Africa is about 400,000 tons. The net deficit in Sub-Saharan Africa is thus projected at 6.1 million tons.

All four regions are projected to continue to have a net deficit in milk in 2000. The net deficit in Latin America—about 5 percent of the total—is the smallest. On the other hand, the net deficit in Asia could be about 40 percent of production, which would be nearly double the shortfall between projected production and consumption in 1990. The size of the gaps in milk in North Africa/Middle East and in Sub-Saharan Africa could also be double the 1990 deficits.

When the countries are grouped by per capita income and by growth rates of income, and when production, consumption, and the net deficit of milk are projected to 1990, milk's position is slightly different from that of meat (see Appendix 4, Table 44). Countries with very low incomes hold larger shares of milk production and consumption than meat, although these proportions are much smaller than their share of population. Countries with high income growth hold shares of output and consumption of milk that are nearly two to two-and-a-half times their share of population. The share of milk consumption in the countries belonging to the $250-499 a year income group is only about 10 percent, although their share of population exceeds 20 percent.

The group of countries with growth rates of per capita income ranging from 1 to 3 percent a year is projected to produce 60 percent of the total output of milk and to consume 54 percent of the total offtake of milk. Both these percentages exceed their population shares. That for milk, in particular, reflects the higher per capita milk consumption in India, which falls in this group. The rapid-growth countries are expected to produce and consume about the same share of milk as their share of population. The countries with very slow growth, which account for one-sixth of the population, could account for 8-9 percent of the total production and consumption.

Eggs

With the relatively high income elasticities of demand for eggs in several countries, the projected consumption of eggs in 1990 in the Third World countries is estimated at 8.7 million tons, provided past trends in income growth continue, which is a little less than double the level in 1977. During the same period, the production of eggs is projected at 8.4 million tons, leaving a gap of 0.3 million tons as compared to the net deficit of 0.2 million tons in 1977. Nearly half the projected increase in consumption of 4.2 million tons of eggs may be attributed to population growth. In percentages, the projected growth in the total domestic utilization of eggs at 5.2 percent is marginally lower than the projected growth of output. Taking into account the growth in population, the annual increase in per capita consumption works out to 2.5 percent (see Table 16).

If the per capita income trends continue to 2000, the total domestic utilization of eggs in that year is projected to reach 14.7 million tons, which is about the same as the projection for output. It is 68 percent higher than that projected for 1990 and more than thrice the 1977 level. Growth in consumption of eggs during the period 1977-2000 at 5 percent a year is expected to be half a percent less than that of projected output.

Under the slower growth assumption, the consumption of eggs is projected to total 8.1 million tons in 1990 and 12.6 million tons in 2000. If the 1961-77 growth rates in egg production continue, a surplus of eggs is projected for the Third World study countries taken together. The surpluses could be large in Latin America and Asia in both 1990 and 2000. In Sub-Saharan Africa net deficits are projected even under the conservative income assumption.

If the demand estimates are reworked at 1977 per capita levels, the eggs required in 1990 would be 6.5 million tons and in 2000, 8.6 million tons. These are much lower than

Table 16—Projected consumption and net surplus or deficit of eggs, under alternative assumptions, all study countries, 1990 and 2000

Assumption	Projected Consumption		Net Surplus/ Deficit	
	1990	2000	1990	2000
	(million metric tons)			
At 1977 per capita trend levels	6.48	8.63	1.97	6.09
Trend income growth	8.75	14.69	-0.30	0.03
Lower income growth	8.06	12.64	0.39	2.08

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Parameters of Demand Functions, Fifth Run," Rome, April 1978 (computer printout); World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

Notes: Consumption refers to total domestic utilization. Deficit refers to the gap between projected production and consumption. For estimates of projected production, see Table 11. A minus sign indicates a net deficit.

the projected production of 8.4 million tons in 1990 and 14.7 million tons in 2000. Under the assumption of trend income growth, the average per capita consumption of eggs in all the study countries would be 2.7 kilograms per year by 1990 and 3.5 kilograms by 2000.

Projections of production and consumption and net surpluses and deficits of eggs under alternative assumptions are given in Appendix 4, Table 43. Looking at the broad picture, the most rapid growth in the total domestic utilization of eggs is projected to be in the North Africa/Middle East region at 6.7 percent, followed by 6.0 percent in Sub-Saharan Africa. However, Latin America could account for a 40 percent share of the total egg consumption of all the study countries in 1990, with Asia second, consuming about one-third of the total. The share of North Africa/Middle East in total egg consumption could increase from 15 percent to 18 percent between 1977 and 1990.

Of the projected consumption of 3.5 million tons of eggs in Latin America, nearly half could be consumed in Upper South America, which is projected to produce 1.8 million tons. At this level of production, this subregion is projected to have a small surplus of 100,000 tons of eggs in 1990. The surplus in the Central America and the Caribbean subregion could be 160,000 tons. With the output of eggs in Latin America projected at 3.7 million tons, there could be a net regional surplus of 0.3 million tons.

Eighty-seven percent of the consumption of eggs in Asia could be from the countries of the East and Southeast Asia subregion, which is projected to have a slightly higher rate of growth than the regional average. In fact, the consumption of eggs in this subregion is projected to almost double between 1977 and 1990. Although production of eggs is projected to grow faster, the subregion is still expected to have a net deficit of 73,000 tons, which would be less than the deficit in 1977. The net deficit in Asia could be more than 100,000 tons, the estimated consumption of 2.8 million tons exceeding the projected production of 2.7 million tons.

Sub-Saharan Africa is projected to have a net deficit in eggs in 1990 of about 218,000 tons, which is a quarter of the estimated consumption. The net deficit in the Western Africa subregion is projected to be a little higher at 224,000 tons, part of which is compensated for by the projected surplus of Central Africa. The surpluses and deficits of countries in Eastern and Southern Africa are projected to be in balance. The growth of consumption of eggs in the West Africa subregion is projected to be about double that in Eastern and Southern Africa. At this rate, consumption of eggs in the West Africa subregion in 1990 could be 2.7 times that in 1977, the most rapid growth among the 10 developing subregions. The average rate of growth in the total domestic utilization of eggs in Sub-Saharan Africa could be 6 percent per year, raising the total consumption of eggs in 1990 to 869,000 tons, as compared to 408,000 tons in 1977.

Growth rates of consumption of eggs in both subregions of North Africa/Middle East are expected to be high: 7 percent in Western Asia and 5.8 percent in Northern Africa. Though the production growth projected for Western Asia is higher than that of consumption, the subregion could still have a deficit

in eggs in 1990 of about 135,000 tons. The Northern Africa subregion could have a deficit of 94,000 tons, which is about 22 percent of its estimated consumption of eggs.

Thus only Latin America is projected to have a net surplus—about 263,000 tons in 1990—whereas the other three regions are projected to have net deficits totaling 563,000 tons. Thus, the net deficit in eggs in 1990 for all the study countries could be 300,000.

Regionally by 2000, Asia is projected to turn from a deficit position to one of marginal surplus. Latin America could have a little more than 1 million tons of surplus, which could be slightly less than the combined net deficits of Sub-Saharan Africa (0.7 million tons) and North Africa/Middle East (0.4 million tons). The deficit in Sub-Saharan Africa could be nearly 42 percent of its projected consumption.

The consumption patterns of eggs by per capita income levels and growth generally follow the pattern of meat. Countries with average annual per capita incomes of $1,250 or more, which represent 15 percent of the population, are expected to account for 38 percent of projected production and consumption. Those with less than $250 per capita could account for less than one-eighth of both production and consumption, but these countries account for more than half the population of the Third World study countries. In fact, at this low level, production and consumption are in balance. The position of the medium-income countries could also improve. With only one-eighth of the population, they are projected to account for about 30 percent of production and consumption. In the countries with average per capita income in the $250-499 range, output and consumption of eggs more or less match the share of population (Appendix 4, Table 44).

The slow-growth countries account for 30 percent of production and 27 percent of total domestic utilization of eggs, with a population share of about 49 percent. Egg consumption in the countries with rapid-income growth accounts for 37 percent of the total, while their production accounts for only 31 percent. This group would have the largest net deficit—620,000 tons.

Gross Surpluses and Deficits

So far in determining the net surplus or deficit in a region or subregion, the implicit assumption has been made that the surplus of one country is transferable to cover the deficit of another country within the group. In actual practice, this may or may not happen, depending on whether intraregional or subregional trade has been established or is possible among the countries concerned. If this assumption is not valid, the aggregate surpluses or deficits could be larger than the net balances for the region or subregion in question. The gross surpluses and deficits for meat, milk, and eggs, which represent the potential exports and imports of these Third World countries, are given by region in Table 17.

Total Domestic Utilization and Nonfood Uses

The estimates of consumption presented so far refer to total domestic utilization of the respective livestock products including human consumption and other uses. In the case of milk, the other uses include feed and allowance for spoilage and waste, whereas the other uses for eggs include those used for hatching and the allowance for waste. For meat, except in a few countries, the entire production is assumed to be available for human consumption. Estimates of production of milk are net of quantities consumed by calves. Table 18 gives a general idea of the projected use of milk and eggs for various purposes in 1990.

Estimates of milk used as feed are based on trends constrained by the growth rate in milk production. Requirements of eggs for hatching and allowances for waste for milk and eggs are estimated, taking into account the base-level percentages of production and applying them to the projected production levels. Thus, for all the study countries taken together, 87 percent of the total domestic use of milk is available for human consumption, whereas the corresponding percentage for eggs is 88 percent.

Per Capita Consumption

Based on the projections under trend income growth the per capita human consumption of livestock products in the Third World countries could reach 15 kilograms of meat, 50 kilograms of milk, and 2.7 kilograms of eggs per year by 1990. Among the regions, Latin America is projected to have the highest per capita consumption—about two to three times the Third World average (see Table 19). Asia could have the lowest

Table 17—Projected gross and net surpluses and deficits in livestock products, by region, 1990 and 2000

Livestock Product/Region	1990 Gross Surplus	1990 Gross Deficit	1990 Net Surplus or Deficit	2000 Gross Surplus	2000 Gross Deficit	2000 Net Surplus or Deficit
			(1,000 metric tons)			
Meat						
Asia	196.6	2,932.2	-2,735.6	642.1	7,342.4	-6,700.3
North Africa/Middle East	60.8	3,096.7	-3,035.9	276.8	7,082.8	-6,806.0
Sub-Saharan Africa	511.5	1,895.3	-1,383.8	903.1	5,633.9	-4,730.8
Latin America	990.6	1,871.8	-881.2	1,893.3	4,520.8	-2,627.5
All study countries	1,759.5	9,796.0	-8,036.5	3,715.3	24,579.9	-20,864.6
Milk						
Asia	285.1	13,688.9	-13,403.8	945.5	27,624.4	-26,678.9
North Africa/Middle East	356.1	10,424.0	-10,067.9	854.6	21,515.6	-20,661.0
Sub-Saharan Africa	15.6	6,149.9	-6,134.3	0.0	13,584.5	-13,584.5
Latin America	1,977.0	7,360.8	-5,383.8	7,568.8	11,033.5	-3,464.7
All study countries	2,633.8	37,623.6	-34,989.8	9,368.9	73,758.0	-64,389.1
Eggs						
Asia	156.8	273.1	-116.3	739.0	649.5	89.5
North Africa/Middle East	92.9	321.7	-228.8	367.8	766.5	-398.7
Sub-Saharan Africa	54.5	272.9	-218.4	128.1	839.4	-711.3
Latin America	412.2	148.9	263.3	1,334.8	285.5	1,049.3
All study countries	716.4	1,016.6	-300.2	2,569.7	2,540.9	28.8

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Parameters of Demand Functions, Fifth Run," Rome, April 1978 (computer printout); FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980; World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); World Bank, *1979 World Bank Atlas* (Washington, D.C.: World Bank, 1979); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

Notes: These projections are based on trend income growth. A minus sign indicates a net deficit.

Table 18—Projected shares of milk and eggs used as food and for other purposes, by region, 1990

Region	Milk Food	Milk Feed[a]	Milk Waste[b]	Eggs Food	Eggs Breeding[b]	Eggs Waste[b]
			(percent)			
Asia	84	12	4	89	6	5
North Africa/Middle East	87	9	4	87	8	5
Sub-Saharan Africa	94	4	2	87	7	6
Latin America	88	8	4	89	5	6
All study countries	87	9	4	88	6	6

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980.

Note: The percentages represent a share of total domestic utilization.

[a] Projections for feed use of milk are based on trend levels, but they are constrained by the growth rate of milk production.

[b] Eggs for breeding and allowances for wastage of milk and eggs are assumed to be a percentage of projected production.

Table 19—Projected per capita consumption of livestock products, by region, 1990 and 2000

Region	Per Capita Consumption					
	1990			2000		
	Meat	Milk	Eggs	Meat	Milk	Eggs
	(kilograms/year)					
Asia	6.3	33.6	1.5	8.7	39.8	2.0
North Africa/ Middle East	23.3	77.3	4.0	32.5	98.0	6.0
Sub-Saharan Africa	13.2	26.9	1.6	17.9	34.1	2.5
Latin America	41.0	105.1	6.4	48.8	117.7	7.8
All study countries	15.1	49.6	2.7	19.7	58.7	3.5

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Parameters of Demand Functions, Fifth Run," Rome, April 1978 (computer printout); FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980; World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); World Bank, *1979 World Bank Atlas* (Washington, D.C.: World Bank, 1979); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.
Note: Milk includes milk products in whole milk equivalents.

Table 20—Per capita consumption of livestock products, selected developed countries, 1975-77 averages

Country	Per Capita Consumption		
	Meat	Milk	Eggs
	(kilograms/year)		
Australia	124	242	11
United Kingdom	70	384	13
United States	114	237	16

Source: Food and Agriculture Organization of the United Nations, "Food Balance Sheets, 1975-77 Average and Per Capita Food Supplies," Rome, 1980.
Note: Milk includes milk products in whole milk equivalents.

per capita consumption of meat and eggs, nearly one-sixth and one-fourth of the levels in Latin America. In the case of milk, the lowest consumption might be in Sub-Saharan Africa, which could be one-fourth of the levels in Latin America. The per capita consumption of the three livestock products in North Africa/Middle East could be about one-and-a-half times the Third World average. By 2000, the average per capita consumption for the study countries could reach 20 kilograms of meat, about 60 kilograms of milk, and 3.5 kilograms of eggs per year—one-fifth to one-third higher than the 1990 level. The regional pattern of consumption at the end of the century could be similar to that in 1990. Even at these levels, the Third World and regional averages could be considerably less than those already reached in many of the developed countries, such as the United States, United Kingdom, and Australia (see Table 20).

Self-Sufficiency Ratios

Self-sufficiency ratios in meat in the mid-1970s were lower than those in the early 1960s in all the regions except Sub-Saharan Africa, where they were the same. If past trends in production continue and if consumption grows as projected under the trend income growth assumption, the self-sufficiency ratio could become worse. Both Sub-Saharan Africa and Latin America could shift from surpluses to deficits; the position for all the study countries taken together could be similar. In the case of milk, all the regions are projected to have deficits in both periods, and the situation could deteriorate rapidly in North Africa/Middle East and Sub-Saharan Africa. By 2000, in Latin America the situation might improve, though the region might still have a deficit. In the other three regions, self-sufficiency ratios might worsen. Sub-Saharan Africa might be able to meet only 38 percent of its requirements for milk. The projected output of eggs is expected to match demand by the end of the century, and the surpluses in Latin America and Asia could balance the deficits in North Africa/Middle East and Sub-Saharan Africa (see Appendix 4, Table 45).

8

CONCLUSIONS AND POLICY IMPLICATIONS

If per capita incomes in the developing countries continue to grow as rapidly as they did during the 1966-77 period, the projected output of meat, milk, and eggs will not come close to meeting the demand for these products by 1990, in any of the four developing regions, with the possible exception of eggs in Latin America. By 2000, the supply-demand imbalances could be even worse, particularly in milk and meat. If the projected demand were to be met entirely from domestic production, the projected annual growth rates of 3.4 percent for meat output and 2.9 percent for milk output during the period 1977-2000 would have to rise by 50 percent each. The growth rate for milk output in Sub-Saharan Africa would virtually have to quadruple to make this region self-sufficient by 2000. A near doubling of the growth rates for meat and milk would be necessary for North Africa/Middle East to achieve self-sufficiency.

Under the alternative assumption, that income growth might be 25 percent slower than 1966-77 growth, the gap between projected production and consumption could still be large for both meat and milk. The deficit for meat could be 10 million tons by 2000, 16 percent of the estimated consumption; the deficit for milk could be 43 million tons, or 20 percent. To meet these deficits from domestic supplies, production growth would have to accelerate by 25 percent for meat and 33 percent for milk over the projected 1977-2000 growth rates. Moreover, under this alternative, all of the regions except Latin America would have deficits in both products. The gap between projected production and consumption in Asia of 20 million tons of milk represents 30 percent of its projected production. And, in North Africa/Middle East the deficit in meat could be more than half of the output projection for 2000. The projected gaps in Sub-Saharan Africa, 2.8 million tons of meat and 10.6 million tons of milk, are also large relative to the net exports of 92,000 tons of meat and imports of 1.2 million tons of milk in the mid-1970s.

Even to maintain the per capita consumption of milk at 1977 trend levels, the output of milk in 1990 would need to be 5 percent higher than is projected. The differences between the projected output and the estimated consumption in 2000 at 1977 per capita consumption levels could also be large for milk in Asia, North Africa/Middle East, and Sub-Saharan Africa. Latin America, on the other hand, is projected to have a surplus exceeding the projected deficits of the other three regions. For meat, projected production in 2000 could exceed estimated consumption by 11 million tons, assuming no increase in per capita incomes. This surplus would be absorbed if per capita incomes rose by only one-third of the projected income growth rates.

Some of these trends are already evident from the available data on trade in livestock products for more recent years. Developing countries (excluding China) that were net exporters of meat in the mid-1970s became net importers in the latter half of the decade, and by 1981 their net imports rose to 1.16 million tons of all types of meat (including offal). Imports of milk and eggs into these countries also showed a similar trend. The net imports of milk (in whole milk equivalents) rose from 6.7 million tons in 1975 to 15.6 million tons in 1981, while those of eggs nearly doubled to 274,000 tons during the same period. If these trends continue, it is obvious that the net deficits in the livestock products of Third World countries could be quite large in the coming decades.

As large-scale transfers of livestock products from developed to developing countries either as trade or aid become less likely, considerable efforts will be needed to accelerate their production in order to reduce the large gaps between projected production and demand. Otherwise relative prices could rise or consumption could shift causing considerable hardship to some poor consumers in Third World countries. Demand for livestock products grows more rapidly in urban areas. In several of the developing countries where urbanization is expanding, the urban demand for these products would be further accelerated. Unless these increases are met from higher rural production or through

imports, per capita consumption in rural areas may decline.

The projections of output and consumption and the resulting gross and net surpluses and deficits discussed in the last two chapters are not to be considered as long-term outlook reports on the meat, milk, and eggs situations in 1990 and 2000. But given the assumptions underlying the projections, these trend-based estimates provide a broad indication of the direction and possible extent of the supply-demand imbalances in livestock products that the developing countries may face in the coming years. If the projected output growth rates based on past trends are not attained, the gaps may be even larger. The deficits can be particularly large in countries with rapid growth in per capita income and high income elasticity of demand for these products.

Moreover, this study has not attempted to analyze the global situation for these products, particularly the trends and outlook in the developed countries. This is not to underrate the importance of viewing the supply-demand situation in the developing countries in the context of the emerging world markets. But the main aim of the study is to highlight the rapid growth in output and consumption of livestock products in the past in the Third World countries and to draw attention, first, to the large gaps between the two that are likely to develop if past output trends continue and income growth is rapid, and, second, to identify the regions where the deficits are likely to be particularly large.

There are, however, other studies based on global models that examine the world situation.[26] Other organizations have made projections of supply and demand for food commodities in 2000 that include livestock products in developing countries.[27] The IFPRI mandate emphasizes the food needs of Third World countries, and IFPRI's food gap analyses, as pointed out earlier, are particularly concerned with the food situation as it may develop under accelerating growth conditions. This is the reason no attempt has been made to indicate the precise manner in which the gap between the projected demand and supply can be filled.

What has been emphasized is the need for further accelerating growth, because the sizes of the gaps projected are so large that it might not be possible to fill them through aid or trade. Moreover, the strategy for achieving future growth with equity in many of the Third World countries suggests a path of labor-intensive, rural employment-oriented programs, and livestock development offers considerable potential for such programs, particularly in poultry, pig, and dairy development. If such a strategy is adopted, the size of the food deficit in the developing countries by the end of the century is likely to depend on the expansion of the derived demand for feed.[28]

Whereas the projections of demand for meat have been made by type of meat, those of supply are based on the past trends in total meat output. The scope for increasing the production of individual types of meat depends not only on climatic and environmental factors, type of farming, and the physical resources in each area, but also on the availability of inputs and infrastructure facilities. Where feed, the major input of livestock production, is inadequate to support the output expansion required to meet the anticipated demand, consideration must be given to the scope for increasing the domestic output of feed. Where this is not possible, imports could be a recourse if foreign exchange is not a constraint and if foreign supplies are available. Demand projections are based on constant relative price assumptions, but the realized demand depends on the prevailing relative prices, which in turn are influenced by the input and output price policies adopted by the national governments. Moreover, in view of the longer time span involved, the

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[26] See, for example, Donald W. Regier, *Livestock and Derived Feed Demand in the World GOL Model,* Foreign Agricultural Economic Report 152 (Washington, D.C.: U.S. Department of Agriculture, 1978).

[27] Some organizations working in this area include the International Institute for Applied Systems Analysis, FAO, Resources for the Future, and Winrock International. Published data include Kenneth R. Farrell et al., "Meeting Future Needs for United States Food, Fiber and Forest Products," in *Reference Document: Needs Assessment for the Food and Agricultural Sciences* (Washington, D.C.: Joint Council on Food and Agricultural Sciences, 1984); Winrock International, *World Agriculture: Review and Prospects into the 1990s, A Summary* (Morrilton, Ark.: Winrock, 1983); and FAO, *Agriculture: Toward 2000.*

[28] Leonardo Paulino, "Food in the Third World: Past Trends and Projections to 2000," International Food Policy Research Institute, Washington, D.C., 1984 (mimeographed).

projections for 2000 are less firm than those for 1990.

The FAO global study, *Agriculture: Toward 2000 (AT 2000)*, covered livestock products and also provided projections of production and consumption of various types of meat, milk, and eggs for 1990 and 2000 for 90 developing countries, under two scenarios: an optimistic scenario A and a medium-growth scenario B.

A comparison of the FAO projections with those of IFPRI shows that for meat IFPRI estimates of output are less than the *AT 2000* estimates under both scenarios, whereas those of consumption are higher. IFPRI's trend estimate of consumption is higher than the *AT 2000* estimate by roughly 10 percent for scenario A and 30 percent for scenario B. *AT 2000* shows a near balance between production and consumption at the end of the century, whereas IFPRI projections show a large gap.

IFPRI's projected output for milk is about 5 percent less than *AT 2000*'s scenario B estimate and 16 percent lower than the scenario A figure. IFPRI's estimate of consumption is at a par with the scenario A figure. But under scenario B, the *AT 2000* consumption figure is 88 percent of IFPRI's estimate.

The differences in the estimates for eggs are narrower, IFPRI's estimates being closer to *AT 2000* scenario A projections. Scenario B estimates are about 2 million tons lower.

A detailed note in Appendix 3 explains the differences in the methodologies adopted for the two sets of figures and the reasons behind them. One of the major causes of differences is the downward adjustment made by FAO in the demand for meat and milk for countries where they judged that the constant price demand estimates were unrealistic. This applies to those situations where domestic supply cannot respond adequately to demand and where the income and balance-of-payments situation of the country does not permit large-scale imports. In other words, the constant price assumption has been relaxed for the low-income developing countries that have balance-of-payments constraints.

The analysis of past trends in meat consumption has shown that the rapidly rising demand for livestock products in developing countries has been met by increased production of pigmeat and poultry meat. This is understandable because the production cycles for pigs and poultry are short, and quick results can be obtained. In several of these countries, this increase was obtained through development of large-scale pig and poultry enterprises in or around urban areas based on the adoption of modern technology. Such activities were often encouraged by governments through appropriate tax incentives, input and output subsidies, development of infrastructure facilities, allocation of foreign exchange, and foreign collaboration arrangements. However, such enterprises are highly capital- and energy-intensive and some are even fully automated. In several cases, they depend upon imports of concentrate feeds, breeding stocks, equipment, and know-how. As a result, their beneficial effects on small farmers' incomes and on rural development in general are slight.

Some countries have attempted expansion of smallholder livestock production in rural areas, particularly of dairy animals, poultry, and pigs. Though in the long run this path of development may be slower and more difficult to organize, it will have greater benefits in increased self-reliance and improved rural employment, incomes, and nutrition. Such small-scale operations are particularly suitable for developing countries with a high density of population, surplus labor, and high rural unemployment or underemployment. Experience in developing countries like India shows that milk production could be organized through small-scale functional cooperatives linked to urban dairy schemes. Rapid increases in pig and poultry production are also possible through similar small-scale enterprises provided the requisite infrastructure and institutional facilities are developed.

Some other general observations about future development of livestock may be in order in this context. Development of production of ruminants on a large scale is feasible in countries where land is not a constraint, as in Latin America and parts of East Africa. Even here, scientific practices need to be introduced to improve the productivity of existing pasture and grazing lands through controlled grazing, better seeding, application of fertilizers, conservation of moisture, and so forth. This calls for increased allocations for research on pastures and grazing. Scope exists in several countries of the Third World for increasing the offtake ratios, introducing better breeds, and improving the efficiency of conversion of feed into meat and milk, all of which would contribute to the acceleration of growth in output. Thus, the

extent to which the expected gap between the projected demand and supply could be reduced through increased technical efficiency of livestock production needs to be examined.

Between the two extremes of fully commercial enterprises and smallholder-oriented development, there are semicommercial systems of medium-size family farms, which purchase part of the feed and sell most of the output, often under a contract to a major urban commercial, state, or cooperatively owned processing and marketing organization. Whatever type of organizational structure is adopted, it is necessary to reorient livestock policies with a view to providing improved access to institutional credit, production inputs, and marketing facilities. Ensuring remunerative prices to the producers and at the same time maintaining reasonable prices to the consumers, particularly in the case of milk, should be the main objective of price policy in this sector, too. It needs to be emphasized that unlike cereals, livestock products are highly perishable and hence need appropriate facilities for processing, transport, storage, and marketing before they reach consumers. Livestock diseases also take a heavy toll of animals and birds. Research into animal diseases, both preventative and curative, needs greater attention, particularly in areas where exotic breeds are introduced. Veterinary facilities need to be expanded considerably to provide the right environment for a rapid increase in livestock production.

Acceleration of the development of meat and milk production would lead to greater demand for utilization of coarse grains as livestock feed. In several developing countries in each region, coarse grains (including maize) are consumed by humans and their increased use as feed implies a diversion from their direct use as food. Competition between the two uses may result in higher prices, which could cause hardship to the vulnerable sections of the population.

Competition between food and feed for the use of grains may develop between the rich and poor people within a country and also between the richer and poorer countries. To meet the situation, action needs to be taken to raise the productivity of cereal feeds wherever the potential exists. Greater emphasis should be placed on research and technology to improve yields of feedgrains and feed efficiency. In addition, the scope for substitution of noncereals such as cassava for cereals in concentrate feeds needs to be explored.[29] In some areas where the food problem is more severe, and where scope exists for development of small ruminant production based on the utilization of grasses and farm by-products, steps should be taken to encourage this. There is no doubt, however—and the demand and supply projections for livestock products indicate this—that over large areas demand for feed and fodder will increase rapidly in the coming decades, resulting in increased competition for land. More intensive use of land should be resorted to and more attention should be given to research and development of feed resources within the country, especially in countries experiencing foreign exchange difficulties. Greater efforts should be made to develop new kinds of feed, such as feeds using more by-products and agricultural wastes and compound feeds. Small-scale livestock enterprises should also be fitted into the mixed farming system.

It should also be kept in mind that in some countries beef and milk are joint products, as are poultry meat and eggs.[30] The profitability of one affects the output of the other. Thus the effect of price and incentive policies on joint products should receive close attention.

In general, because livestock yields in several developing countries are presently much lower than those in developed economies, scope probably exists for rapid improvement through adoption of improved breeding and feeding practices, provision of veterinary services, and initiation of appropriate incentive policies and institutions. This emphasizes the need for allocation of more resources to livestock research, including research on feeds, at both national and international levels.

Therefore, appropriate production programs, which suit the conditions in the de-

[29] It would be necessary to supplement cassava with protein sources.

[30] This may not be true in countries where there are specific breeds used for meat and milk or in the case of poultry, for meat and eggs.

veloping countries concerned and the species of livestock to be developed, need to be drawn up. This would require large public investments in research, extension, and development of infrastructure. Some of these investments are beyond the capacity of the poorer developing countries, and in these countries foreign aid and assistance would be appropriate.

APPENDIX 1: CLASSIFICATION OF COUNTRIES SELECTED FOR THE STUDY

Table 21—Classification of developing countries by per capita income, income growth, and net meat trade

Region/Subregion/ Country	1977 GNP Per Capita				1966-77 Growth of GNP Per Capita				1973-77 Net Trade in Meat		
	Less than $250	$250-$499	$500-$1,249	$1,250 or More	Less than 1 Percent	1.0-2.9 Percent	3.0-4.9 Percent	5 Percent or More	Importer	Exporter	Other
Asia											
South Asia											
Bangladesh	x				x						x
Bhutan	x				x						x
India	x					x				x	
Nepal	x					x			x		
Pakistan	x					x					x
Sri Lanka	x					x					x
East and Southeast Asia											
Burma	x					x					x
Cambodia (Kampuchea)	x				x				x		
Fiji				x			x		x		
Hong Kong				x				x	x		
Indonesia		x						x		x	
Korea, Democratic People's Republic of			x					x			x
Korea, Republic of			x					x	x		
Laos	x				x				x		
Malaysia			x				x		x		
Mongolia			x			x				x	
Papua New Guinea			x				x		x		
Philippines		x					x		x		
Singapore				x				x	x		
Thailand		x					x			x	
Vietnam	x				x					x	
North Africa/Middle East											
Northern Africa											
Algeria			x				x		x		
Egypt		x					x		x		
Libya				x	x				x		
Morocco			x				x		x		
Sudan		x				x				x	
Tunisia			x					x	x		
Western Asia											
Afghanistan	x				x						x
Cyprus				x			x		x		
Iran				x				x	x		
Iraq				x			x		x		
Jordan			x					x	x		
Kuwait				x	x				x		
Lebanon			x				x		x		
Oman				x				x	x		
Saudi Arabia				x				x	x		
Syria			x					x	x		
Turkey			x				x			x	
Yemen Arab Republic		x			x				x		
Yemen, People's Democratic Republic of		x					x		x		
Sub-Saharan Africa											
West Africa											
Benin	x				x				x		
Burkina Faso (Upper Volta)	x				x					x	
Chad	x				x					x	
Gambia	x					x			x		
Ghana		x			x				x		

(continued)

Table 21—Continued

Region/Subregion/ Country	1977 GNP Per Capita				1966-77 Growth of GNP Per Capita				1973-77 Net Trade in Meat		
	Less than $250	$250-$499	$500-$1,249	$1,250 or More	Less than 1 Percent	1.0-2.9 Percent	3.0-4.9 Percent	5 Percent or More	Importer	Exporter	Other
Guinea	x					x				x	
Guinea-Bissau	x				x				x		
Ivory Coast			x			x			x		
Liberia		x				x			x		
Mali	x					x				x	
Mauritania		x			x					x	
Niger	x				x					x	
Nigeria		x						x	x		
Senegal		x			x				x		
Sierra Leone	x				x				x		
Togo		x					x		x		
Central Africa											
Angola		x			x				x		
Burundi	x					x				x	
Cameroon		x				x			x		
Central African Republic	x					x			x		
Congo			x			x			x		
Gabon				x				x	x		
Rwanda	x					x				x	
Zaire	x				x				x		
Eastern and Southern Africa											
Botswana		x						x		x	
Ethiopia	x				x					x	
Kenya		x				x				x	
Lesotho	x							x	x		
Madagascar	x				x					x	
Malawi	x					x			x		
Mauritius			x				x		x		
Mozambique	x				x				x		
Namibia			x		x					x	
Réunion				x		x			x		
Somalia	x				x					x	
Swaziland			x					x		x	
Tanzania	x					x				x	
Uganda		x			x				x		
Zambia			x		x				x		
Zimbabwe			x			x				x	
Latin America											
Central America and Caribbean											
Costa Rica				x			x			x	
Cuba			x		x				x		
Dominican Republic			x					x		x	
El Salvador			x			x			x		
Guatemala			x			x				x	
Haiti	x					x				x	
Honduras		x			x					x	
Jamaica				x		x			x		
Mexico				x		x				x	
Nicaragua			x			x				x	
Panama				x		x			x		
Trinidad and Tobago				x		x			x		
Upper South America											
Bolivia		x				x				x	
Brazil				x				x		x	
Colombia			x				x			x	
Ecuador			x				x		x		
Guyana			x			x			x		
Paraguay			x				x			x	

(continued)

Table 21—Continued

Region/Subregion/ Country	1977 GNP Per Capita				1966-77 Growth of GNP Per Capita				1973-77 Net Trade in Meat		
	Less than $250	$250-$499	$500-$1,249	$1,250 or More	Less than 1 Percent	1.0-2.9 Percent	3.0-4.9 Percent	5 Percent or More	Importer	Exporter	Other
Peru			x			x			x		
Surinam				x			x		x		
Venezuela				x		x			x		
Lower South America											
Argentina				x		x				x	
Chile				x	x				x		
Uruguay				x		x				x	
Total	32	20	29	23	30	36	20	18	60	37	7

Notes: Of the total population of the 104 study countries in 1977, 57.9 percent were from Asia, 11.4 percent from North Africa/Middle East, 14.8 percent from Sub-Saharan Africa, and 15.9 percent from Latin America.

The income groups are determined by the GNP per capita calculated in U.S. dollars, based on the 1961-77 trend of real GNP. Of the total population of the study countries, 51.6 percent lived in countries in the very low-income group (less than $250 average income per year); 20.8 percent were in low-income countries ($250-$499); 12.9 percent were in middle-income countries ($500-$1,249); and 14.7 percent in high-income countries ($1,250 or more per year).

Those countries with the slowest growth of GNP per capita, less than 1 percent per year, had a 16.0 percent share of the total population in 1977; the slow-growth countries, with 1.0-2.9 percent growth, a 48.9 percent share; the medium-growth countries, with 3.0-4.9 percent growth, a 13.3 percent share; and the rapid-growth countries, with more than 5.0 percent growth, a 21.8 percent share.

The countries that were meat importers during the 1973-77 period comprised 25.4 percent of the total population; those that were meat exporters, 56.8 percent; and the others—those that did not trade in meat at all or those with imports and exports in balance—had a 17.8 percent share of the total population.

APPENDIX 2: DATA AND METHODOLOGY

Data

The data on livestock numbers, output, consumption, and trade used in the study are taken from the international data base of FAO. The annual data on livestock numbers and output for the period 1961-65 are from the 1975 "FAO Production Yearbook" data tape, while those for the years 1966 to 1977 are from the 1979 data tape. The consumption and trade data are from the "Global Agriculture Programming System Supply Utilization Accounts" tapes, which contain the statistical base developed by FAO for their more comprehensive global study, *Agriculture: Toward 2000 (AT 2000)*. These supply-utilization accounts show 1961-65 averages and annual estimates for the 1966-77 period. FAO also provided estimates of income elasticities at five-year intervals by commodity for each country, which were used for the consumption projections. Population estimates and projections are mostly from the United Nations Department of International Economic and Social Affairs, based on the 1978 assessment of world demographic data. For some countries, the study uses the 1977 population estimates of the World Bank, but the population projections are based on the projected growth rates of the United Nations. The annual GNP data for each country, which provide estimates of trend growth of per capita income at constant 1977 prices, are from the World Bank.

Methodology

Past Trends

The analysis of past trends in the different variables used in this study are based on annual averages for the two five-year periods 1961-65 (early 1960s) and 1973-77 (mid-1970s) for each individual country, subregion, and region. These averages are used for absolute measures of change and relative distributions. The annual growth rates calculated for this period represent the compound growth rates between the mid-years of the two quinquennia.

Output Projections

The annual data for 1961-77 for each country are used to project the output of livestock products. The trend growth rates as well as the estimated trend values are obtained for meat, milk, and eggs separately, using the logarithmic trend equation (1) fitted to the time-series data:[31]

$$\ln Y_t = a + bt, \qquad (1)$$

where

Y_t = estimate of the variable in year t,

a = constant term (the logarithm of the variable's estimate for the base year t = 0),

b = the logarithm of the value 1 plus the annual rate of change (1 + r) in the variable, and

t = period of years starting from the base year.

The projected outputs of each of these products for 1990 and 2000 for each country are aggregated to give the results for subregions, regions, and the total for all the 104 study countries. A similar procedure is adopted to aggregate countries into groups according to average per capita income, income growth, and trade in meat. Because errors in data reporting at the country level tend to be compensated for in the aggregations, it can be expected that measures for individual countries are less reliable than those for country groups.

The method of projecting the output of meat to 1990 and 2000 on the basis of trends shown by the 1961-77 time-series data may be biased by the existence of cyclicality. The traditional procedure for decomposing a

[31] Meat comprises beef, veal, buffalo meat, mutton, goat meat, pigmeat, and poultry meat expressed in carcass equivalents. Milk comprises cow, buffalo, sheep, goat, and camel milk and milk products expressed in whole milk equivalents. Eggs include hen eggs and other eggs.

series, by first detrending it, cannot be applied, because that would be begging the question in trying to estimate the real trend. IFPRI has identified a method to estimate the trend and cyclical components simultaneously.[32] The trend thus obtained (that is, with cyclical influences removed) can then be extrapolated to obtain long-term projections. This method has been tested on the production of ruminant meat (beef and buffalo meat and mutton and goat meat) in developing countries. Although the results are statistically significant, comparisons of these projections with those obtained from the direct application of simple exponential trending show little difference between them in the aggregate for beef and buffalo meat and mutton and goat meat production. Hence, simple trending is used uniformly in this study for the output projections for all three major livestock products. The economic basis for cyclical patterns in ruminant meat production in most developing countries has not yet been fully demonstrated. Most livestock experts believe that the cyclical behavior shown in some of the countries may be more weather related than economically induced.

For calculating growth rates for country groups, the usual equation for measuring the average annual rate of change of the variable between two points of time is used.

$$Y_t = Y_0 (1 + r)^t, \qquad (2)$$

where

Y_0 = estimate of the variable for the base year, and

r = annual growth rate of the variable.

Exceptions to the 1961-77 Trend Projections

Thus, based on continuing historical country trends in livestock production, the output projections are essentially extrapolations, using equation (1) during the period 1961-77. In some countries, however, where the trends for the 1961-77 period appear to be unsuitable, the 1970-77 period is used for projections. For meat, these countries include Singapore in Asia; Afghanistan, Cyprus, and the Yemen Arab Republic in North Africa/Middle East; and Guyana and Surinam in Latin America. For milk they include the Democratic People's Republic of Korea in Asia and Afghanistan, Jordan, and the Yemen Arab Republic in North Africa/Middle East. For eggs they include Hong Kong in Asia, Libya in North Africa/Middle East, and Benin and Mozambique in Sub-Saharan Africa.

Production of milk for some countries is trended from the 1966-77 data because annual estimates of camel milk output are not available for the period 1961-65. Countries for which this procedure is adopted are Algeria, Iran, Iraq, Libya, Morocco, Saudi Arabia, the Sudan, Tunisia, and the People's Democratic Republic of Yemen in North Africa/Middle East and Chad, Ethiopia, Kenya, Mauritania, Niger, and Somalia in Sub-Saharan Africa.

For developing countries with negative growth rates in output, it is assumed that no further decline in production will occur, and the trend estimate of output for 1977 is used for both 1990 and 2000. The countries for which a constant 1977 trend value is used for meat are Chad, Ethiopia, and Niger in Sub-Saharan Africa; for milk, Hong Kong in Asia, Burkina Faso, Madagascar, Mauritania, Namibia, and Niger, in Sub-Saharan Africa; and Guyana, Surinam, and Uruguay in Latin America; and for eggs, Bangladesh in Asia.

Some countries, such as the Democratic People's Republic of Korea, the Republic of Korea, and Saudi Arabia for milk, and Pakistan and Zambia for eggs, show extremely rapid growth, perhaps because they started from a low base or perhaps for other reasons such as statistical noncomparability. In these cases, future growth in production is constrained at 8 percent per year.[33] It may be added that although annual data on production by type of meat and milk are available, only the total output of all types of each of these products is used in the projections because the rate of growth of the aggregate is more stable than that of the individual components.[34]

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[32] For details of the method and the results see Patrick Yeung, "A Method for the Simultaneous Estimation of Trends and Cycles," International Food Policy Research Institute, Washington, D.C., 1985 (mimeographed). A copy of this report is available upon request.

[33] The rates of increase for rapid-growth countries cluster around 8 percent per year.

[34] In some countries such a procedure may not be strictly advisable because each of these types constitutes a distinct enterprise, particularly where they do not compete for available resources.

Projections are made separately for direct consumption by people and for feed, waste, and nonfood uses. For each of the products—meat, milk, and eggs—the demand for direct consumption is first projected for each country using the trend estimate of per capita consumption in 1977, per capita growth in income, the income elasticity of demand, and projected population. To this estimate are added the milk required for feed use, the eggs required for breeding, and the allowances for waste in both these products. The historical pattern of domestic utilization from FAO data shows little or no allowances for meat waste or for industrial use (nonfood manufactures) of meat, milk, and eggs; hence these utilization categories are assumed to be zero.

Direct Consumption. The trend estimates of the per capita use of each of the livestock products for consumption by the human population in 1977 are obtained for each country by using equation (1) for 1966-77, which is the period for which annual consumption data are available. In the case of meat, the estimates are calculated separately for beef and buffalo meat, mutton and goat meat, pigmeat, and poultry meat; the sum of these estimates serves as the trend estimate of the per capita consumption of total meat for the country. Projections of per capita consumption in 1990 and 2000 were obtained for each type of meat separately, making use of income elasticity coefficients worked out by FAO and trend growth rates of per capita GNP (also based on 1966-77)[35] in equation (3).

$$C_T = C_{1977}\,[1 + (r_y \times n)]^{T-1977}, \qquad (3)$$

where

C = per capita consumption of the commodity during the indicated year,

r_y = the trend annual growth rate of per capita real income,

n = the income elasticity of the demand for the commodity (when n is not constant, stepwise projections are made), and

T = 1990 or 2000.

The total demand for direct consumption for each country in 1990 and 2000 is calculated by multiplying the projected per capita consumption obtained from equation (3) by the United Nations' medium-variant population projection for 1990 or 2000. Both production and consumption projections implicitly assume unchanged price relationships within each commodity group.

In countries where per capita income has declined or has grown unusually slowly, a minimum of 0.5 percent has been imposed. These include Bangladesh and Bhutan in Asia; Kuwait and Libya in North Africa/Middle East; Angola, Benin, Chad, Ghana, Madagascar, Mauritania, Mozambique, Namibia, Niger, Senegal, Sierra Leone, Somalia, Zaire, and Zambia in Sub-Saharan Africa; and Chile and Cuba in Latin America.

In countries where growth rates in per capita income are unusually high, a maximum of 6.0 percent has been imposed. These include: Indonesia, the Republic of Korea, and Singapore in Asia; Iran, Oman, Saudi Arabia, Tunisia, and the Peoples Democratic Republic of Yemen in North Africa/Middle East; Botswana, Gabon, Lesotho, Nigeria, and Swaziland in Sub-Saharan Africa; and Brazil in Latin America.

Feed, Waste, and Nonfood Uses. The projections for feed use of milk are based on trend rates of growth but constrained by the growth rate of milk production. Estimates of eggs required for breeding and allowances for waste of milk and eggs are calculated as percentages from projected production levels. These percentages are initially derived for the period 1974-76 from the basic data set of FAO's *AT 2000*, and they are adapted to reflect the projected situation in 1990, assuming ceilings of 10 percent for waste and 15 percent for eggs required for breeding.

Alternative Assumptions. The estimated demand for each of the products in 1990 and 2000 is also calculated based on two other alternative assumptions—namely, per capita income growth 25 percent less than the trend growth and a constant per capita 1977 trend estimate of direct consumption (that is, on the basis of zero income growth). The basis

[35] Maximum and minimum limits on annual per capita income growth rates were set at 6.0 and 0.5 percent respectively.

for these alternative assumptions is explained in the text.

Gross and Net Surpluses and Deficits

The difference between the projected production and projected demand (total domestic utilization) gives the surplus or deficit for each country. For subregions, regions, and other country groups, the surpluses and deficits of individual countries in the group are separately aggregated and denoted by gross surplus and gross deficit for the geographical area or income group. The difference between the two (also equal to the difference between total production and total demand for the country group) represents the net surplus or net deficit, as the case may be, for the subregion, region, or country group.

APPENDIX 3: COMPARISON OF IFPRI AND FAO PROJECTIONS OF LIVESTOCK PRODUCTS

The FAO global study, *Agriculture: Toward 2000 (AT 2000),* which looks at agricultural perspectives and policy issues in the Third World countries also includes livestock products. The study projects production and consumption of various types of meat, milk, and eggs for 1990 and 2000 for 90 developing countries. These projections for livestock products are presented for two scenarios: first, an optimistic scenario A, which assumes that the developing countries will achieve the economic growth targets of the United Nations' International Development Strategy and at the same time attain substantial improvement in agricultural output, and second, a medium-growth scenario B, which assumes that these countries will achieve more modest growth in agriculture and the whole economy. The study notes that the demand for meat, dairy products, and eggs is expected to rise faster than the demand for crops: thus both scenarios call for output of livestock to increase relatively more rapidly than crops. Between 1980 and 2000, livestock production is projected to increase by 4.5 percent a year in scenario A and by 3.7 percent in scenario B, whereas crop production is estimated to rise by 3.5 percent in scenario A and 3.0 percent in scenario B.[36] The estimates of output and demand based on a trend scenario are not given for animal products.

As shown in the discussion on methodology, IFPRI projections of production and consumption are based on continuation of past trends, between 1961 and 1977 for output and 1966-77 in the case of per capita GNP, although constraints are imposed on the trend growth in some cases. For output, an upper limit of 8 percent is assumed for the sustained rapid growth of eggs and milk in a few countries. In the case of per capita income, a lower bound of 0.5 percent per year and an upper bound of 6.0 percent per year are set.

Whereas the *AT 2000* analysis includes 90 countries, the IFPRI projections for livestock products cover 104 developing countries. Both studies exclude China. Also, IFPRI uses GNP per capita, while FAO uses GDP and makes allowances for savings. The resulting Personal Consumption Expenditure per capita of FAO is therefore lower in the base period and projected to grow more slowly in the future than GNP per capita. At the same time, FAO's GDP growth estimates are somewhat higher than those based on the World Bank GNP figures, and thus the two sets of figures counterbalance each other. The sources of other data are the same for both the FAO and IFPRI projections, though the base periods are slightly different.

There is one other important difference in approach. Whereas FAO estimates the output of each kind of meat by projecting separately the number of animals, the offtake percentages, and the carcass weight per animal, IFPRI's projections relate to total meat output. In the case of consumption, both IFPRI and FAO consider each type of meat separately and then aggregate the total consumption (demand). When comparing the projections of output and demand made by the two organizations, these differences must be kept in mind.

Table 22 presents the projections of output and demand of meat, milk, and eggs for the year 2000 made by IFPRI and FAO. The IFPRI data are made comparable in geographical coverage by excluding the estimates for 14 countries not covered by *AT 2000.*

The conclusion that emerges is that the IFPRI estimate of meat output in 2000 is less than that of *AT 2000* under both scenarios, whereas IFPRI's estimates of meat consumption are higher. The IFPRI trend estimate of demand is higher than FAO's scenario B by 30 percent, and it is higher than the scenario A estimate by 10 percent. FAO estimates that production and consumption will be nearly in balance, whereas IFPRI projections show a large gap. In the case of milk, IFPRI's projected output is about 5 percent less than *AT 2000*'s scenario B estimate and 16 percent lower than the scenario A figure. IFPRI's estimates of consumption are about the same as the scenario A figure, but under scenario B, the *AT 2000* consumption figure is 88 percent of IFPRI's estimate. By comparison, the differences in the estimates for eggs are narrower: IFPRI's estimates fall between the *AT 2000* scenario A and scenario B pro-

[36] FAO, *Agriculture: Toward 2000.*

Table 22—FAO and IFPRI projections to 2000 of production and consumption of livestock products, selected developing countries

Commodity/ Output or Demand	FAO Scenario A	FAO Scenario B	IFPRI[a]
	(million metric tons)		
Meat			
Production	62.1	53.2	49.5
Consumption	63.0	53.4	69.7
Net balance	-0.9	-0.2	-20.2
Milk			
Production	211.1	186.2	176.6
Consumption	237.4	209.8	238.5
Net balance	-26.3	-23.6	-61.9
Eggs			
Production	14.8	12.7	14.5
Consumption	14.8	12.5	14.4
Net balance	...	0.2	0.1

Source: Food and Agriculture Organization of the United Nations, *Agriculture: Toward 2000* (Rome: FAO, 1981).

[a] Projections are based on the trend income growth assumption.

jections, though closer to the former. Scenario B estimates are about 2 million tons lower than IFPRI's.

One of the major causes for the differences between the two sets of projections is the downward adjustments made by FAO in the demand for meat and milk in the *AT 2000* study, for countries where, first, the constant price demand estimates are unrealistic because domestic supply is not able to respond to the demand, and second, the income and balance-of-payments situation does not permit large-scale meat imports.[37] Thus, the constant price assumption is relaxed for the low-income developing countries with balance-of-payments constraints. With regard to other possible factors, FAO's estimation of the population of the 90 countries in 2000 at 3,630 million is only slightly higher (0.6 percent) than the IFPRI estimate of 3,607 million. For GDP, the FAO scenarios A and B envisage overall annual growth rates of 7.0 and 5.7 percent per year between 1980-2000.

[37] J.P. Hrabovszky, personal communication.

Table 23—Growth of population, per capita consumption, and income and income elasticities as projected by FAO and IFPRI to 2000

Variable	FAO Scenario A 1980-2000[a]	FAO Scenario B 1980-2000[b]	IFPRI 1977-2000[c]
Income growth (percent/year)	7.00	5.70	6.84
Population growth (percent/year)	2.40	2.40	2.44
Per capita income growth (percent/year)	4.49	3.22	4.30
Per capita meat consumption growth (percent/year)	1.99[a]	1.26[a]	2.53
Per capita milk consumption growth (percent/year)	1.33[a]	0.79[a]	1.42
Implied income elasticity of demand for meat	0.44[b]	0.39[b]	0.59
Implied income elasticity of demand for milk	0.30[b]	0.25[b]	0.33

Source: Food and Agriculture Organization of the United Nations, *Agriculture: Toward 2000* (Rome: FAO, 1981).

[a] Calculations are based on implied growth rates of meat and milk consumption during the period 1975-79 to 2000 as presented in *AT 2000*, Table 6.

[b] This estimate also includes price effects and is based on per capita GDP growth, not growth in Personal Consumption Expenditures.

[c] Projections are based on the trend income growth assumption; and per capita consumption relates to domestic utilization.

On a per capita basis, the growth rates work out to 4.5 percent for scenario A and 3.2 percent for scenario B. The implied GNP growth rates by country used by IFPRI work out to 6.8 percent per year for the period 1977-2000 for the Third World as a whole, which is closer to FAO's scenario A estimate. The major parameters adopted in the two studies are in Table 23. The lower estimates of implied elasticity derived from FAO projections appear to be the result of downward adjustments in demand made by them.

APPENDIX 4: SUPPLEMENTARY TABLES

Table 24—World meat production and growth, by country group, 1961-65 to 1973-77 averages

Type of Meat/Country Group[a]	1961-65	Percent of World Total	1973-77	Percent of World Total	Growth Rate 1961-65 to 1973-77
	(1,000 metric tons)		(1,000 metric tons)		(percent/year)
Total[b]					
World	81,815		120,136		3.25
Developed countries	54,010	66	79,293	66	3.25
Developing countries	27,805	34	40,843	34	3.26
Beef and buffalo					
World	32,080		45,168		2.89
Developed countries	21,201	66	31,414	70	3.33
Developing countries	10,879	34	13,754	30	1.97
Mutton and goat					
World	6,673		7,211		0.65
Developed countries	3,569	53	3,523	49	-0.11
Developing countries	3,104	47	3,687	51	1.45
Pig					
World	31,165		45,216		3.15
Developed countries	20,862	67	28,690	63	2.69
Developing countries	10,303	33	16,526	37	4.02
Poultry					
World	11,896		22,540		5.47
Developed countries	8,377	70	15,665	69	5.35
Developing countries	3,519	30	6,875	31	5.74

Sources: Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.
Note: Parts may not add to total because of rounding.

[a] Countries are grouped according to the classification system of the Food and Agriculture Organization of the United Nations.

[b] Total meat includes beef and buffalo meat, mutton and goat meat, pigmeat, and poultry.

Table 25—World milk production and growth, by country group, 1961-65 to 1973-77 averages

Type of Milk/Country Group[a]	1961-65	Percent of World Total	1973-77	Percent of World Total	Growth Rate 1961-65 to 1973-77
	(1,000 metric tons)		(1,000 metric tons)		(percent/year)
Total[b]					
World	357,320		432,564		1.61
Developed countries	288,234	81	339,052	78	1.36
Developing countries	69,086	19	93,512	22	2.55
Cow					
World	325,562		392,360		1.57
Developed countries	282,275	87	333,636	85	1.40
Developing countries	43,287	13	58,724	15	2.57
Buffalo					
World	19,216		26,757		2.80
Developed countries	89	...	90	...	0.09
Developing countries	19,127	100	26,667	100	2.81
Sheep					
World	5,854		6,871		1.34
Developed countries	3,119	53	3,442	50	0.82
Developing countries	2,735	47	3,429	50	1.90
Goat					
World	6,688		6,576		-0.14
Developed countries	2,751	41	1,885	29	-3.10
Developing countries	3,937	59	4,692	71	1.47

Sources: Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.
Note: Parts may not add to totals because of rounding.

[a] Countries are grouped according to the classification system of the Food and Agriculture Organization of the United Nations.

[b] Total milk includes cow, buffalo, sheep, and goat milk and milk products in whole milk equivalents.

Table 26—World egg production and growth, by country group, 1961-65 to 1973-77 averages

Type of Egg/Country Group[a]	1961-65	Percent of World Total	1973-77	Percent of World Total	Growth Rate 1961-65 to 1973-77
	(1,000 metric tons)		(1,000 metric tons)		(percent/year)
Total[b]					
World	16,707		23,838		3.01
Developed countries	11,907	71	16,202	68	2.60
Developing countries	4,800	29	7,636	32	3.94
Hen					
World	16,448		23,497		3.02
Developed countries	11,812	72	16,068	68	2.60
Developing countries	4,637	28	7,429	32	4.01
Other					
World	259		340		2.30
Developed countries	96	37	134	39	2.83
Developing countries	164	63	207	61	1.97

Sources: Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.
Note: Parts may not add to total because of rounding.

[a] Countries are grouped according to the classification system of the Food and Agriculture Organization of the United Nations.

[b] Total eggs include hen eggs and other eggs.

Table 27—Average output of meat per animal and milk per cow, by country group and region, 1961-65 and 1973-77

Livestock Product	World	Developed Countries	Developing Countries	All Study Countries	Asia	North Africa/ Middle East	Sub-Saharan Africa	Latin America
				(kilograms)				
Beef and veal								
1961-65	163.8	166.3	158.7	161.2	120.3	110.1	126.2	192.5
1973-77	194.1	212.2	159.5	162.3	125.8	112.6	125.0	193.6
Buffalo meat								
1961-65	160.9	130.1	161.5	135.5	130.5	158.7	...	...
1973-77	155.4	188.2	155.0	130.2	104.0	133.2	...	...
Mutton and lamb								
1961-65	14.8	15.2	14.0	13.9	11.4	15.4	11.4	15.4
1973-77	15.2	16.0	14.1	14.0	11.8	15.9	11.0	14.5
Goat meat								
1961-65	11.4	11.5	11.4	10.8	9.8	13.8	10.3	10.7
1973-77	11.4	11.7	11.4	10.8	9.9	14.1	9.8	11.0
Pigmeat								
1961-65	63.1	68.3	54.9	53.6	46.7	63.8	45.5	62.5
1973-77	68.0	76.6	55.8	54.8	47.0	66.9	45.2	65.0
Cow's milk[a]								
1961-65	1,727.6	2,483.1	562.0	572.7	438.8	580.5	301.7	854.0
1973-77	1,927.5	2,940.2	637.6	642.3	485.1	618.9	303.0	926.6

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.
Note: The ellipses (. . .) indicate a nil or negligible amount.
[a] Cow's milk is given in kilograms per cow per year.

Table 28—Growth in numbers and production of livestock by region, 1961-65 to 1973-77 averages

Use/Type of Livestock	Asia	North Africa/ Middle East	Sub-Saharan Africa	Latin America	All Study Countries
			(percent)		
Meat					
Cattle					
Stock	0.55	2.27	1.31	2.75	1.57
Animals slaughtered	2.08	2.82	1.85	2.09	2.13
Production	2.46	3.02	1.76	2.14	2.19
Buffalo					
Stock	1.56	1.19	...	...	1.56
Animals slaughtered	2.33	3.46	...	...	2.55
Production	2.27	1.97	...	...	2.21
Sheep					
Stock	0.68	1.82	1.04	-0.96	0.69
Animals slaughtered	1.88	2.64	1.07	-0.12	1.69
Production	2.20	2.95	0.74	-0.64	1.79
Goats					
Stock	1.11	0.29	1.03	-0.14	0.77
Animals slaughtered	1.26	0.94	0.96	0.16	1.03
Production	1.37	1.12	0.54	0.32	1.00
Pigs					
Stock	2.53	3.76	4.06	2.10	2.35
Animals slaughtered	3.16	6.31	4.40	3.03	3.20
Production	3.23	6.73	4.33	3.37	3.37
Dairy					
Cows in milk	-0.01	2.08	1.58	2.75	1.54
Yield per cow	0.84	0.54	0.04	0.68	0.96
Production	0.83	2.63	1.62	3.45	2.51

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.
Note: The ellipses (. . .) indicate a nil or negligible amount.

Table 29—Production, consumption, and annual growth rates of meat for selected developing countries, by region and subregion, 1961-65 and 1973-77 averages

Region/Subregion/ Country	Population Growth Rate 1961-65 to 1973-77	Meat Production			Meat Consumption		
		1961-65	1973-77	Growth Rate	1961-65	1973-77	Growth Rate
	(percent)	(1,000 metric tons)		(percent)	(1,000 metric tons)		(percent)
Asia	2.5	3,422.1	4,758.1	2.8	3,518.7	4,986.0	2.9
Bangladesh	2.7	203.8	220.6	0.7	203.8	220.7	0.7
Burma	2.3	106.5	172.7	4.1	106.7	172.7	4.1
India	2.3	626.3	726.1	1.2	630.2	729.5	1.2
Indonesia	2.5	325.5	392.9	1.6	320.4	396.5	1.8
Korea, Republic of	2.2	97.5	230.4	7.4	95.2	232.7	7.7
Malaysia	2.8	80.0	134.9	4.5	91.7	148.3	4.1
Mongolia	3.0	164.9	189.0	1.1	115.1	124.5	0.7
Pakistan	2.9	379.2	557.1	3.3	379.2	543.4	3.0
Philippines	3.1	389.1	642.7	4.3	405.3	615.0	3.5
Thailand	3.0	329.6	438.5	2.4	312.4	431.0	2.7
Others	2.3	719.7	1,053.2	3.2	858.7	1,371.7	4.0
Subregion							
South Asia	2.4	1,279.7	1,593.7	1.8	1,290.4	1,590.6	1.8
East and Southeast Asia	2.6	2,142.3	3,164.4	3.3	2,228.3	3,395.4	3.6
North Africa/Middle East	2.6	1,911.2	2,875.9	3.5	2,034.8	3,285.4	4.1
Afghanistan	2.4	170.5	170.9	0.0	169.5	171.7	0.1
Algeria	2.7	73.8	117.9	4.0	103.2	122.1	1.4
Egypt	2.4	257.3	354.5	2.7	278.4	392.5	2.9
Iran	2.9	240.1	462.7	5.6	235.0	558.7	7.5
Iraq	3.3	84.6	126.0	3.4	85.4	144.7	4.5
Morocco	2.7	151.0	189.9	1.9	150.5	190.4	2.0
Sudan	2.4	161.1	277.1	4.6	173.8	272.0	3.8
Syria	3.3	58.5	91.1	3.8	60.3	101.7	4.5
Tunisia	2.0	41.4	87.2	6.4	42.6	93.2	6.7
Turkey	2.5	535.2	766.5	3.0	516.0	751.8	3.2
Others	2.8	137.7	232.1	4.4	220.1	486.6	6.8
Subregion							
Northern Africa	2.5	695.7	1,059.9	3.6	761.7	1,131.0	3.3
Western Asia	2.7	1,215.5	1,816.0	3.4	1,273.1	2,154.3	4.5
Sub-Saharan Africa	2.7	2,181.0	2,875.0	2.3	2,143.5	2,733.7	2.0
Cameroon	2.0	43.1	78.0	5.1	45.8	82.1	5.0
Ethiopia	2.4	408.3	397.1	-0.2	404.7	386.4	-0.4
Kenya	3.6	144.2	201.3	2.8	139.2	164.1	1.4
Madagascar	2.3	149.7	173.9	1.3	134.1	163.9	1.7
Namibia	2.6	90.4	138.5	3.6	34.4	51.3	3.4
Nigeria	3.0	293.6	366.5	1.9	344.2	412.7	1.5
Somalia	2.4	72.0	127.8	4.9	92.0	102.5	0.9
Tanzania	2.8	123.4	166.7	2.5	112.3	164.2	3.2
Uganda	3.4	66.4	115.3	4.7	68.2	100.4	3.3
Zimbabwe	3.7	101.3	177.9	4.8	86.6	164.3	5.5
Others	2.7	688.6	932.0	2.6	682.0	941.8	2.7
Subregion							
West Africa	2.9	715.0	861.0	1.6	734.1	896.5	1.7
Central Africa	2.2	154.2	269.7	4.8	189.7	316.2	4.3
Eastern and Southern Africa	2.8	1,311.8	1,744.2	2.4	1,219.7	1,521.0	1.9
Latin America	2.7	8,064.5	11,510.0	3.0	7,237.5	10,683.9	3.3
Argentina	1.4	2,705.6	3,145.5	1.3	2,077.1	2,628.8	2.0
Brazil	2.9	2,197.4	3,639.5	4.3	2,146.2	3,502.1	4.2
Chile	1.9	189.4	308.0	4.1	232.0	333.1	3.1
Colombia	2.7	497.8	653.9	2.3	476.3	627.8	2.3
Cuba	1.8	214.5	256.5	1.5	218.0	265.0	1.6
Mexico	3.3	790.6	1,279.0	4.1	709.5	1,231.8	4.7
Paraguay	2.7	138.8	165.6	1.5	116.5	147.1	2.0
Peru	2.8	191.9	311.2	4.1	196.8	303.1	3.7
Uruguay	0.7	391.2	430.9	0.8	311.3	321.3	0.3

(continued)

Table 29—Continued

Region/Subregion/ Country	Population Growth Rate 1961-65 to 1973-77	Meat Production			Meat Consumption		
		1961-65	1973-77	Growth Rate	1961-65	1973-77	Growth Rate
	(percent)	(1,000 metric tons)		(percent)	(1,000 metric tons)		(percent)
Venezuela	3.4	214.5	431.2	6.0	240.4	511.9	6.5
Others	2.8	532.8	888.7	4.4	513.4	811.9	3.9
Subregion							
Central America and Caribbean	3.0	1,375.0	2,153.3	3.8	1,274.9	2,046.3	4.0
Upper South America	2.9	3,403.3	5,472.3	4.0	3,342.3	5,354.5	4.0
Lower South America	1.5	3,286.2	3,884.4	1.4	2,620.3	3,283.1	1.9
All study countries	2.6	15,578.8	22,019.0	2.9	14,934.5	21,689.0	3.2

Sources: Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.

Notes: Meat includes beef and buffalo meat, mutton and goat meat, pigmeat, and poultry meat in carcass weight equivalents.

The selection of countries is based on the amount of meat production in 1973-77. The top 10 countries within the region are then listed alphabetically. A complete list of countries is given in Appendix 1, Table 21.

Parts may not add to total because of rounding.

Table 30—Production, consumption, and annual growth rates of milk for selected developing countries, by region and subregion, 1961-65 and 1973-77 averages

Region/Subregion/ Country	Population Growth Rate 1961-65 to 1973-77	Milk Production			Milk Consumption		
		1961-65	1973-77	Growth Rate	1961-65	1973-77	Growth Rate
	(percent)	(1,000 metric tons)		(percent)	(1,000 metric tons)		(percent)
Asia	2.5	29,180.8	37,696.1	2.2	31,100.4	39,544.8	2.0
Bangladesh	2.7	825.0	1,054.1	2.1	872.6	1,167.4	2.5
Burma	2.3	197.9	261.7	2.4	309.4	298.8	-0.3
India	2.3	20,149.0	25,183.6	1.9	20,631.8	24,384.0	1.4
Indonesia	2.5	36.0	50.5	2.9	120.1	367.6	9.8
Korea, Republic of	2.2	7.1	172.3	30.4	3.2	25.8	19.0
Mongolia	3.0	219.0	233.0	0.5	225.0	251.2	0.9
Nepal	2.1	541.3	681.9	1.9	541.3	631.9	1.9
Pakistan	2.9	6,889.0	9,630.1	2.8	6,940.0	9,719.8	2.8
Sri Lanka	2.1	157.0	196.3	1.9	257.6	282.7	0.8
Vietnam	2.1	30.7	48.7	3.9	105.9	152.9	3.1
Others	2.9	128.8	183.9	3.0	1,093.5	2,212.7	6.0
Subregion							
South Asia	2.4	28,570.9	36,778.4	2.1	29,252.9	36,248.2	1.8
East and Southeast Asia	2.6	610.0	917.8	3.5	1,847.4	3,296.6	4.9
North Africa/Middle East	2.6	10,835.2	14,044.1	2.2	11,658.0	16,169.4	2.8
Afghanistan	2.4	745.2	847.3	1.1	749.0	862.7	1.2
Algeria	2.7	353.5	583.4	4.3	534.9	1,081.9	6.0
Egypt	2.4	1,160.8	1,791.2	3.7	1,177.2	1,831.7	3.8
Iran	2.9	1,504.4	2,050.9	2.6	1,545.5	2,288.9	3.3
Iraq	3.3	397.4	460.8	1.2	433.4	592.0	2.6
Morocco	2.7	376.4	524.8	2.8	444.4	614.5	2.7
Sudan	2.4	923.6	1,347.6	3.2	1,098.7	1,383.0	1.9
Syria	3.3	519.6	554.4	0.5	543.1	635.5	1.3
Tunisia	2.0	137.3	239.4	4.7	173.0	366.9	6.5
Turkey	2.5	4,090.5	4,824.0	1.4	4,091.0	4,809.5	1.4
Others	2.8	626.5	820.3	2.3	867.8	1,702.8	5.8

(continued)

Table 30—Continued

Region/Subregion/ Country	Population Growth Rate 1961-65 to 1973-77	Milk Production			Milk Consumption		
		1961-65	1973-77	Growth Rate	1961-65	1973-77	Growth Rate
	(percent)	(1,000 metric tons)		(percent)	(1,000 metric tons)		(percent)
Subregion							
Northern Africa	2.5	2,995.6	4,547.3	3.5	3,491.7	5,501.4	3.9
Western Asia	2.7	7,839.6	9,496.8	1.6	8,166.3	10,668.0	2.3
Sub-Saharan Africa	2.7	4,647.1	5,520.5	1.4	5,183.1	6,661.8	2.1
Chad	2.0	171.0	201.0	1.4	182.8	224.7	1.7
Ethiopia	2.4	533.0	617.3	1.2	658.3	780.2	1.4
Kenya	3.6	722.4	955.7	2.4	723.1	701.0	-0.3
Mauritania	2.6	191.8	171.3	-0.9	210.0	228.5	0.7
Niger	3.1	206.1	189.2	-0.7	214.0	216.1	0.1
Nigeria	3.0	252.0	297.3	1.4	320.0	691.6	6.6
Somalia	2.4	393.8	499.3	2.0	570.8	705.9	1.8
Tanzania	2.8	553.2	693.8	1.9	590.2	753.4	2.1
Uganda	3.4	201.9	273.8	2.6	256.7	362.8	2.9
Zimbabwe	3.7	218.0	254.0	1.3	223.8	268.1	1.5
Others	2.5	1,203.9	1,367.8	1.1	1,233.4	1,729.5	2.9
Subregion							
West Africa	2.9	1,201.4	1,271.5	0.5	1,415.6	2,024.8	3.0
Central Africa	2.2	221.6	289.2	2.2	293.8	457.3	3.8
Eastern and Southern Africa	2.8	3,224.1	3,959.8	1.7	3,473.6	4,179.7	1.6
Latin America	2.7	20,043.1	29,994.8	3.4	21,840.1	32,543.5	3.4
Argentina	1.4	4,294.1	5,454.2	2.0	4,241.8	5,152.7	1.6
Brazil	2.9	5,298.8	9,719.0	5.2	6,107.8	9,996.0	4.2
Chile	1.9	791.3	987.7	1.9	928.3	1,211.9	2.2
Colombia	2.7	1,842.6	2,190.6	1.5	1,977.4	2,248.7	1.1
Cuba	1.8	390.0	920.0	7.4	594.2	1,446.9	7.7
Ecuador	3.0	381.5	787.0	6.2	407.3	830.6	6.1
Mexico	3.3	3,270.8	5,212.3	4.0	3,517.4	5,793.9	4.2
Peru	2.8	585.2	835.2	3.0	680.1	1,128.1	4.3
Uruguay	0.7	763.8	717.6	-0.5	763.8	724.4	-0.4
Venezuela	3.4	548.3	1,169.5	6.5	969.2	1,568.9	4.1
Others	2.8	1,876.7	2,001.7	0.5	1,652.8	2,441.4	3.3
Subregion							
Central America and Caribbean	3.0	4,742.5	7,908.3	4.4	5,512.4	9,370.2	4.5
Upper South America	2.9	9,451.4	14,927.1	3.9	10,393.6	16,084.3	3.7
Lower South America	1.5	5,849.2	7,159.4	1.7	5,934.0	7,089.0	1.5
All study countries	2.6	64,706.2	87,255.5	2.5	69,781.6	94,919.5	2.6

Sources: Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.

Notes: Milk includes cow, buffalo, sheep, and goat milk and milk products in whole milk equivalents.
The selection of countries is based on the amount of milk production in 1973-77. The top 10 countries within the region are then listed alphabetically. A complete list of countries is given in Appendix 1, Table 21.
Parts may not add to total because of rounding.

Table 31—Production, consumption, and annual growth rates of eggs for selected developing countries, by region and subregion, 1961-65 and 1973-77 averages

Region/Subregion/ Country	Population Growth Rate 1961-65 to 1973-77	Egg Production			Egg Consumption		
		1961-65	1973-77	Growth Rate	1961-65	1973-77	Growth Rate
	(percent)	(1,000 metric tons)		(percent)	(1,000 metric tons)		(percent)
Asia	2.5	668.9	1,254.4	5.4	699.7	1,319.4	5.4
Bangladesh	2.7	47.4	38.1	-1.8	47.4	38.1	-1.8
India	2.3	75.0	83.0	0.8	75.2	82.9	0.8
Indonesia	2.5	54.0	102.6	5.5	54.0	106.9	5.9
Korea, Republic of	2.2	46.0	177.9	11.9	46.0	177.9	11.9
Korea, Democratic People's Republic of	2.7	40.8	72.1	4.9	40.8	72.1	4.9
Malaysia	2.8	42.5	101.2	7.5	48.4	102.8	6.5
Pakistan	2.9	9.0	50.4	15.4	9.1	60.0	17.0
Philippines	3.1	89.5	174.7	5.7	89.5	174.7	5.7
Thailand	3.0	96.4	170.4	4.9	89.5	167.8	5.4
Vietnam	2.1	98.8	162.8	4.2	97.3	162.5	4.4
Others	2.3	69.5	121.2	4.7	102.5	173.7	4.5
Subregion							
South Asia	2.4	154.1	202.7	2.3	154.7	212.2	2.7
East and Southeast Asia	2.6	514.8	1,051.7	6.1	545.0	1,107.2	6.1
North Africa/Middle East	2.6	271.8	548.6	6.0	282.8	608.5	6.6
Afghanistan	2.4	14.0	15.6	0.9	14.0	15.6	0.9
Algeria	2.7	8.5	16.0	5.4	11.7	21.4	5.2
Egypt	2.4	39.7	67.5	4.5	39.6	70.0	4.9
Iran	2.9	36.6	108.0	9.4	36.8	118.9	10.3
Iraq	3.3	7.2	16.1	6.9	7.8	31.2	12.2
Lebanon	2.7	8.8	23.4	8.5	7.7	14.2	5.2
Morocco	2.7	37.7	53.8	3.0	37.0	53.8	3.2
Syria	3.3	12.9	27.9	6.6	12.5	32.0	8.1
Tunisia	2.0	8.6	17.1	5.9	9.7	18.2	6.3
Turkey	2.5	68.3	147.7	6.6	67.9	147.7	6.7
Others	2.6	29.5	55.5	5.4	39.1	85.5	6.7
Subregion							
Northern Africa	2.5	106.8	177.1	4.3	109.2	187.1	4.6
Western Asia	2.7	165.0	371.5	7.0	173.6	421.4	7.7
Sub-Saharan Africa	2.7	251.9	375.7	3.4	252.6	382.5	3.5
Ethiopia	2.4	57.6	68.6	1.5	56.9	68.3	1.5
Ghana	2.6	4.8	10.0	6.3	4.8	10.0	6.3
Kenya	3.6	8.4	16.8	5.9	10.0	17.7	4.9
Madagascar	2.3	10.6	12.9	1.6	10.6	12.9	1.6
Malawi	3.0	3.8	9.3	7.7	3.8	9.3	7.7
Nigeria	3.0	82.4	117.3	3.0	82.4	117.2	3.0
Tanzania	2.8	12.8	22.3	4.7	12.8	22.3	4.7
Uganda	3.4	7.3	11.1	3.6	6.1	14.0	7.2
Zambia	2.9	3.7	15.4	12.6	3.8	15.9	12.7
Zimbabwe	3.7	6.7	9.1	2.6	6.6	9.1	2.7
Others	2.5	53.8	82.9	3.7	52.0	92.6	4.9
Subregion							
West Africa	2.9	119.1	172.5	3.1	119.4	173.3	3.2
Central Africa	2.2	13.3	21.1	3.9	13.5	21.6	4.0
Eastern and Southern Africa	2.8	119.5	182.1	3.6	119.8	187.6	3.8
Latin America	2.7	917.8	1,747.5	5.5	918.8	1,761.2	5.6
Argentina	1.4	153.6	195.5	2.0	148.4	207.7	2.8
Brazil	2.9	245.4	444.9	5.1	245.3	444.9	5.1
Chile	1.9	40.6	63.1	3.7	40.6	63.2	3.8
Colombia	2.7	61.8	114.1	5.2	61.8	111.1	5.0
Cuba	1.8	33.6	80.6	7.6	33.9	83.5	7.8
El Salvador	3.2	15.8	28.4	5.0	15.4	27.5	5.0
Guatemala	3.1	26.2	32.3	1.8	26.5	32.1	1.6
Mexico	3.3	169.8	444.5	8.3	169.8	444.5	8.3

(continued)

Table 31—Continued

Region/Subregion/ Country	Population Growth Rate 1961-65 to 1973-77	Egg Production			Egg Consumption		
		1961-65	1973-77	Growth Rate	1961-65	1973-77	Growth Rate
	(percent)	(1,000 metric tons)		(percent)	(1,000 metric tons)		(percent)
Peru	2.8	18.7	49.3	8.4	18.9	49.0	8.3
Venezuela	3.4	41.8	95.3	7.1	47.2	96.8	6.2
Others	2.5	110.5	199.5	5.0	111.0	200.9	5.1
Subregion							
Central America and Caribbean	3.0	306.5	704.4	7.2	307.6	710.0	7.2
Upper South America	2.9	399.6	767.6	5.6	405.2	763.5	5.4
Lower South America	1.5	211.8	275.5	2.2	206.0	287.7	2.8
All study countries	2.6	2,110.4	3,926.2	5.3	2,153.9	4,071.6	5.5

Sources: Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.

Notes: Eggs include all types, not only those from hens.
The selection of countries is based on the amount of egg production in 1973-77. The top 10 countries within the region are then listed alphabetically. A complete list of countries is given in Appendix 1, Table 21.
Parts may not add to total because of rounding.

Table 32—Income elasticities of demand for livestock products and cereals, 1975

Country Group/Region	Meat	Milk	Eggs	Cereals
Developed economies[a]	0.25	-0.05	0.27	-0.22
Developing economies[a]	0.63	0.57	1.00	0.16
Africa	0.79	0.68	1.05	0.21
Asia and Far East	0.97	0.52	1.07	0.22
Near East	0.72	0.53	0.83	0.13
Latin America	0.37	0.49	0.60	0.16

Source: Food and Agriculture Organization of the United Nations, "Parameters of Demand Functions, Fifth Run," Rome, April 15, 1978 (computer printout).

[a] Countries are grouped according to the classification system of the Food and Agriculture Organization of the United Nations.

Table 33—Average per capita consumption of livestock products in 1973-77, by region and by level of per capita income in 1977

Product/Per Capita Income Group	Asia	North Africa/ Middle East	Sub-Saharan Africa	Latin America	All Study Countries
			(kilograms/year)		
Meat					
Less than $250	2.8	8.9	10.2	10.6	4.0
$250–$499	6.9	12.4	7.5	19.2	8.1
$500–$1,249	10.2	14.6	14.1	22.8	15.9
$1,250 or more	56.8	18.3	27.4	38.5	35.0
All groups	4.3	14.4	9.3	33.8	10.9
Milk					
Less than $250	42.4	44.5	25.5	19.0	40.1
$250–$499	6.7	59.3	18.8	41.5	19.0
$500–$1,249	14.6	84.8	26.2	91.8	53.8
$1,250 or more	59.6	70.5	55.1	110.7	101.5
All groups	34.4	71.1	22.6	103.1	47.8
Eggs					
Less than $250	0.5	0.8	1.2	1.8	0.6
$250–$499	2.1	1.7	1.4	4.1	1.9
$500–$1,249	5.4	3.3	1.3	5.2	4.2
$1,250 or more	12.5	3.4	3.2	5.8	5.5
All groups	1.1	2.7	1.3	5.6	2.0

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980.
Notes: Consumption refers to total domestic utilization. A complete list of countries included in the study and their classifications are given in Appendix 1, Table 21.

Table 34—Growth of consumption of livestock products, by region and by per capita income growth rates, 1961-65 to 1973-77 averages

Product/Per Capita Income Growth Rate[a]	Asia	North Africa/ Middle East	Sub-Saharan Africa	Latin America	All Study Countries
			(percent)		
Meat					
Less than 1 percent	2.66	2.45	1.39	2.44	2.04
1-2.9 percent	2.04	3.80	3.42	3.02	2.88
3-4.9 percent	3.39	2.91	4.86	2.38	2.94
5 percent or more	4.20	7.86	1.64	4.16	4.40
Milk					
Less than 1 percent	2.48	2.65	1.62	4.63	2.76
1-2.9 percent	1.76	1.94	1.70	2.93	2.08
3-4.9 percent	5.49	2.43	4.41	2.37	2.71
5 percent or more	9.27	3.99	5.91	4.17	4.44
Eggs					
Less than 1 percent	3.10	4.48	3.50	5.68	3.95
1-2.9 percent	4.00	4.63	4.21	5.90	5.42
3-4.9 percent	5.75	5.72	4.97	5.10	5.62
5 percent or more	7.41	9.26	3.03	5.07	6.18

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current or Constant Market Prices," Washington, D.C., 1979 (computer printout); and World Bank, *1979 World Bank Atlas* (Washington, D.C.: World Bank, 1979).
Note: Consumption refers to total domestic utilization. A complete list of countries included in the study and their classifications are given in Appendix 1, Table 21.

[a] Growth rates of per capita income are based on 1966-77 data.

Table 35—Exports, imports, and net trade of meat, for selected developing countries, by region and subregion, 1961-65 and 1973-77 averages

Region/Subregion/Country	1961-65			1973-77		
	Exports	Imports	Net Trade[a]	Exports	Imports	Net Trade[a]
	(1,000 metric tons)					
Asia	100.9	204.7	-103.8	135.5	421.8	-286.3
Bangladesh	...	...	...	...	...	...
Burma	...	0.2	-0.2	...	...	...
India	0.6	0.1	0.5	1.8	0.2	1.6
Indonesia	4.1	1.2	2.9	6.5	1.9	4.6
Korea, Republic of	2.4	0.1	2.3	16.9	19.1	-2.2
Malaysia	1.0	17.9	-16.9	5.8	30.3	-24.5
Mongolia	50.4	0.5	49.9	64.7	1.3	63.4
Pakistan	...	0.4	-0.4	0.2	0.2	0.0
Philippines	...	16.2	-16.2	0.3	7.6	-7.3
Thailand	17.9	0.3	17.6	10.9	1.6	9.3
Subregion						
South Asia	1.9	8.5	-6.6	3.2	8.8	-5.6
East and Southeast Asia	99.0	196.2	-97.2	132.3	413.0	-280.7
North Africa/Middle East	42.8	142.1	-99.3	37.9	397.9	-360.0
Afghanistan	...	...	...	...	...	...
Algeria	0.5	31.6	-31.1	...	4.4	-4.4
Egypt	0.2	21.3	-21.1	1.3	38.5	-37.2
Iran	6.5	1.1	5.4	0.3	97.6	-97.3
Iraq	0.1	1.0	-0.9	...	19.8	-19.8
Morocco	0.7	0.8	-0.1	0.2	7.3	-7.1
Sudan	4.6	0.5	4.1	9.6	0.2	9.4
Syria	9.3	11.1	-1.8	2.7	13.4	-10.7
Tunisia	0.1	1.3	-1.2	...	7.3	-7.3
Turkey	18.6	0.1	18.5	14.0	0.7	13.3
Subregion						
Northern Africa	6.1	57.7	-51.6	11.1	86.1	-75.0
Western Asia	36.7	84.4	-47.7	26.8	311.8	-285.0
Sub-Saharan Africa	263.5	195.2	68.3	301.2	209.2	92.0
Cameroon	1.1	3.8	-2.7	2.6	6.8	-4.2
Ethiopia	5.4	0.1	5.3	12.3	0.2	12.1
Kenya	13.1	7.4	5.7	12.7	2.0	12.5
Madagascar	7.5	0.4	7.1	8.4	0.1	8.3
Namibia	44.9	...	44.9	66.7	...	66.7
Nigeria	1.4	41.7	-40.3	0.1	44.1	-44.0
Somalia	14.8	...	14.8	29.3	...	29.3
Tanzania	10.5	1.5	9.0	2.9	1.6	1.3
Uganda	0.8	2.6	-1.8	...	1.4	-1.4
Zimbabwe	18.7	2.7	16.0	16.8	1.0	15.8
Subregion						
West Africa	112.1	117.7	-5.6	88.9	113.2	-24.3
Central Africa	5.3	39.4	-34.1	10.1	56.6	-46.5
Eastern and Southern Africa	146.1	38.1	108.0	202.2	39.4	162.8
Latin America	1,088.4	193.3	895.1	1,144.8	286.2	858.6
Argentina	668.3	0.7	667.6	471.4	0.4	471.0
Brazil	67.7	13.3	54.4	194.8	46.5	148.3
Chile	1.1	44.3	-43.2	1.9	23.5	-21.6
Colombia	21.7	0.3	21.4	90.7	0.6	90.1
Cuba	0.4	5.2	-4.8	...	8.5	-8.5
Mexico	125.6	6.3	119.3	95.6	13.0	82.6
Paraguay	53.4	21.5	31.9	46.3	23.1	23.2
Peru	0.2	18.6	-18.4	...	12.7	-12.7
Uruguay	104.5	0.1	104.4	120.2	...	120.2
Venezuela	...	26.1	-26.1	0.2	69.2	-69.0
Subregion						
Central America and Caribbean	170.6	57.3	113.3	209.2	99.0	110.2
Upper South America	143.9	90.9	53.0	342.1	163.3	178.8
Lower South America	773.9	45.1	728.8	593.5	23.9	569.6

(See sources and notes on page 80.)

Table 36—Exports, imports, and net trade of milk, for selected developing countries, by region and subregion, 1961-65 and 1973-77 averages

Region/Subregion/Country	1961-65			1973-77		
	Exports	Imports	Net Trade[a]	Exports	Imports	Net Trade[a]
	(1,000 metric tons)					
Asia	39.1	2,010.1	-1,971.0	140.5	3,081.8	-2,941.3
Bangladesh	...	47.6	-47.6	0.1	113.6	-113.5
Burma	...	111.5	-111.5	...	37.1	-37.1
India	...	482.8	-482.8	0.4	308.2	-307.8
Indonesia	...	84.1	-84.1	...	310.2	-310.2
Korea, Republic of	...	65.8	-65.8	...	15.1	-15.1
Mongolia	...	6.0	-6.0	...	18.3	-18.3
Nepal	...	...	...	...	...	...
Pakistan	...	51.0	-51.0	...	90.7	-90.7
Sri Lanka	0.2	100.8	-100.6	...	86.4	-86.4
Vietnam	...	75.2	-75.2	...	104.2	-104.2
Subregion						
South Asia	0.2	682.2	-682.0	0.5	598.9	-598.4
East and Southeast Asia	38.9	1,327.9	-1,289.0	140.0	2,482.9	-2,342.9
North Africa/Middle East	12.4	678.9	-666.5	21.1	2,033.1	-2,012.0
Afghanistan	...	3.8	-3.8	...	15.4	-15.4
Algeria	...	182.7	-182.7	...	452.2	-452.2
Egypt	0.9	17.3	-16.4	...	40.5	-40.5
Iran	0.2	41.3	-41.1	0.4	238.3	-237.9
Iraq	0.2	36.3	-36.1	0.1	131.2	-131.1
Morocco	0.1	68.1	-68.0	...	89.7	-89.7
Sudan	...	13.7	-13.7	...	30.2	-30.2
Syria	4.3	27.9	-23.6	8.4	83.5	-75.1
Tunisia	1.6	37.3	-35.7	0.1	127.6	-127.5
Turkey	0.2	0.7	-0.5	0.2	3.9	-3.7
Subregion						
Northern Africa	2.6	339.3	-336.7	0.1	901.9	-901.8
Western Asia	9.8	339.6	-329.8	21.0	1,131.2	-1,110.2
Sub-Saharan Africa	33.0	488.5	-455.5	52.6	1,254.1	-1,201.5
Chad	...	2.2	-2.2	...	13.4	-13.4
Ethiopia	0.1	7.7	-7.6	0.7	15.6	-14.9
Kenya	23.2	19.5	3.7	48.3	7.4	40.9
Mauritania	...	3.3	-3.3	...	40.6	-40.6
Niger	...	0.8	-0.8	...	19.9	-19.9
Nigeria	...	68.1	-68.1	...	394.2	-394.2
Somalia	...	1.0	-1.0	...	11.9	-11.9
Tanzania	0.2	37.3	-37.1	...	59.6	-59.6
Uganda	0.1	23.7	-23.6	...	24.9	-24.9
Zimbabwe	8.5	14.3	-5.8	...	14.1	-14.1
Subregion						
West Africa	0.2	210.5	-210.3	2.8	723.6	-720.8
Central Africa	...	72.2	-72.2	0.5	168.2	-167.7
Eastern and Southern Africa	32.8	205.8	-173.0	49.3	362.3	-313.0
Latin America	60.8	1,871.0	-1,810.2	362.3	3,091.1	-2,728.8
Argentina	52.3	...	52.3	295.2	26.0	269.2
Brazil	...	179.0	-179.0	1.5	278.5	-277.0
Chile	...	137.0	-137.0	3.1	215.6	-212.5
Colombia	...	134.8	-134.8	13.8	71.9	-58.1
Cuba	...	204.2	-204.2	...	626.9	626.9
Ecuador	...	25.8	-25.8	0.1	28.4	-28.3
Mexico	0.1	246.7	-246.6	1.6	635.0	-633.4
Peru	0.2	95.1	-94.9	...	289.6	-289.6
Uruguay	...	0.1	-0.1	4.3	2.3	-2.0
Venezuela	0.1	434.2	-434.1	0.3	405.8	-405.5
Subregion						
Central America and Caribbean	8.2	778.1	-769.9	44.0	1,686.1	-1,642.1
Upper South America	0.3	955.8	-955.5	15.7	1,161.1	-1,145.4
Lower South America	52.3	137.1	-84.8	302.6	243.9	58.7

(See sources and notes on page 80.)

Table 37—Exports, imports, and net trade of eggs, for selected developing countries, by region and subregion, 1961-65 and 1973-77 averages

Region/Subregion/Country	1961-65			1973-77		
	Exports	Imports	Net Trade[a]	Exports	Imports	Net Trade[a]
	(1,000 metric tons)					
Asia	14.6	48.8	-34.2	5.3	56.6	-51.3
Bangladesh	...	...	...	...	...	...
India	0.3	0.5	-0.2	0.1	...	0.1
Indonesia	...	...	...	...	0.1	-0.1
Korea, Democratic People's Republic of	...	...	...	...	...	...
Korea, Republic of	...	0.1	-0.1	...	...	...
Malaysia	0.7	6.6	-5.9	0.1	1.8	-1.7
Pakistan	0.5	...	0.5	...	...	...
Philippines	...	...	...	...	...	...
Thailand	6.8	...	6.8	2.6	...	2.6
Vietnam	1.5	...	1.5	0.3	...	0.3
Subregion						
South Asia	0.8	0.8	0.0	0.2	...	0.2
East and Southeast Asia	13.8	48.0	-34.2	5.1	56.6	-51.5
North Africa/Middle East	4.2	10.7	-6.5	10.7	61.2	-50.5
Afghanistan	...	...	...	...	...	...
Algeria	...	3.2	-3.2	...	5.4	-5.4
Egypt	0.2	...	0.2	...	...	...
Iran	...	0.2	-0.2	0.1	10.9	-10.8
Iraq	...	0.6	-0.6	...	15.1	-15.1
Lebanon	2.4	1.3	1.1	10.1	0.9	9.2
Morocco	0.8	...	0.8	...	...	...
Syria	0.4	...	0.4	0.1	3.5	-3.4
Tunisia	...	0.1	-0.1	...	1.1	-1.1
Turkey	0.4	...	0.4	...	...	...
Subregion						
Northern Africa	0.2	3.4	-3.2	...	7.6	-7.6
Western Asia	4.0	7.3	-3.3	10.7	53.6	-42.9
Sub-Saharan Africa	1.1	1.2	-0.1	0.6	2.3	-1.7
Ethiopia	0.7	...	0.7	0.4	...	0.4
Ghana	...	...	...	...	...	...
Kenya	0.2	...	0.2	0.1	...	0.1
Madagascar	...	...	...	...	...	...
Malawi	...	...	...	...	...	...
Nigeria	...	...	...	...	...	...
Tanzania	...	...	...	...	...	...
Uganda	...	...	...	...	...	...
Zambia	...	0.1	-0.1	...	...	...
Zimbabwe	0.1	...	0.1	...	...	...
Subregion						
West Africa	...	0.3	-0.3	0.1	0.2	-0.1
Central Africa	...	0.1	-0.1	...	0.5	-0.5
Eastern and Southern Africa	1.1	0.8	0.3	0.5	1.6	-1.1
Latin America	7.8	8.7	-0.9	1.3	6.9	-5.6
Argentina	6.3	1.1	5.2	...	0.1	-0.1
Brazil	0.2	...	0.2	0.3	0.2	0.1
Chile	...	...	...	...	...	...
Colombia	...	...	...	...	...	...
Cuba	...	0.3	-0.3	...	...	...
El Salvador	0.5	0.1	0.4	0.3	0.2	0.1
Guatemala	0.1	0.4	-0.3	0.4	0.1	0.3
Mexico	...	...	...	...	0.1	-0.1
Peru	...	0.2	-0.2	...	0.1	-0.1
Venezuela	...	5.5	-5.5	0.1	1.6	-1.5
Subregion						
Central America and Caribbean	0.7	1.9	-1.2	0.9	0.1	0.8
Upper South America	0.2	5.7	-5.5	0.4	6.7	-6.3
Lower South America	6.9	1.1	5.8	...	0.1	-0.1

(See sources and notes on page 80.)

Sources and Notes for Tables 35, 36, and 37

Source: Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980.

Notes: Export and import figures for meat (Table 35) include the carcass weight equivalent of traded live animals. In Table 36, milk products in whole milk equivalents are included. Import figures include food aid. The ellipses (. . .) indicate a nil or negligible amount.

The selection of countries is based on the amount of meat, milk, and egg production in 1973-77. The top 10 countries within the region are then listed alphabetically. Regional totals include data for countries not individually listed. A complete list of countries is given in Appendix 1, Table 21.

[a] Net trade is export minus imports; negative figures are net imports and are indicated by a minus sign.

Table 38—Average exports, imports, and net trade of meat in 1973-77, by region and by level of per capita income, 1977

Trade Variable/ Per Capita Income Group	Asia	North Africa/ Middle East	Sub-Saharan Africa	Latin America	All Study Countries
			(1,000 metric tons)		
Exports					
Less than $250	5.6	. . .	136.5	1.1	143.2
$250–$499	17.7	11.0	75.0	34.0	137.7
$500–$1,249	87.5	25.0	89.7	190.3	392.5
$1,250 or more	24.7	1.9	. . .	919.4	946.0
All groups	135.5	37.9	301.2	1,144.8	1,619.4
Imports					
Less than $250	12.6	. . .	57.2	0.4	70.2
$250–$499	11.1	46.3	78.7	6.6	142.7
$500–$1,249	81.2	78.2	55.3	66.6	281.3
$1,250 or more	316.9	273.4	18.0	212.6	820.9
All groups	421.8	397.9	209.2	286.2	1,315.1
Net trade					
Less than $250	−7.0	. . .	79.3	0.7	73.0
$250–$499	6.6	−35.3	−3.7	27.4	−5.0
$500–$1,249	6.3	−53.2	34.4	123.7	111.2
$1,250 or more	−292.2	−271.5	−18.0	706.8	125.1
All groups	−286.3	−360.0	92.0	858.6	304.3

Sources: Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980.

Notes: Export and import figures include the carcass weight equivalents of traded live animals. The ellipses (. . .) indicate a nil or negligible amount. A list of the countries included in the study and their classifications are given in Appendix 1, Table 21. Net trade is exports minus imports. Negative figures are net imports and are indicated by a minus sign.

Table 39—Average exports, imports, and net trade of meat in 1973-77, by region and by per capita income growth rates, 1966-77

Trade Variable/ 1966-77 Per Capita Income Growth Rate	Asia	North Africa/ Middle East	Sub-Saharan Africa	Latin America	All Study Countries
			(1,000 metric tons)		
Exports					
Less than 1 percent	2.4	0.9	189.7	26.4	219.4
1-2.9 percent	68.0	9.6	59.3	747.0	883.9
3-4.9 percent	17.0	23.4	0.3	170.3	211.0
5 percent or more	48.1	4.0	51.9	201.1	305.1
All groups	135.5	37.9	301.2	1,144.8	1,619.4
Imports					
Less than 1 percent	3.8	51.9	59.4	35.8	150.9
1-2.9 percent	10.1	0.2	83.0	166.6	259.9
3-4.9 percent	75.9	114.2	8.4	34.4	232.9
5 percent or more	332.0	231.6	58.4	49.4	671.4
All groups	421.8	397.9	209.2	286.2	1,315.1
Net trade					
Less than 1 percent	-1.4	-51.0	130.3	-9.4	68.5
1-2.9 percent	57.9	9.4	-23.7	580.4	624.0
3-4.9 percent	-58.9	-90.8	-8.1	135.9	-21.9
5 percent or more	-283.9	-227.6	-6.5	151.7	-366.3
All groups	-286.3	-360.0	92.0	858.6	304.3

Sources: Food and Agriculture Organization of the United Nations, "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980.

Notes: Export and import figures include the carcass weight equivalents of traded live animals. The ellipses (. . .) indicate a nil or negligible amount. A list of the countries included in the study and their classifications are given in Appendix 1, Table 21. Net trade is exports minus imports. Negative figures are net imports and are indicated by a minus sign.

Table 40—Growth of production and consumption of meat, self-sufficiency ratios, and per capita consumption in meat-importing and meat-exporting countries, by region, 1961-65 and 1973-77 averages

Region/Trade Status	1961-65 to 1973-77 Growth Rate[a]		Self-Sufficiency Ratio[b]		Per Capita Consumption
	Production	Consumption	1961-65	1973-77	1973-77
	(percent/year)				(kilograms/year)
Asia					
Meat importers	4.54	4.66	0.83	0.81	13.15
Meat exporters	1.93	2.03	1.04	1.03	2.74[c]
North Africa/Middle East					
Meat importers	3.95	4.91	0.89	0.80	15.85
Meat exporters	3.43	3.35	1.01	1.02	18.23
Sub-Saharan Africa					
Meat importers	3.47	2.86	0.80	0.86	6.78
Meat exporters	1.72	1.43	1.17	1.21	13.38
Latin America					
Meat importers	4.13	4.05	0.91	0.92	27.44
Meat exporters	2.84	3.16	1.15	1.11	35.48
All study countries					
Meat importers	4.04	4.21	0.86	0.84	13.37
Meat exporters	2.59	2.77	1.12	1.10	12.13

Sources: Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980.

[a] The production and consumption of meat of countries that did not trade in meat in 1973-77 were excluded from the computation of growth rates.

[b] The self-sufficiency ratio is the ratio of average production to average consumption of meat during 1973-77.

[c] If India is excluded, the average per capita consumption for the rest of Asia comes to roughly 7 kilograms.

Table 41—Projections of meat production and consumption to 1990 and 2000 under zero, low, and trend income growth assumptions,by region and subregion

Region/Subregion	1990						
		Consumption			Surplus or Deficit		
	Trend Production	Zero Income Growth[a]	Low Income Growth	Trend Income Growth	Zero Income Growth	Low Income Growth	Trend Income Growth
	(1,000 metric tons)						
All study countries	35,782.3	32,055.4	39,653.7	43,818.1	3,720.9	-3,871.4	-8,035.8
Asia	7,518.8	7,182.4	9,347.4	10,254.3	330.4	-1,828.6	-2,735.5
South Asia	2,142.1	2,325.9	2,774.1	2,934.4	189.8	-632.0	-792.3
East and Southeast Asia	5,376.7	4,856.5	6,573.3	7,319.9	520.2	-1,196.6	-1,943.2
North Africa/Middle East	5,010.0	5,226.6	7,216.9	8,045.9	-216.6	-2,206.9	-3,035.9
Northern Africa	1,879.3	1,747.3	2,349.8	2,598.3	132.0	-470.5	-719.0
Western Asia	3,130.7	3,479.3	4,867.1	5,447.6	-348.6	-1,736.4	-2,316.9
Sub-Saharan Africa	4,505.1	4,224.9	4,633.7	5,888.7	280.2	-128.6	-1,383.6
West Africa	1,219.7	1,384.3	2,109.1	2,443.9	-164.6	-889.4	-1,224.2
Central Africa	549.6	487.7	570.5	596.3	61.9	-20.9	-46.7
Eastern and Southern Africa	2,735.8	2,352.9	1,954.1	2,848.7	382.9	-781.7	-112.9
Latin America	18.748.4	15,421.5	18,455.7	19,629.2	3,326.9	292.7	-880.8
Central America and Caribbean	3,858.3	3,211.8	3,669.1	3,835.9	646.5	189.2	22.4
Upper South America	10,124.6	8.354.0	10,800.4	11,767.8	1,770.6	-675.8	-1,643.2
Lower South America	4,765.5	3,855.7	3,986.2	4,025.5	909.8	779.3	740.0

Region/Subregion	2000						
		Consumption			Surplus or Deficit		
	Trend Production	Zero Income Growth[a]	Low Income Growth	Trend Income Growth	Zero Income Growth	Low Income Growth	Trend Income Growth
	(1,000 metric tons)						
All study countries	50,945.0	40,082.3	61,168.0	71,788.2	10,862.7	-10,223.0	-20,843.2
Asia	10,532.9	8,735.6	14,208.6	17,233.1	1,797.3	-3,675.7	-6,700.2
South Asia	2,642.5	2,907.9	3,983.0	4,412.2	-265.4	-1,340.5	-1,769.7
East and Southeast Asia	7,890.4	5,827.7	10,225.6	12,820.9	2,062.7	-2,335.2	-4,930.5
North Africa/Middle East	7,501.6	6,658.7	11,720.3	14,307.5	842.9	-4,218.7	-6,805.9
Northern Africa	2,843.5	2,224.7	3,805.6	4,597.1	618.8	-962.1	-1,753.6
Western Asia	4,658.1	4,434.0	7,914.7	9,710.4	224.1	-3,256.6	-5,052.3
Sub-Saharan Africa	6,257.5	5,594.5	9,071.8	10,987.7	663.0	-2,814.3	-4,730.2
West Africa	1,569.8	1,851.4	4,156.7	5,621.7	-281.6	-2,586.9	-4,051.9
Central Africa	887.2	615.2	817.0	893.2	272.0	70.2	-6.0
Eastern and Southern Africa	3,800.5	3,127.9	4,098.1	4,472.8	672.6	-297.6	-672.3
Latin America	26,633.0	19,093.5	26,167.3	29,259.9	7,539.5	465.7	-2,626.9
Central America and Caribbean	5,765.0	4,206.4	5,306.0	5,753.6	1,558.6	459.0	11.4
Upper South America	15,397.7	10,665.5	16,425.9	19,007.1	4,732.2	-1,028.2	-3,609.4
Lower South America	5,490.3	4,221.6	4,435.4	4,499.2	1,268.7	1,054.9	991.1

Sources: Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Parameters of Demand Functions, Fifth Run," Rome, April 1978 (computer printout); FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980; World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); World Bank, *1979 World Bank Atlas* (Washington, D.C.: World Bank, 1979); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

Notes: Parts may not add to totals because of rounding. A list of the countries included in the study and their classification are given in Appendix 1, Table 21.

[a] Estimates of consumption under zero income growth refer to the requirements for the 1990 and 2000 populations at 1977 per capita consumption levels.

Table 42—Projections of milk production and consumption to 1990 and 2000 under zero, low, and trend income growth assumptions, by region and subregion

Region/Subregion	1990						
		Consumption			Surplus or Deficit		
	Trend Production	Zero Income Growth[a]	Low Income Growth	Trend Income Growth	Zero Income Growth	Low Income Growth	Trend Income Growth
	(1,000 metric tons)						
All study countries	131,105.2	137,415.4	158,271.6	166,095.0	-6,310.2	-27,166.4	-34,989.8
Asia	51,724.8	55,047.2	62,382.0	65,128.8	-3,322.4	-10,657.2	-13,404.0
South Asia	49,972.2	50,004.1	55,412.3	57,343.9	-31.9	-5,440.1	-7,371.7
East and Southeast Asia	1,752.6	5,043.1	6,969.7	7,784.9	-3,290.5	-5,217.1	-6,032.3
North Africa/Middle East	20,693.4	23,425.4	28,731.7	30,761.3	-2,732.0	-8,038.3	-10,067.9
Northern Africa	7,401.1	8,837.9	10,646.8	11,340.8	-1,436.8	-3,245.7	-3,939.7
Western Asia	13,292.3	14,587.5	18,084.9	19,420.8	-1,295.2	-4,792.6	-6,128.2
Sub-Saharan Africa	7,022.3	10,120.7	12,309.8	13,156.6	-3,098.4	-5,287.5	-6,134.3
West Africa	1,503.0	3,117.4	4,546.6	5,152.9	-1,614.4	-3,043.6	-3,649.9
Central Africa	417.7	694.1	797.7	823.7	-276.4	-380.0	-406.0
Eastern and Southern Africa	5,101.6	6,309.2	6,965.5	7,180.0	-1,207.6	-1,863.9	-2,078.4
Latin America	51,664.7	48,822.1	54,848.1	57,048.5	2,842.6	-3,183.4	-5,383.8
Central America and Caribbean	15,099.4	15,121.0	16,977.7	17,639.4	-21.6	-1,878.3	-2,540.0
Upper South America	27,326.7	25,249.1	29,290.9	30,799.3	2,077.6	-1,964.2	-3,472.6
Lower South America	9,238.6	8,452.0	8,579.5	8,609.8	786.6	659.1	628.8

Region/Subregion	2000						
		Consumption			Surplus or Deficit		
	Trend Production	Zero Income Growth[a]	Low Income Growth	Trend Income Growth	Zero Income Growth	Low Income Growth	Trend Income Growth
	(1,000 metric tons)						
All study countries	177,576.4	173,617.6	220,538.4	241,965.5	3,858.6	-43,062.0	-64,489.3
Asia	64,916.7	67,643.0	84,490.2	91,595.6	-2,826.4	-19,673.5	-26,779.0
South Asia	62,037.4	61,580.6	73,657.7	78,255.2	356.8	-11,720.3	-16,317.8
East and Southeast Asia	2,879.3	6,062.4	10,832.4	13,340.4	-3,183.1	-7,953.1	-10,461.1
North Africa/Middle East	27,642.7	29,873.1	41,961.4	48,303.7	-2,230.3	-14,318.7	-20,660.9
Northern Africa	10,295.2	11,513.2	15,659.2	17,4274	-1,218.0	-5,364.0	-7,132.2
Western Asia	17,347.5	18,359.9	26,302.2	30,876.3	-1,012.3	-8,954.7	-13,528.7
Sub-Saharan Africa	8,263.5	13,318.5	18,821.2	21,848.0	-5,054.9	-10,557.7	-13,584.4
West Africa	1,683.3	4,088.3	7,804.6	10,194.0	-2,405.0	-6,121.3	-8,510.7
Central Africa	538.6	884.3	1,133.1	1,216.7	-345.7	-594.5	-678.1
Eastern and Southern Africa	6,041.6	8,345.9	9,883.5	10,437.3	-2,304.2	-3,841.9	-4,395.6
Latin America	76,753.5	62,783.0	75,265.6	80,218.2	13,970.2	1,487.9	-3,465.0
Central America and Caribbean	23,957.3	20,121.8	24,321.6	26,009.2	3,835.5	-364.3	-2,051.9
Upper South America	41,731.9	33,331.8	41,411.0	44,627.9	8,399.8	320.9	-2,896.3
Lower South America	11,064.3	9,329.4	9,533.0	9,581.1	1,734.9	1,531.3	1,483.2

Sources: Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980; World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); World Bank, *1979 World Bank Atlas* (Washington, D.C.: World Bank, 1979); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

Notes: Parts may not add to totals because of rounding. A list of the countries included in the study and their classifications are given in Appendix 1, Table 21.

[a] Estimates of consumption under zero income growth refer to the requirements for the 1990 and 2000 populations at 1977 per capita consumption levels.

Table 43—Projections of egg production and consumption to 1990 and 2000 under zero, low, and trend income growth assumptions, by region and subregion

Region/Subregion	1990						
		Consumption			Surplus or Deficit		
	Trend Production	Zero Income Growth[a]	Low Income Growth	Trend Income Growth	Zero Income Growth	Low Income Growth	Trend Income Growth
	(1,000 metric tons)						
All study countries	8,446.0	6,476.4	8,059.0	8,746.2	1,969.6	387.0	-300.2
Asia	2,715.6	2,065.1	2,610.5	2,831.9	650.5	105.1	-116.3
South Asia	334.2	331.4	365.6	377.1	2.8	-31.4	-42.9
East and Southeast Asia	2,381.4	1,733.7	2,245.0	2,454.8	647.7	136.4	-73.4
North Africa/Middle East	1,363.8	1,055.8	1,432.1	1,592.6	308.0	-68.3	-228.8
Northern Africa	329.9	294.2	386.2	423.5	35.7	-56.3	-93.6
Western Asia	1,033.9	761.6	1,045.9	1,169.1	272.3	-12.0	-135.2
Sub-Saharan Africa	650.5	561.4	744.2	868.9	89.1	-93.7	-218.4
West Africa	280.5	255.3	394.5	504.7	25.2	-114.0	-224.2
Central Africa	45.0	33.2	38.2	39.5	11.8	6.8	5.5
Eastern and Southern Africa	325.0	272.9	311.5	324.7	52.1	13.5	0.3
Latin America	3,716.1	2,794.1	3,272.2	3,452.8	922.0	443.9	263.3
Central America and Caribbean	1,551.9	1,198.7	1,340.1	1,390.7	353.2	211.8	161.2
Upper South America	1,770.9	1,241.2	1,551.7	1,673.2	529.7	219.2	97.7
Lower South America	393.3	354.2	380.4	388.9	39.1	12.9	4.4

Region/Subregion	2000						
		Consumption			Surplus or Deficit		
	Trend Production	Zero Income Growth[a]	Low Income Growth	Trend Income Growth	Zero Income Growth	Low Income Growth	Trend Income Growth
	(1,000 metric tons)						
All study countries	14,717.5	8,633.2	12,639.9	14,688.7	6,084.3	2,077.6	28.9
Asia	4,688.6	2,650.1	3,860.2	4,599.1	2,038.6	828.4	89.6
South Asia	531.3	436.2	513.0	541.8	95.2	18.3	-10.5
East and Southeast Asia	4,157.3	2,213.9	3,347.2	4,057.3	1,943.4	810.1	100.1
North Africa/Middle East	2,673.5	1,495.2	2,585.0	3,072.2	1,178.5	88.5	-398.6
Northern Africa	505.8	385.3	623.4	739.2	120.7	-117.6	-233.3
Western Asia	2,167.7	1,109.9	1,961.4	2,333.0	1,057.8	206.3	-165.3
Sub-Saharan Africa	988.6	767.0	1,352.3	1,699.9	218.8	-363.7	-711.4
West Africa	398.0	349.6	804.6	1,106.1	48.4	-406.6	-708.1
Central Africa	77.0	45.6	57.3	61.8	31.3	19.7	15.1
Eastern and Southern Africa	513.6	371.8	490.4	532.0	139.1	23.2	-18.4
Latin America	6,366.8	3,718.4	4,842.4	5,317.5	2,648.4	1,524.4	1,049.3
Central America and Caribbean	2,697.6	1,644.5	1,987.0	2,122.9	1,053.0	710.6	574.6
Upper South America	3,167.2	1,677.2	2,409.6	2,732.2	1,490.0	757.6	435.0
Lower South America	502.0	396.7	445.8	462.4	105.4	56.2	39.7

Sources: Food and Agriculture Organization of the United Nations (FAO) "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Parameters of Demand Functions, Fifth Run," Rome, April 1978 (computer printout); FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980; World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); World Bank, *1979 World Bank Atlas* (Washington, D.C.: World Bank, 1979); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

Notes: Parts may not add to totals because of rounding. A list of the countries included in the study and their classifications are given in Appendix 1, Table 21.

[a] Estimates of consumption under zero income growth refer to the requirements for the 1990 and 2000 populations at 1977 per capita consumption levels.

Table 44—Projected production, consumption, and net surplus or deficit of meat, milk, and eggs, by per capita income and income growth rate, all study countries, 1990

Product/Income Group	Production	Consumption	Net Surplus or Deficit	Share of 1977 Population
		(million metric tons)		(percent)
Meat				
1977 per capita income				
Less than $250	5.90	6.98	-1.08	51.6
$250-$499	5.57	8.13	-2.56	20.8
$500-$1,249	7.14	9.33	-2.19	12.9
$1,250 or more	17.17	19.38	-2.21	14.7
All groups	35.78	43.82	-8.04	100.0
1966-77 per capita income growth				
Less than 1 percent	5.14	5.07	0.07	16.0
1-2.9 percent	13.69	14.04	-0.35	48.9
3-4.9 percent	6.11	8.84	-2.73	13.3
5 percent or more	10.84	15.87	-5.03	21.8
All groups	35.78	43.82	-8.04	100.0
Milk				
1977 per capita income				
Less than $250	55.85	65.13	-9.28	51.6
$250-$499	8.94	17.51	-8.57	20.8
$500-$1,249	21.56	30.50	-8.94	12.9
$1,250 or more	44.76	52.96	-8.20	14.7
All groups	131.11	166.10	-34.99	100.0
1966-77 per capita income growth				
Less than 1 percent	11.30	13.66	-2.36	16.0
1-2.9 percent	77.81	89.77	-11.96	48.9
3-4.9 percent	17.30	27.88	-10.58	13.3
5 percent or more	24.70	34.79	-10.09	21.8
All groups	131.11	166.10	-34.99	100.0
Eggs				
1977 per capita income				
Less than $250	1.03	1.03	...	51.6
$250-$499	1.56	1.86	-0.30	20.8
$500-$1,249	2.64	2.54	0.10	12.9
$1,250 or more	3.22	3.32	-0.10	14.7
All groups	8.45	8.75	-0.30	100.0
1966-77 per capita income growth				
Less than 1 percent	1.13	0.93	0.20	16.0
1-2.9 percent	2.50	2.37	0.13	48.9
3-4.9 percent	2.19	2.20	-0.01	13.3
5 percent or more	2.63	3.25	-0.62	21.8
All groups	8.45	8.75	-0.30	100.0

Sources: Calculated from basic data in Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Parameters of Demand Functions, Fifth Run," Rome, April 1978 (computer printout); FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980; World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); World Bank, *1979 World Bank Atlas* (Washington, D.C.: World Bank, 1979); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

Notes: Net deficits are indicated by minus signs. Parts may not add to totals because of rounding. A list of the countries included in the study and their classifications are given in Appendix 1, Table 21.

Table 45—Self-sufficiency ratios for livestock products, by region, 1961-65 and 1973-77 averages and projections to 1990 and 2000

Product/Period	Asia	North Africa/ Middle East	Sub-Saharan Africa	Latin America	All Study Countries
Meat					
1961-65	97	95	103	112	105
1973-77	94	89	103	108	101
1990	73	62	77	96	82
2000	61	52	57	91	71
Milk					
1961-65	94	94	91	92	93
1973-77	93	87	82	92	91
1990	79	67	53	91	79
2000	71	57	38	96	73
Eggs					
1961-65	95	98	100	100	98
1973-77	96	92	99	100	97
1990	96	86	75	108	97
2000	102	87	58	120	100

Sources: Food and Agriculture Organization of the United Nations (FAO), "Global Agriculture Programming System Supply Utilization Accounts Tape," Rome, June 1980; FAO, "Parameters of Demand Functions, Fifth Run," Rome, April 1978 (computer printout); FAO, "Production Yearbook Tapes, 1975 and 1979," Rome, 1976 and 1980; World Bank, "Gross National Product, 1960-78: Time Series Data by Country at Current and Constant Market Prices," Washington, D.C., 1979 (computer printout); World Bank, *1979 World Bank Atlas* (Washington, D.C.: World Bank, 1979); and United Nations, Department of International Economic and Social Affairs, *World Population Trends and Prospects by Country, 1950-2000* (ST/ESA/SER.R/33), 1979.

Note: Self-sufficiency ratios for 1961-65 and 1973-77 are computed by dividing production by production plus net trade to represent consumption; those for 1990 and 2000 are obtained by dividing the projected production by projected total domestic utilization, based on the trend income growth assumption.

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