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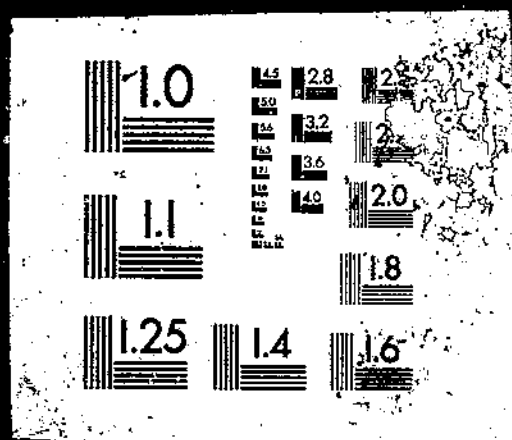
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Japan's Feed-Livestock Economy  
Prospects for the 1980's

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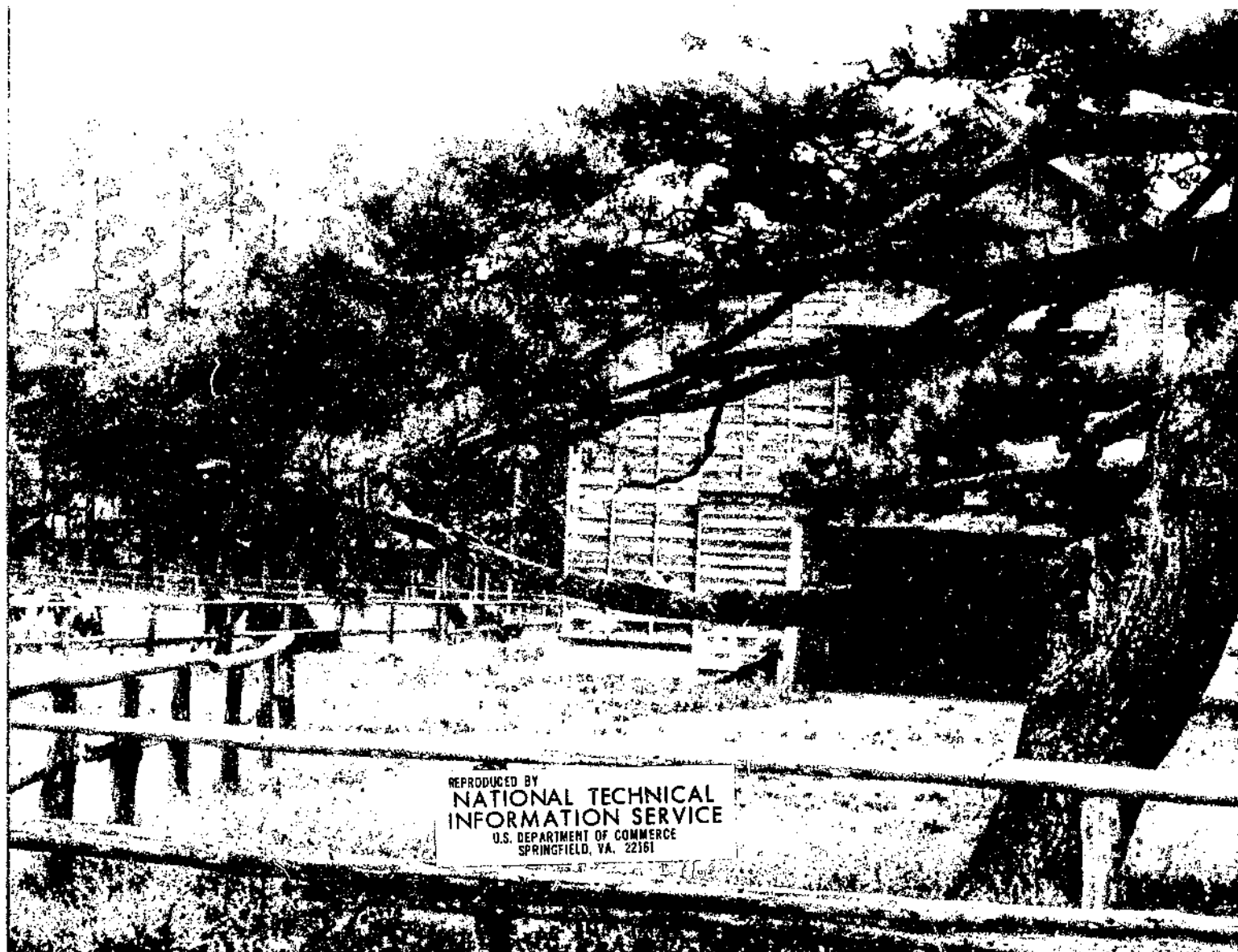
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# Japan's Feed-Livestock Economy

## Prospects for the 1980's

William T. Coyle



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### **Abstract**

Japanese consumption of livestock products through 1990 will grow at a slower pace than in 1960-80. Expansion of Japan's livestock industry will depend heavily on imported feedstuffs, mainly from the United States. By 1990, U.S. exports of grains and soybeans to Japan may rise by a third over current levels to about 20 million metric tons of grain and 6 million metric tons of soybeans. The Japanese market for imported beef will grow but that for imported dairy products, pork, or poultry will show little or no growth.

Keywords: Japan, feed grains, livestock products, U.S. trade, projections.

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JFY Japan fiscal year: April-March	
MAF Ministry of Agriculture and Forestry [1960-78]	
MAFF Ministry of Agriculture, Forestry, and Fisheries [1978 to present]	
MTN Multilateral Trade Negotiations	
TDN Total digestible nutrients	
LIPC Livestock Industry Promotion Corporation	



## Summary

Japan's livestock industry is expected to expand less rapidly in the eighties than in the sixties and seventies. The United States will be an important supplier of additional grain and soybeans required to support this expansion. Annual U.S. grain exports to Japan are projected to increase by about 20 percent, reaching about 20 million metric tons by 1990. Annual U.S. soybean exports to Japan will probably increase by about 30 percent, reaching about 6 million metric tons by 1990. The Japanese market for imported livestock products will grow for beef and dairy products but decline for pork and poultry. U.S. exports of beef to Japan could quintuple during the decade.

Japanese demand for livestock products grew rapidly during the past 20 years, but per capita consumption of meat and dairy products is still low compared with other developed countries. Eggs are the only livestock product consumed in amounts comparable with other developed countries. Future consumption of livestock products will depend largely on income and population growth and changes in relative prices as well as changes in tastes and preferences.

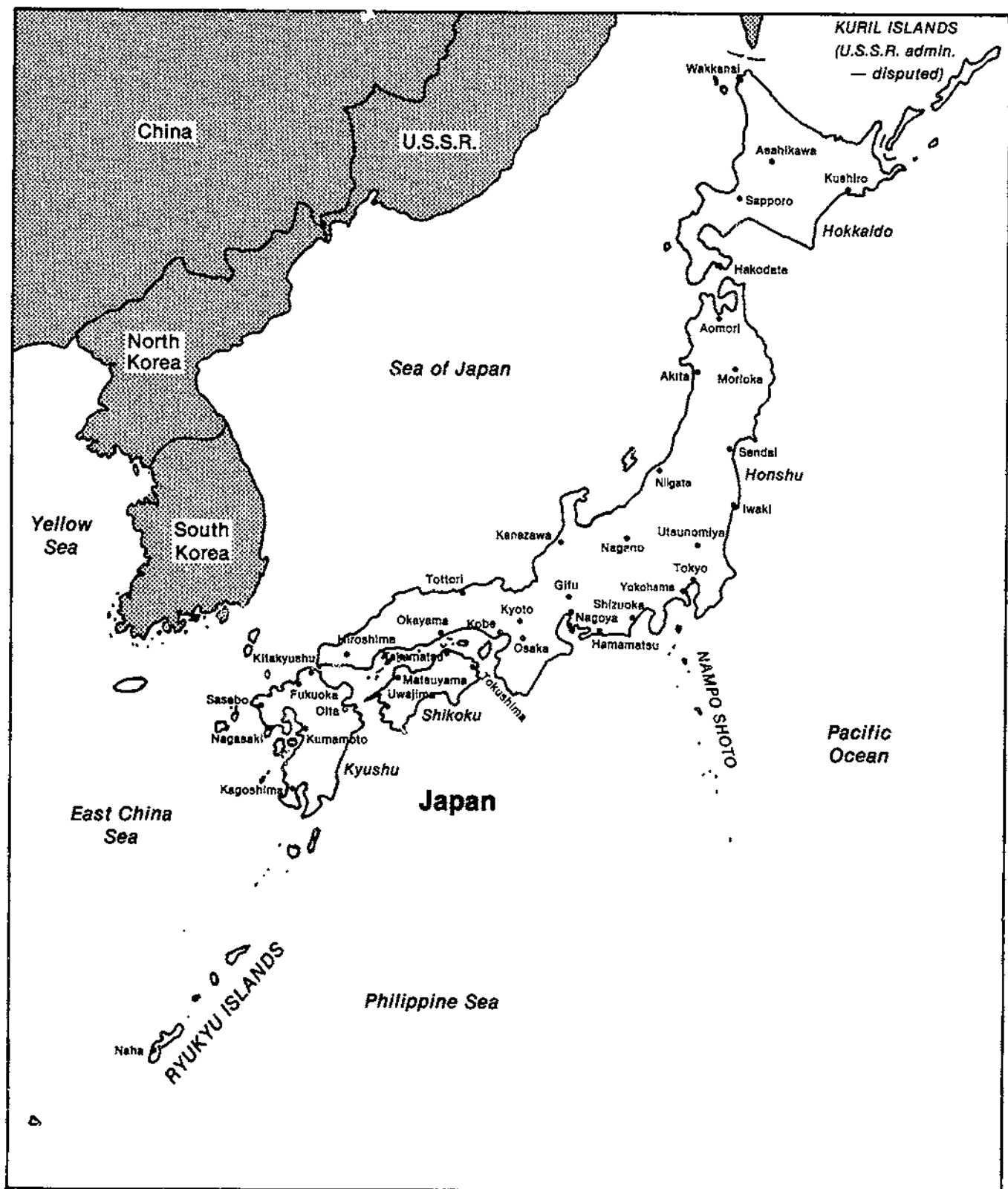
Limited pasture and forage area has constrained beef and dairy production and has led to substantial Government intervention to maintain producers' income. Self-sufficiency in beef is likely to decline from 73 percent in 1978 to less than 50 percent by the end of the decade while that for dairy products should remain constant at about 90 percent.

Poultry and pork production, increasingly reliant on confined feeding techniques, has required less Government protection and has undergone more rapid structural change than the beef sector. Self-sufficiency in pork and

poultry products should remain high (close to or above 90 percent) and may even increase.

The future of Japan's fishing industry will largely determine the future of its livestock industry. Fish is still the most important source of animal protein in the Japanese diet, providing about 50 percent of the total. The 200-mile fishing limits imposed by many coastal nations have reduced Japan's hauls from distant fisheries. An increased public commitment has helped to offset these losses by spurring large catches from Japan's coastal waters and from marine aquaculture. But the total catch has remained between 10 million and 11 million metric tons since 1972, leading to reduced self-sufficiency, increased imports, and higher real prices. Adjustment in Japan's fishery industry, the capacity of its coastal waters to sustain larger yields, and maintenance of minimum catches in foreign waters will be critical in providing sufficient low-priced marine products to the Japanese so as to prevent a major dietary shift to livestock products.

Japan's small arable land area, about 1 percent that of the United States, precludes extensive cultivation of feed crops. Pasture area is also quite limited, confined mostly to the less populated areas of Hokkaido and northern Honshu. Dependent on imports for about 70 percent of its feed supply, Japan is sensitive to the issues of continuity and security of feed supply. State trading, Government stockpiling, a feed price stabilization fund, supply-purchase agreements, and efforts to diversify sources of supply are among the measures adopted to secure supplies and stabilize prices. At present, expansion of Japan's pasture and forage area is an important government priority. Growth in the number of grazing animals will probably parallel the expansion in pasture and fodder production. Japan is unlikely to succeed in its efforts to significantly increase its degree of self-sufficiency in feed and forage production.



# Japan's Feed-Livestock Economy: Prospects for the 1980's

**William T. Coyle**  
Agricultural Economist

## Introduction

The growth of Japan's livestock economy during the eighties will depend heavily on U.S. exports of feed grains and oilseeds—commodities that annually rank as the leading U.S. agricultural exports. During the seventies, the United States established itself as the top supplier to Japan for the three feedstuffs—corn, sorghum, and soybeans—most vital to Japan's livestock industry. Moreover, Japan was a leading market for U.S. exports of these three commodities during this period.

Japanese livestock feeding accounts for 80-85 percent of all coarse grain consumption in the country. Because only 2 percent of total coarse grain consumption is produced domestically, massive amounts are imported each year. Since 1970, the annual rate of increase in coarse grain imports has been 5.6 percent—or an average increase in volume of about 800,000 tons per year. By 1980, Japan imported 18.7 million metric tons of coarse grains, with 84 percent coming from the United States, including about 90 percent of Japan's corn and sorghum.<sup>1</sup>

Annual growth in soybean and meal imports (meal basis) during the seventies was about 3.7 percent, slower than for coarse grain because of slow growth in the food use of soybeans as well as diversification in the kinds of protein meal used in feeds (rapeseed and animal byproduct meals, for example). The United States supplied more than 90 percent of Japan's soybean imports and more than 80 percent of its soybean meal imports. The U.S. share of soybean meal imports declined through the seventies with increased competition from Brazil.

<sup>1</sup>The U.S. share of Japan's coarse grain imports in 1980 was much higher than the average for 1970-79 (59 percent) because of the U.S. suspension of grain sales to the Soviet Union. Argentina, which had exported substantial quantities of sorghum to Japan during 1977-79, redirected most of its supplies to the Soviet Union during 1980-81.

Over the past decade, Japan has taken one-fifth of total U.S. corn exports, half of U.S. sorghum exports, and more than one-fifth of U.S. soybean exports. The combined value of these three commodities represented about half of the total value of U.S. agricultural exports to the Japanese market during the seventies.

Thus, the importance of the Japanese market for coarse grains and oilseeds should not be underestimated. At the outset of the eighties, it is important to look ahead and focus on future developments. Because 80-85 percent of Japanese coarse grain and oilseed consumption is used as feed, future imports will depend upon what happens to Japan's livestock sector.

The future shape of Japan's feed-livestock economy will depend on:

- The changing role of livestock products and fish in the Japanese diet.
- Government trade and farm policy and its effect on the growth and development of the livestock sector.
- The ability of Japan's fishery industry to adjust to limited access to foreign fishing grounds, and the public commitment to protect and promote development of domestic coastal resources.
- The availability of feedstuffs, both imported and domestically produced.

Each of the above subjects is discussed in this report, with particular attention to the 1960-80 period. The final sections derive projections to 1985 and 1990 of the production, consumption, and trade in finished livestock products, as well as the derived demand for feed grain and protein meal.

## Japan's Feed-Livestock Economy

### The Role of Livestock Products and Fish in the Japanese Diet

The Japanese consumed practically no meat and dairy products until about 100 years ago. After World War II, meat and dairy consumption grew rapidly. This section examines the changing role of livestock products and fish in the Japanese diet during 1960-80. The choice of 1960 as a beginning point is somewhat arbitrary, although by then the physical damage of World War II had been repaired, the economy was robust and growing at a rapid rate, and the Japanese diet was on the verge of unprecedented change.

The dietary change over the 20-year period should, however, be placed in perspective. Although consumption of livestock products increased three to four times between 1960 and 1980, the Japanese still consume relatively small amounts of meat and dairy products.<sup>2</sup> Beef consumption, for example, was only 1.2 kilograms (kg) per person per year in 1960, by 1980 it had nearly tripled—but was still a mere 3.5 kg. Total meat consumption increased

<sup>2</sup>"Meat" in this report is defined as the edible flesh of mammals and fowls as distinguished from that of fish or shellfish.

from 5.0 to 22.4 kg over the same period (tables 1 and 2), reaching a level one-fourth to one-third that of other developed countries. By the end of the seventies, the Japanese diet was still predominantly vegetarian, with fish and rice of central importance. Livestock products contributed only 11 percent of total calories, compared with 28 to 34 percent in other developed countries (table 3).

The consumption pattern that has evolved is best explained by family income, the prices of livestock products and substitutes, cultural and religious values, and urbanization.

Real family income in Japan has grown over the past two decades along with an 8-percent annual growth in real Gross National Product (GNP). Private consumption expenditures grew at a slower rate (7.4 percent), because of the growing importance of other components of gross national expenditures like trade surpluses and business investment. The proportion of family income spent on food items fell from about 32 percent of disposable household income in the early sixties to about 24 percent in the last half of the seventies. The Japanese now spend a larger proportion of the family food budget on meat and fish, less on dairy products and eggs, and substantially more

Table 1—Annual per capita consumption of livestock products and fish, Japan

Japan fiscal year	Per capita consumption of livestock products and fish, Japan										Population
	Meat					Dairy products		Fish and shellfish			
	Beef	Pork	Chicken	Other	Whale	Total	Eggs		Fluid milk	Total	
-----Kilograms-----											
1960	1.2	1.3	.4	.5	1.6	5.0	4.9	10.7	22.3	27.8	93.4
1961	1.2	2.1	.8	.4	1.9	6.4	6.5	11.8	24.9	29.8	94.2
1962	1.3	2.7	1.0	.5	2.4	7.9	6.9	12.0	28.4	29.9	95.2
1963	1.6	2.3	1.2	.7	2.0	7.8	7.5	15.1	32.8	29.9	96.3
1964	1.8	2.6	1.4	.8	1.9	8.5	8.6	16.9	35.5	25.3	97.1
1965	1.5	3.1	1.6	.7	2.1	9.0	8.8	18.4	37.4	29.2	98.5
1966	1.3	4.1	2.0	1.0	2.0	10.4	9.2	20.2	41.7	29.2	99.0
1967	1.2	4.6	2.4	1.1	1.8	11.1	10.1	21.3	43.3	30.9	100.2
1968	1.4	4.3	2.6	1.3	1.4	11.0	11.7	23.0	44.8	32.3	101.5
1969	1.8	4.4	3.3	1.4	1.3	12.2	12.6	24.3	47.3	30.7	102.5
1970	2.0	4.7	3.8	1.1	1.5	13.1	14.8	25.3	50.1	32.1	103.6
1971	2.3	5.1	4.3	1.6	1.3	14.6	14.9	25.3	50.7	32.9	105.1
1972	2.4	5.6	4.7	1.5	1.2	15.4	14.6	26.5	51.9	33.6	106.3
1973	2.3	6.4	5.1	1.4	1.0	16.2	14.5	26.9	52.9	34.3	108.7
1974	2.5	6.5	5.1	1.6	1.1	16.8	14.1	27.0	52.0	35.0	110.1
1975	2.5	6.5	5.2	1.7	.9	16.8	14.0	28.2	53.3	34.6	112.0
1976	2.7	7.7	5.8	1.7	.7	18.6	14.3	29.4	54.6	34.8	113.2
1977	3.0	8.3	6.5	1.8	.7	20.3	14.4	31.0	57.0	34.1	114.0
1978	3.3	8.7	7.1	1.7	.5	21.3	14.9	32.1	59.3	35.5	115.3
1979	3.4	9.6	7.5	1.6	.4	22.5	14.7	33.3	61.9	34.5	116.2
1980	3.5	9.6	7.7	1.2	.4	22.4	14.6	33.9	62.2	34.8	117.3
-----Million-----											

## Role of Livestock and Fish

**Table 2—Average annual percentage change in per capita consumption of livestock products and fish, Japan**

Item	1960-65	1965-70	1970-75	1975-79	1980-79	1972-85 <sup>1</sup>	1978-90 <sup>2</sup>
<i>Percent per year</i>							
Beef and veal	4.6	5.9	4.6	8.0	5.6	3.2	2.8-3.5
Pork	19.0	8.7	6.7	10.2	11.1	2.3	1.7-2.3
Chicken	32.0	18.9	6.5	9.6	16.7	1.5	1.8-2.3
Meat	12.5	7.8	5.1	7.6	8.2	2.1	1.9-2.5
Eggs	12.4	11.0	- 1.1	1.2	6.0	.2	.06
Dairy products	10.9	6.3	1.4	3.9	5.5	1.8	1.5-2.0
Milk	11.5	6.6	2.2	4.2	6.2	NA	NA
Milk products	10.4	6.0	.6	3.5	4.9	NA	NA
Fish	1.0	1.9	1.5	- .1	1.1	1.3	1.0
Per capita real GNP	8.5	10.4	3.5	4.9	6.8	NA	NA
Per capita real private consumption expenditures	7.8	7.9	4.5	3.9	6.2	5.0	3.7
Population	1.0	1.3	1.4	.9	1.2	1.0	.8

NA = Not available.

<sup>1</sup>Projections published in the Ministry of Agriculture and Forestry's *Long-Term Prospects of Production and Demand of Agricultural Products in Japan*, August 1975.

<sup>2</sup>Projections published in MAFF's *The Long-Term Prospects for the Demand and Supply of Agricultural Products*, November 1980.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, annual issues.

**Table 3—Annual per capita consumption of livestock products and fish, selected countries, 1975-77 averages**

Country	Annual per capita consumption				Per capita daily intake		Protein from		Total calories from	
	Meat	Dairy products	Eggs	Fish	Protein	Calories	Livestock products <sup>1</sup>	Fish	Livestock products <sup>1</sup>	Fish
	----- Kilograms -----				Grams	Number	----- Percent -----			
Argentina	118.8	78.9	7.4	2.9	110.2	3,359	63.6	1.1	29.1	.2
Australia	123.6	134.0	12.3	8.3	108.8	3,400	65.0	3.2	34.2	.8
Canada	101.8	134.8	12.8	9.9	101.1	3,345	60.8	3.8	31.9	.7
China	22.3	4.1	3.6	4.3	61.7	2,362	14.7	3.2	8.5	.5
Germany	83.5	97.4	17.1	6.1	85.3	3,361	59.1	4.1	28.6	.7
Hong Kong	72.9	9.0	12.9	44.3	81.5	2,671	41.2	17.4	24.0	3.2
Japan	25.4	33.3	15.8	43.8	86.1	2,848	22.1	26.1	10.8	6.2
Norway	51.3	215.2	9.1	19.4	87.4	3,124	55.7	8.6	29.1	1.7
South Korea	7.9	4.1	4.8	37.6	73.0	2,681	3.8	13.0	3.1	2.1
United Kingdom	69.7	171.5	13.1	10.9	91.5	3,311	56.3	4.6	28.4	.7
United States	114.2	152.1	15.9	8.1	106.1	3,538	65.4	3.0	33.9	.6

<sup>1</sup>Excludes animal fats and oils.

<sup>2</sup>FAO numbers are not consistent with those published by the Government of Japan.

Source: United Nations Food and Agricultural Organization, *Food Balance Sheets 1975-77 averages and Per Capita Food Supplies 1961-65 averages 1967-77*, Rome, 1980.

on food consumed outside the home (in restaurants, for example). The proportion of expenditures on cereals, mainly rice, has declined, while the proportions spent on fresh vegetables, fruits, and processed foods have remained nearly constant. These changes in expenditures do not all reflect changes in quantities consumed. A shrinking share of the food budget was spent on dairy products and eggs since declining real prices more than offset increases in consumption (table 4).

A number of studies (see appendix tables 1 through 3) have measured the income elasticity of demand for var-

ious livestock products consumed in Japan. Estimates from these studies indicate that meat consumption is more elastic with respect to income than is the consumption of eggs, dairy products, and fish.

Estimates of the income elasticity of demand for fish for the period, 0.49 by Lopez and 0.58 by Kester, indicate that fish consumption has been less responsive to income change than has meat consumption (36, 30).<sup>3</sup>

However, despite the recent rapid growth in meat consumption, the Japanese eat more fish than all other meats combined. Growth in income has led to little increase in overall fish consumption per capita, but has shifted some demand away from lower priced products (mackerel and fish paste products) to higher priced luxury items (salmon and tuna).

Table 4—Proportion of household food expenditures spent on livestock products, fish, and food consumed away from home, Japan

Item	1963-65	1968-70	1973-75	1976-78
	Percent			
Total livestock products	16.2	17.4	17.6	16.9
Total meat	8.3	9.7	11.3	11.4
Beef	2.6	2.3	2.8	3.1
Pork <sup>1</sup>	3.2	4.4	5.0	4.9
Chicken	1.1	1.6	1.7	1.8
Dairy products	4.1	4.6	3.9	3.7
Fluid milk	3.1	3.5	3.0	2.8
Butter	.3	.2	.1	.1
Cheese	.1	.2	.2	.2
Eggs	3.8	3.1	2.4	1.8
Total fish	12.8	13.0	13.9	14.9
Fresh	6.6	7.0	7.6	7.9
Salted and dried	2.6	3.2	3.6	3.7
Processed	2.9	2.1	2.0	2.3
Canned	.4	.3	.3	.3
Meals away from home	7.3	9.8	11.8	13.1
Food expenditures as a percentage of total living expenditures	38.3	34.7	32.2	30.8
Living expenditures as a percentage of disposable income	83.2	80.6	76.7	77.2
Food expenditures as a percentage of disposable income	31.9	28.0	24.7	23.8

<sup>1</sup>Includes ham and bacon.

Source: Government of Japan Statistics Bureau, Office of the Prime Minister, *Annual Report on the Family Income and Expenditure Survey, 1978*. July 1979.

As their real household income grew, the Japanese began to eat out more often. Many of these meals feature either fish or livestock products. The share of the family food budget spent on meals outside of the home increased sharply from an average of 7 percent in 1963-65 to 13 percent in 1976-78. A comparison of food balance sheet data and family budget data indicates that as much as 30-35 percent of meat and 40-45 percent of fish are consumed outside of the home. Fast-food chains specializing in occidental foods grew rapidly in the seventies and such companies as Nihon McDonald and Nihon Kentucky Fried Chicken expected to increase their outlets from about 450 in 1979 to 700 in 1981 (17). In 1980, these companies ranked second and eighth in the \$80 billion Japanese restaurant and catering business.<sup>4</sup> Although expenditures at western restaurants are a relatively small proportion of total away-from-home food expenditures, many Japanese restaurants also feature meat dishes like *sukiyaki* (beef) and *yakitori* (chicken).

*Real prices of most livestock products* (except beef) have declined, encouraging the Japanese to eat more meat, while real prices for fish have increased (tables 5 and 6). As a result, the consumption of chicken, pork, eggs, and fluid milk has grown faster than consumption of beef and fish.

The growth rates for consumption of eggs and dairy products slowed considerably in the seventies due to noneconomic factors as well as price changes.

<sup>3</sup>Italicized numbers in parentheses refer to items listed in the Bibliography at the end of this report.

<sup>4</sup>*Nihon Keizai Shimbun* (English edition), May 5, 1981.

# Role of Livestock and Fish

Table 5—Average retail prices of livestock products and fish, Japan

Year	Beef and veal <sup>1</sup>	Pork <sup>1</sup>	Chicken <sup>1</sup>	Eggs <sup>2</sup> (Tokyo)	Fluid milk <sup>2</sup> (Tokyo)	Fresh fish and shellfish <sup>2</sup>	Consumer Price Index <sup>2</sup>	Private consumption expenditures <sup>2</sup>
	Yen/kilogram					Index 1975 = 1,000		Billion yen
1960	549	642	483	NA	77	148	332	NA
1961	637	615	502	221	85	166	347	9,949
1962	702	569	686	229	94	183	371	11,500
1963	748	724	718	242	103	213	402	13,496
1964	804	753	721	227	104	228	417	15,656
1965	854	745	718	219	108	273	445	18,486
1966	1,050	694	724	240	108	277	468	21,437
1967	1,240	714	728	228	112	313	486	24,705
1968	1,420	849	744	241	116	356	512	28,632
1969	1,350	960	748	226	130	403	539	33,293
1970	1,370	909	767	267	135	485	580	38,647
1971	1,470	930	712	229	146	577	615	43,559
1972	1,510	992	724	238	146	598	645	50,267
1973	1,980	1,120	801	263	160	672	719	60,489
1974	2,450	1,240	960	341	214	879	894	73,629
1975	2,710	1,550	1,000	367	233	1,000	1,000	85,539
1976	3,160	1,680	1,110	339	252	1,161	1,093	96,386
1977	3,150	1,590	1,040	365	257	1,371	1,181	107,836
1978	3,090	1,570	1,030	312	262	1,402	1,226	118,612
1979	3,151	1,500	993	314	272	1,462	1,270	129,568
1980	3,390	1,450	1,140	382	272	1,540	1,372	139,472

NA = Not available.

<sup>1</sup>Ministry of Agriculture, Forestry, and Fisheries, *The Meat Statistics of Japan*, Jan. 1981.

<sup>2</sup>Office of the Prime Minister, *Monthly Statistics of Japan*, various issues.

Table 6—Average percentage change in retail prices of livestock products and fish, Japan

Item	1960-65	1965-70	1970-75	1975-80	1978	1979	1980	1960-79
	Percent per year				Yen/kg			Percent per year
Beef and veal	9.2	9.9	14.6	4.6	3,090	3,151	3,390	9.6
Pork	3.0	4.1	11.3	-1.3	1,570	1,500	1,450	4.6
Chicken	8.3	1.3	5.4	2.7	1,030	993	1,140	3.9
Eggs	-2	4.0	6.6	.8	312	314	382	2.0
Fluid milk	7.0	4.6	11.5	3.1	262	272	272	6.9
Fresh fish and shellfish	13.0	12.2	15.6	9.0	1,402	1,462	1,540	12.8
	----- 1972 = 1,000 yen -----							
Consumer Price Index	6.0	5.4	11.5	6.5	1,226	1,270	1,372	7.3

Based on table 5.

## Japan's Feed-Livestock Economy

High prices have limited consumption of many livestock products. Japanese food prices are generally much higher than those in other countries, even for rice, Japan's principal staple. The prices of eggs and some dairy products appear to be in line with those in other developed countries; but Japanese meat prices, depending on the type and cut, are two to five times as high as comparable U.S. prices (46, June 1980, June 1981).

Changes in the prices of substitutes have affected consumption patterns. For example, the prices of fruit juices and other competing beverages have fallen somewhat faster than milk prices, leading to slightly faster growth in consumption of these beverages (12, pp. 103, 104). Margarine began to substitute for butter in the seventies because of its spreadability, health considerations, and changes in relative prices (12, 7, pp. 106).

Rapidly rising fish prices probably led to increased consumption of some livestock products, although the statistical evidence for this is not clear. The elasticity of demand for livestock products with respect to the price of fish seems to be weak or not significant. Kester found the relationships between fish and beef and fish and chicken to be about 0.22 and 0.15, respectively (30). Sawada's estimates of cross-elasticities of demand for pork and chicken with respect to fish prices were 0.4 and 0.3. (24, pp. 346, 347). Part of the problem in finding a stronger cross-price relationship between livestock products and fish lies in the definition of fish. In Japan, fish represents a great variety of products, ranging from cheap to expensive. Substitution probably occurs not only among fish products but between various fish products and similarly priced livestock products. The primary shifts are probably between fresh fish and either poultry or pork, since these products on average are rather close in price. Substitution of beef for higher grades of fish, like tuna, is also probable, while meat sausage, pressed ham, and eggs substitute for less expensive fish and fish products (9).

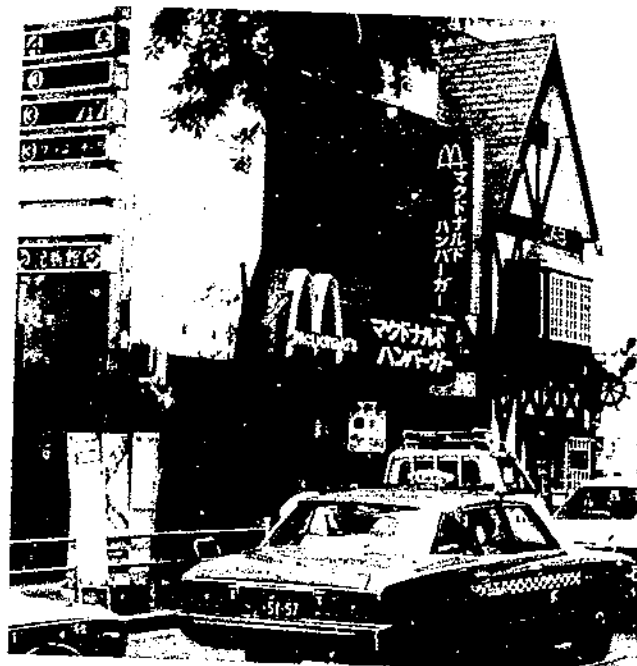
*Noneconomic factors*, like cultural values and changes associated with urbanization and economic development, have also influenced the Japanese diet. Separating economic from noneconomic phenomena is often impractical: cultural and religious values, for example, often underlie governmental policies that directly affect commodity prices, incomes, and income distribution.

Increased consumption of livestock products is often associated with westernization, which has been resisted because of various historical and cultural factors. Buddhism is one such factor, whose influence imparted a feeling that went beyond the religious:

Abstinence from meat was firmly rooted in both ritualistic tradition and innate revulsion . . . Indeed, during the long period of Japan's seclusion (beginning with the Nara period of 710-784), meat was thought unfit for human consumption. Buddhist injunctions against eating meat had been challenged with little success by Christian missionaries, and although game and fowl were abundant in earlier times, they were forever left in peace. What probably also tilted Japanese taste toward a vegetarian diet is the fact that eating animal fat produces butyric acid which gives the carnivore a disagreeable smell. (41)

Somewhat conflicting information with respect to consumption of fowl comes from Tezuka who writes that, although

cows and horses were taboo as food because they were used in cultivating the soil . . . the roasting of fowl as in *maruyaki* and on skewers as in *kushiyaki* apparently began during the Third Shogun of the Muromachi Period (1332-1568). (44, pp. 12, 16)



An increasing preference for Western food is reflected in the growing number of fast food restaurants in Japan. Although meat consumption quadrupled from 1960-80, it was still low: 25 kg per person compared with about 114 kg per person in the United States.



Throughout its history, Japan has "pursued a policy of either enthusiastically accepting ideas from the outside world or shutting the world out entirely for centuries at a time" (43). Brief exposure to Portuguese traders in the 16th century elicited strong Japanese reaction to the "pale, long-nosed, meat-gobbling foreigners" (43, pp. 19). It was not until the Meiji restoration (1868) that a period of increased exposure to the West began. It began slowly. As "new dietary ideas took hold and most of the people gradually abandoned Buddhist regulations forbidding meat consumption, chicken, pork, and beef appeared more frequently" (43, pp. 22).

The long tradition of vegetarianism and the once religious taboo against meat consumption undoubtedly continue to have some effect on modern Japan. Although one could argue that low levels of meat consumption today result from economic phenomena, mainly high prices, the high prices are largely a function of governmental policies that perhaps reflect a general feeling that high levels of meat consumption are not that essential. The Japanese now accept their diet as adequate, healthful, and distinct from that of the West. At 2,500 calories per day, the Japanese diet is well below the caloric intake of other developed countries, but more than sufficient to meet human requirements. The Government does not seem to be motivated to raise caloric intake or to alter the composition of the diet (14).

Further indication of a residual prejudice against meat consumption is the negative attitude of the Japanese toward the *burakumin* (or *eta*), a group of people that represents about 2 percent of Japan's population. This group, one of the few minority groups in an otherwise homogeneous population, is distinguished only by its "association with leather work or butchery. Most Japanese are loath to have contact with them and are careful to check family records to insure that they avoid intermarriage" (40, pp. 36).

The dietary pattern in Japan has also been affected by factors associated with increased trade and contact with the West, urbanization, and the expanding importance and influence of the media. Although Japan opened itself up to the West in the mid-19th century, only after World War II did contact with the West become pervasive, when Japan was administered by Allied occupation forces during 1945-52. In 1946, a new national school lunch program was initiated, featuring such nontraditional foods as dairy products and bread. Migration to urban areas, increased exposure to electronic media, and the country's aggressive trading all contributed to broader contact with the West and its dietary pattern.

### Japan's Livestock Economy

Japan's livestock production has expanded in response to growing consumer demand for meat, eggs, and dairy products (table 7). The Government has had a major role in shaping the country's livestock industry through protective policies implemented since the passage of the Basic Agricultural Law (127) in 1961 (table 8). The law provides for "selective expansion of agricultural production by increased production of products in growing demand, by diversion of production from products in decreasing demand, by rationalizing production of products which compete with foreign agricultural products." Livestock products were among those products in growing demand.

The Law for Price Stabilization of Livestock Products, also enacted in 1961, provided the legal and administrative machinery to carry out the broader intent of the Basic Law. The Livestock Industry Promotion Corporation (LIPC), a public corporation modeled after earlier institutions designed to stabilize dairy prices, was set up to stabilize prices for livestock products in general (32). Some programs involved the Corporation's direct involvement in procuring, storing, and selling designated livestock products (of either domestic or foreign origin) in order to maintain wholesale prices within a predetermined range. Other programs to promote the livestock industry have included storage subsidies and loan guarantees to producer groups, school lunch subsidies, and market promotion activities. The Livestock Industry Promotion Council, consisting of up to 25 members, was in-

Table 7—Growth in Japan's livestock production

Item	1960-65	1965-70	1970-75	1975-79	1960-79
Percent per year					
Beef and veal	6.1	6.9	4.3	5.2	5.6
Pork	20.9	12.4	5.2	13.2	12.8
Chicken	36.0	19.8	8.4	9.6	18.4
Eggs	13.3	11.5	.5	2.5	7.0
Milk	11.0	7.9	.9	5.6	6.5
All livestock products	14.2	9.4	4.4	6.4	8.7
Fish	2.3	6.2	2.4	.2	2.9

Sources: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, various issues; U.S. Dept. of Agriculture, Economic Research Service, *World Index of Agricultural and Food Production*, SB-699, July 1981.

This section would not have been possible without the assistance of Lois Caplan. She researched and drafted sections on the beef and poultry industries and developed many of the supporting tables.

stituted to advise the Minister of Agriculture on such problems as upgrading domestic breeds, improving livestock management, and stabilizing livestock and feed prices (32).

The Basic Agricultural Law and the Law for Price Stabilization of Livestock Products created the policy environment for livestock producers. Although the LIPC touched all livestock activities in one way or another initially, it

emphasized dairy and pork operations and practically ignored the poultry industry (broilers and eggs; 34, p. 28). Starting in 1965, the LIPC influenced beef prices somewhat by importing and selling foreign beef (34, p. 30). This influence became stronger as beef producers became more closely tied to the dairy sector. In the early seventies, beef fatteners experienced a severe cost-price squeeze that motivated policymakers to develop programs that handled beef in much the same way as dairy

Table 8—Japanese policies affecting its livestock sector

Type of policy	Dairy	Beef	Pork	Eggs	Chicken
Price	<p>Deficiency payments paid to producer to guarantee price for manufactured milk</p> <p>Limit on amount of manufactured milk eligible for support</p> <p>Wholesale price established for designated dairy products</p>	<p>Wholesale floor and ceiling prices are established for Wagyu and dairy steer beef.</p>	<p>Wholesale floor and ceiling prices are established</p>	<p>Government participates in egg price stabilization fund</p> <p>Production adjustment by tying producer behavior to eligibility for compensatory payments</p>	<p>Private price stabilization fund</p>
Stockholding	<p>LIPC buys, holds, and sells designated dairy products to keep market price within predetermined floor and ceiling prices</p>	<p>LIPC purchases and releases beef to the market</p>	<p>LIPC buys domestic pork at the floor price and sells it at the ceiling price</p> <p>Administrative guidance<sup>1</sup></p>	<p>Government participation in National Fluid Egg Manufacturer and Stockpiling Company</p>	<p>Administrative guidance<sup>1</sup></p>
Imports	<p>Quotas set for</p> <ul style="list-style-type: none"> <li>—evaporated and condensed milk</li> <li>—powdered milk</li> <li>—whey</li> <li>—butter</li> <li>—processed cheese</li> <li>—lactose</li> <li>—other</li> </ul> <p>Tariff quota on natural cheese</p> <p>Tariffs, 25 to 35 percent</p>	<p>Semiannual quota set for beef. Most of trade controlled by LIPC through licensing system</p> <p>Tariff—25 percent for beef</p> <p>Tariff on beef offals will be reduced from 25 percent to 15 percent by 1987</p> <p>Surcharges</p>	<p>Trade controlled by private trade</p> <p>Variable levy system restricts imports; system is waived from time to time</p> <p>Tariff—10 percent, scheduled to decline to 5 percent by 1987</p> <p>Administrative guidance<sup>1</sup></p>	<p>Tariffs—20 percent for some products and 25 percent or 60 yen per kg for others</p>	<p>Tariff—20 percent; tariff on chicken legs will be reduced to 10 percent by 1987</p> <p>Administrative guidance<sup>1</sup></p>
Subsidies	<p>Various subsidies paid to promote consumption of dairy products and to encourage dairy production (lower input costs)</p>	<p>Feeder calf and feed prices are subsidized through price stabilization funds</p>	<p>Some producers subscribe to a Government-supported feed price stabilization scheme</p>		

<sup>1</sup>Administrative guidance (*gyoseishido*) consists of recommendations, advice, or directions issued by a Japanese Government agency and is void of coercive legal power.

products and pork (34, p. 30). On the other hand, egg and chicken meat production, closely interrelated industries, evolved quickly into discrete specialized activities requiring little or no governmental interference.

The characteristics of a livestock industry and of Japan's natural resources greatly influence the industry's need for government protection. A severe land constraint, exacerbated by governmental policies (the Land Law of 1952, for example, which keeps farm sizes very small and the rice policy, which channels resources into rice production), has made it difficult for dairy and beef producers to make their operations more efficient to the same extent as poultry and pork producers. Pork and poultry operations are characterized by intensive use of land through confined feeding techniques and almost complete reliance on commercially purchased feed concentrates (made mostly from imported grains and oilseeds). Poultry production has been possible with border protection limited to relatively low tariffs on chicken imports (20 percent or less), compared with those on beef (25 percent) and dairy products (25-35 percent). The volume of beef and dairy imports is restricted, whereas poultry imports are not. The LIPC is most heavily involved in stabilizing prices of beef and dairy products. Pork imports are somewhat restrained with a variable levy system that is waived from time to time. Pork is not protected by

an import quota system, and private traders, not the LIPC, manage the trade.

Sectoral characteristics and Government policy have affected the economic performance of each industry. High and rising nominal rates of protection (wholesale prices compared with import prices) for beef and dairy products have assured profitability and reduced the tempo of adjustment and structural change. Relatively lower and declining rates for pork, chicken, and eggs have led to rapid structural change (table 9).

Producer prices for beef and milk have risen more rapidly than those for products more subject to free market forces (table 10). The product-feed price ratios for beef and milk have increased rapidly since 1960. On the other hand, the product-feed price ratios for chicken and eggs have declined, leading to rapid modernization and growth in the scale of operations in these increasingly competitive sectors (table 11). Average farm size of egg, broiler, and pork producers (measured by the number of animals) has grown much more quickly than that of dairy and beef producers (table 12). The rapid decline in the number of beef producers has not led to significant consolidation and expansion of individual herds. Although there are more feedlot operations, the average Japanese beef herd today has only five or six animals.

Japan's greater efficiency in pork and poultry production has led to less dependence on trade. During 1960-79, Japan imported less than 5 percent of its eggs and chicken requirements and about 10 percent of its pork requirements. Beef imports, on the other hand, rose constantly.

Table 9—Japanese wholesale prices compared with import prices, selected livestock products

Year	Beef <sup>1</sup>	Pork <sup>1</sup>	Chicken <sup>1</sup>	Eggs <sup>2</sup>	Nonfat dry milk <sup>3</sup>	Butter <sup>3</sup>
Percent of import price						
1960-65	253	222	135	NA	NA	NA
1965-70	333	160	128	123	423	244
1970-75	344	139	131	108	290	233
1975-79	545	124	129	96	455	323

Note: Differences in quality are not taken into account in comparing domestic prices with import prices. Import prices include transportation and insurance costs.

NA = Not available.

<sup>1</sup>Wholesale prices divided by import unit values. Import values converted to carcass basis using 0.7 for beef and pork and 0.72 for chicken.

<sup>2</sup>Tokyo wholesale prices for fresh eggs, divided by import unit values for egg products (powdered eggs and egg yolks).

<sup>3</sup>Stabilization indicative prices divided by import unit values.

Sources: Ministry of Finance, *Japan Exports and Imports*, various issues; Office of the Prime Minister, *Japan Statistical Yearbook*, various issues; Ministry of Agriculture, Forestry, and Fisheries, *The Meat Statistics of Japan*, Jan. 1981.

Table 10—Changes in livestock product prices, Japan

Item	1960-65	1965-70	1970-75	1975-79	1980-79
Percent per year					
Livestock products	3.8	2.8	14.4	1.4	5.7
Beef and veal	9.4	9.2	15.1	3.7	9.6
Pork	.9	1.9	15.7	-6.4	3.2
Chicken	5.2	-6	8.7	-4.6	2.4
Eggs	NA	0	9.5	-4.9	1.1
Milk	8.1	5.6	14.0	2.4	7.7
All agricultural products	8.3	5.5	12.6	4.2	7.8
Rice	9.1	4.9	13.4	3.4	7.9

NA = Not available.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, various issues.

## Japan's Feed-Livestock Economy

An average of 3 percent of total beef consumption was imported in 1960-65, compared with 27 percent in 1975-79. Imports of dairy products (milk equivalent) averaged about 15 percent, with some decline in recent years due to slower growth in consumption.

Livestock production in Japan has become increasingly important to the agricultural economy, rising from 15 percent of gross agricultural income in 1960 to 26 percent in 1979. At the same time, rice production has become less important, falling from 49 percent in 1960 to 34 percent in 1979. Among livestock activities, dairy and hog production are presently the biggest gross income earners. Egg production, the most important during the sixties, is now third, followed by beef and chicken. Broiler producers have the largest gross income per farm and beef producers the smallest.

U.S. efforts in recent years to expand trade in high-quality beef have elicited strong opposition from Japanese producers. Even though Japanese beef production is generally a sideline activity accounting for relatively little farm income, beef producers have succeeded in obtaining substantial Government support, particularly in the last 10 years. Their success is probably attributable to the large number of producers and to the industry's increasingly close ties with the highly protected dairy industry. Japan had 340,200 beef producers in 1982—more than any other livestock activity in the country. Liberalization in beef trade would hurt not only beef producers but also the 98,900 dairy farmers who earn 10-20 percent of their income from the sale of culls and steers for beef production.

The following sections look more closely at the structural characteristics and policies affecting each of the five principal livestock activities.

### Beef Sector

The Buddhist taboo against eating meat made killing a cow for food unthinkable (41, p. 190). When Commodore Matthew Perry arrived in 1853 and the first U.S. Consul General, Townsend Harris, in 1856, there was "not a sheep or goat in all Nippon, and the few bullocks that were kept were used for burden or the plough only; they were never eaten" (34, p. 194). When Harris first consumed beef is not known but a monument in Shimoda indicates the spot on which the first cow was slaughtered for human consumption. About 15 years later, the Emperor tasted beef for the first time, after which the people slowly began to accept it as food (41, p. 195). In the early years, beef came mainly from slaughtered draft animals and culled dairy animals. Not until after World War II were beef animals raised specifically for eating.

**Structural Characteristics.** Twenty years ago, most domestic Japanese beef came from the native Wagyu breed, an animal that had been used primarily for draft purposes before being replaced by tractors in the fifties. The large inventory of this breed assured an adequate supply of feeder stock for fattening and eventual slaughter. Its declining role as a work animal, however, led to a reduction in total inventory from 2.34 million in 1960 to 1.55 million in 1967. In the midsixties, governmental policies arrested the decline and encouraged a return to larger Wagyu herds. By 1980, Wagyu numbers had increased but total inventory was still below its 1960 level.

Typically Wagyu are raised as a sideline to other agricultural activities. Average herd size is still very small but has grown from about 1.3 animals during 1960-65 to 4.7 during 1975-79. With the rise in average herd size, the number of beef farms fell from 2 million in 1960 to about

Table 11—Changes in product-feed price relationships, Japan

Item	1960-65	1965-70	1970-75	1975-79	1980-79
<i>Percent per year</i>					
Livestock products	1.3	1.7	2.6	3.1	2.1
Beef and veal	NA	5.4	2.9	5.8	4.6
Pork	3.6	-7	2.6	-4.9	.2
Chicken	NA	-2.6	-3.0	-2.9	-1.0
Eggs	NA	-9	-1.9	-4.0	-2.9
Milk	3.9	4.2	-2.4	3.6	3.5

NA = Not available.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, various issues.

Table 12—Average herd or flock size for principal Japanese livestock enterprises

Item	1960-65	1965-70	1970-75	1975-79	1979
<i>Animals per farm</i>					
Beef and veal cattle	1.3	1.6	2.9	4.7	5.5
Swine	4.0	9.7	23.3	46.4	60.7
Broilers	NA	1,852.8	5,101.0	10,081.0	12,684.0
Layers	25.9	62.2	186.6	492.1	670.3
Dairy cattle	2.6	4.4	8.2	13.9	16.8

NA = Not available.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, various issues.

340,200 in 1982. There was also a general trend toward greater specialization, with Wagyu calves sold at 8-10 months to feedlots for fattening.

Shortage of pasture lands and limited production of forage and grains have caused most beef producers to rely on commercially purchased feed concentrates, most of which are imported. Average annual consumption of formula feed per beef animal was 230 kilograms in 1965-70. By 1975-80 the average had jumped to 1,088 kilograms, and fulfilled about half of the nutritional requirements of an adult beef animal. Increased use of concentrates and confinement feeding have raised the average slaughter weight from 217 kg in 1960-64 to 334 kg in 1975-79.

The cost of raising beef in Japan depends on whether the producer breeds and raises calves or fattens and finishes older animals (feedlot operators). Some producers do both. Breeding and raising operations have higher labor costs. But feed costs are lower, since a large proportion of grain, pasture, or other forage crops is produced on the farm. Fattening operations are land intensive and spend more on feed. The cost of feeder stock is usually the largest expense.

The Government has pursued policies designed to maintain beef producers' income as well as to enhance the country's self-sufficiency in beef. Despite prices that

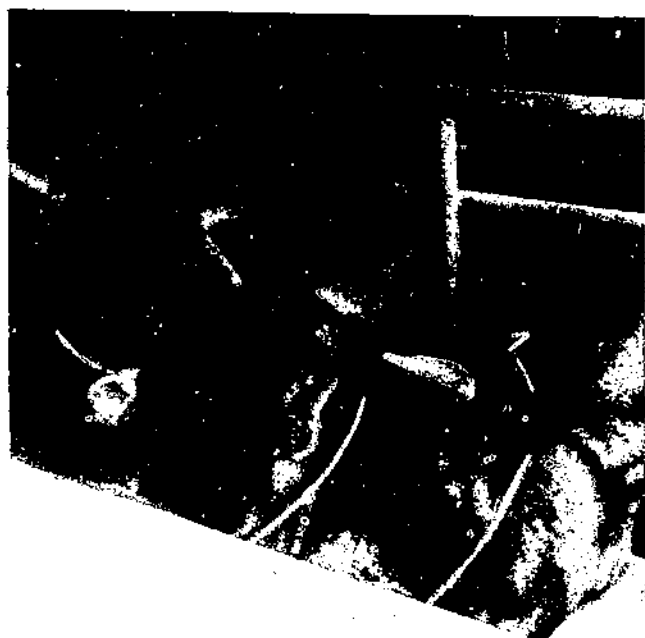
have been three to four times the world level in recent years, the self-sufficiency ratio slipped from an average of 96 percent in 1960-65 to 73 percent in 1975-79 (tables 13 and 14). Efforts to expand production in line with consumers' needs have been constrained by limited pasture area and forage production. The reduction in the size of the Wagyu herd during the sixties and the slower growth of the dairy herd in the seventies also limited the number of calves available for fattening.

The dairy herd provides about 60 to 70 percent of the beef produced in Japan, either as fattened dairy steers or as older culled cows. Dairy steers were an increasingly important source of beef through the midseventies and then leveled off toward the end of the decade at about 30 percent of total supplies. Culled dairy cows have also provided about 30 percent of the domestic beef supply in recent years.

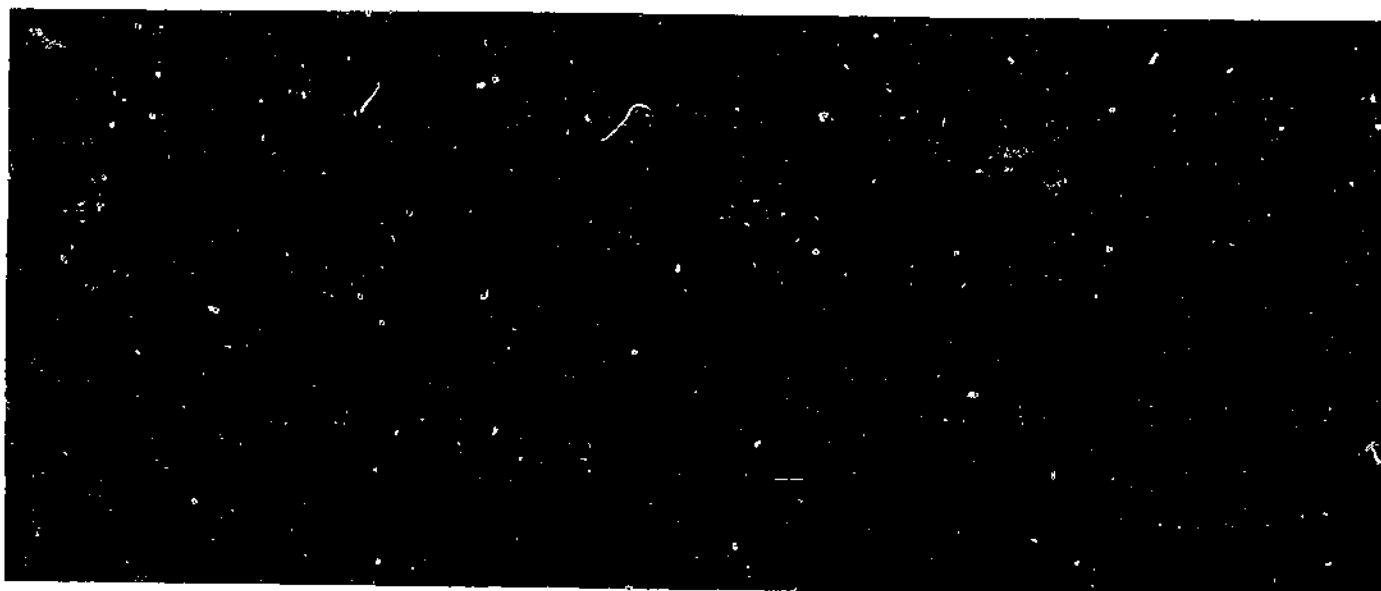
Despite the importance of dairy animals in total beef production, Japanese dairy farmers receive only 10-20 percent of their gross agricultural income from the sale of calves and culls. Dairy producers, therefore, are more interested in the profitability of milk production. At the margin, however, relative prices of milk and beef affect decisions about culling cows and selling calves.

**Government Policies.** The objectives of Japan's beef policy are to maintain producer income and to improve the country's self-sufficiency in beef (currently 73 percent—see table 49 for projections). To keep producer prices of beef at a level that assures a reasonable return, the Government has administered prices through import controls and stock adjustments. Similarly, the Government has implemented programs to stabilize the prices of important inputs such as feed and feeder animals.

Import controls on beef were first imposed in the late fifties in order to reduce the drain of scarce foreign exchange. Traders were required to have a special license and a foreign exchange allocation to import beef. In April 1964, beef became subject to import quota restrictions. The Livestock Industry Promotion Corporation (LIPC), which was created to carry out the Law for Price Stabilization of Livestock Products (1961), was empowered in 1964 "to stabilize the domestic market for beef." Between 1965 and 1971 the LIPC and private traders were allocated the beef import quota, with the LIPC controlling a growing percentage of the total. Additional firms were given licenses in ensuing years but the number has remained small. The LIPC controls about 90 percent of the quota now. MAFF adjusts the size of the quota on a semiannual basis with the goal of stabilizing prices on the Japanese market. The quota has varied from as much as 160,000 tons in Japan fiscal year (JFY) 1973 to zero in JFY 1974 (tables 15 and 16).



The Wagyu is the predominant beef breed raised in Japan. Most Japanese beef production, however, now comes from dairy cattle.



An unusual sight in Japan—a large herd of Hereford cattle at an experimental farm outside of Obihiro, Hokkaido.

The typical beef herd in Japan has 5 to 6 animals, compared with about 50 in the average U.S. beef herd.

Table 13—Japan's supply and distribution of beef

Japan fiscal year	Domestic production	Imports	Exports	Change in stocks	Supplies for domestic consumption	Domestic utilization				Annual per capita consumption
						Waste	Gross food	Ratio	Net food	
----- 1,000 metric tons ----- Percent 1,000 metric tons Kilograms										
1960	141	6	—	—	147	3	144	77	111	1.2
1961	141	6	—	—	147	3	144	77	111	1.2
1962	153	4	—	—	157	3	154	77	119	1.3
1963	198	5	—	—	203	4	199	77	153	1.6
1964	229	6	—	—	235	5	230	77	177	1.8
1965	190	11	—	—	201	4	197	77	152	1.5
1966	152	14	—	—	166	3	163	77	126	1.3
1967	148	16	—	—	164	3	161	77	124	1.2
1968	172	15	—	—	187	4	183	77	141	1.4
1969	230	18	—	—	248	5	243	77	187	1.8
1970	265	33	—	—	298	6	292	72	210	2.0
1971	279	62	—	—	341	7	334	72	240	2.3
1972	290	73	—	—	363	7	356	72	256	2.4
1973	215	170	—	28	357	7	350	72	252	2.3
1974	326	40	—	- 18	384	8	376	72	271	2.5
1975	327	91	—	11	407	8	399	70	279	2.5
1976	309	134	—	- 7	450	9	441	70	309	2.7
1977	371	132	—	6	497	10	487	70	341	3.0
1978	406	146	—	- 3	555	11	544	70	381	3.3
1979	400	189	—	5	584	12	572	70	400	3.4
1980	431	172	—	6	597	12	585	70	410	3.5

— = None or negligible.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, annual issues.

Various innovations have been made over the years to make the import quota system more flexible. The "one-touch" system (1970) allows authorized importers to sell LIPC quota beef directly to authorized distributors in order to reduce the handling of chilled beef, a very perishable commodity (22, p. 6).

The "tender" system (1971) was introduced to insure that the quality and quantity of frozen imported beef would match domestic demand. The LIPC periodically issues tenders to importers, specifying quality, quantity, and delivery time for different lots of beef and then purchases from the lowest bidders. The beef is then sold to end users by auction at wholesale markets or to specified organizations at a fixed price (22, p. 6).

Japan imposes a 25-percent ad valorem tariff on all imported beef.<sup>5</sup> Various surcharges are also levied to reduce the disparity between the prices of imported and domestic beef. These revenues are used to support and promote the livestock industry.

Live animals, both feeder and slaughter cattle, do not come under the import quota system but rather a tariff quota system.<sup>6</sup> To the extent that live cattle are imported for slaughter, the effectiveness of other import restrictions is diminished.

<sup>5</sup>The tariff on beef offals will be cut from 25 percent to 15 percent by 1987 as a result of an agreement reached at the Tokyo round of multilateral trade negotiations.

<sup>6</sup>Tariff quotas are applied to 11 agricultural items. Quotas are set periodically, generally twice a year. Imports that exceed quota levels are subject to a more restrictive tariff policy.

Table 14—Beef prices, Japan

Japan fiscal year	A	B	C	D	E	F	G	Wholesale price compared with the import price $\frac{F}{D} \times 100$
	Import unit value		Exchange rate	Import price		Wholesale, carcass price	Retail price	
	For all beef	From the United States		$A \times C$	Producer price			
				1,000				
	----- <i>Dol. per metric ton</i> -----		<i>Yen per dol.</i>	----- <i>Yen per kilogram</i> -----				<i>Percent</i>
1960	555	—	360	200	178	287	549	144
1961	569	—	360	205	194	337	637	164
1962	529	—	360	190	203	342	702	180
1963	504	—	360	181	202	345	748	191
1964	592	—	360	213	213	347	804	163
1965	640	—	360	230	279	510	854	222
1966	782	—	360	282	339	605	1,050	215
1967	984	—	360	354	388	762	1,240	215
1968	971	—	360	350	407	825	1,420	236
1969	847	—	360	305	393	813	1,350	267
1970	960	—	360	346	433	843	1,370	244
1971	1,112	2,536	351	390	466	860	1,470	221
1972	1,378	3,518	303	418	533	930	1,510	222
1973	2,249	3,375	271	609	811	1,419	1,980	233
1974	2,514	3,339	292	734	749	1,445	2,450	197
1975	1,678	4,463	297	498	866	1,640	2,710	329
1976	1,734	3,167	297	515	963	1,986	3,160	386
1977	1,588	3,000	271	430	953	2,007	3,150	467
1978	2,188	3,538	210	455	980	1,938	3,090	426
1979	3,129	3,880	219	685	1,150	2,056	3,150	300
1980	3,581	4,773	227	811	1,143	2,161	3,390	266
1981	3,245	4,108	221	717	1,097	2,142	3,360	299

— = None or negligible.

Sources: Ministry of Finance, *Japan Exports and Imports*, annual issues; Ministry of Agriculture, Forestry, and Fisheries, *The Meat Statistics of Japan*, June 1981.

## Japan's Feed-Livestock Economy

The LIPC influences domestic beef prices by adjusting stocks and through the semiannual adjustment in the import quota. A price stabilization scheme for beef was instituted in May 1975, giving the LIPC authority to maintain wholesale prices of second-grade Wagyu and dairy steer beef at predetermined levels. The midpoint for second-grade Wagyu beef is based on a calculation that considers average farm and wholesale prices over the prior 7-year period as well as the current costs of fattening such an animal. Floor and ceiling prices are calculated on the basis of historical price variation. Floor and ceiling prices for dairy steer beef are about 80 percent of the corresponding Wagyu prices (35, pp. 168-172).

The Government has also been involved in stabilizing the price of feed, an increasingly important input in beef production and other livestock enterprises, by stockpiling feed grains and establishing a feed price stabilization fund. These policies are described in the section on feed supply.

During the sixties, to help slow the general decline in Wagyu numbers, feeder calf support prices were introduced to insulate the feeder calf market from downward swings in the wholesale beef market. When feeder calf prices fall below a predetermined level, producers' returns are supplemented from a stabilization fund that is supported by producers, the Prefectural (state) Government, and the national Government. Reserve and contingency funds are also available if the basic fund is depleted. About 40 percent of the LIPC budget is used for this program (33).

The Government is also involved in other activities that affect the profitability of beef production. Most of these are related to reducing the effective cost of inputs or to streamlining the marketing system. For example, the Government provides subsidies for the enlargement and improvement of pasture. Efforts to enlarge pasture area include increasing the area planted to grasses and forages, especially in upland areas, and developing public lands for pasture. Subsidies are currently paid for double-

Table 15—Japan's beef import quotas

Japan fiscal year	Total <sup>1</sup>	General	Hotel	School lunch	Okinawa	Boiled and canned beef
<i>Metric tons</i>						
1960	4,200	—	—	—	—	—
1961	3,000	—	—	—	—	—
1962	3,000	—	—	—	—	—
1963	5,000	—	—	—	—	—
1964	3,000	—	—	—	—	—
1965	10,100	—	—	—	—	—
1966	8,500	8,500	—	—	—	—
1967	19,000	15,100	—	—	—	3,900
1968	21,440	15,340	—	—	—	6,100
1969	28,200	24,000	500	—	—	3,700
1970	24,700	20,530	500	—	—	3,630
1971	36,500	31,800	500	—	—	4,200
1972	77,830	67,300	1,000	—	4,330	5,200
1973	160,000	155,800	—	—	—	4,200
1974 <sup>1</sup>	—	—	—	—	—	—
1975	84,430	73,470	1,000	1,000	4,930	4,030
1976	96,500	80,000	1,000	3,000	5,500	7,000
1977	92,500	80,000	2,000	2,200	5,300	3,000
1978	112,000	95,000	3,000	3,000	5,600	5,400
1979	134,500	116,500	3,000	2,500	5,800	6,700
1980	134,800	119,000	3,000	2,250	5,850	4,700
1981	126,800	111,000	3,000	2,250	5,850	4,700

— = None or negligible.

<sup>1</sup>Quotas were suspended between February 1974 and January 1975.

Sources: U.S. Dept. of Agriculture, Foreign Agriculture Service.



cropping hay and fodder crops on rice paddy land. The production of forage crops has also been encouraged under the riceland diversion programs of the seventies and eighties.

The Government promotes modernization of the domestic beef industry by providing low-interest loans for purchasing machinery and livestock, and for improving installations such as livestock sheds. Subsidies are provided to develop large-scale feedlot operations. The Government encourages cooperative ventures that are better able to take advantage of economies of scale by sharing equipment and machinery.

The Regional Agricultural Production Integration Program organizes regionally integrated production units that make joint use of facilities and are large enough to use large-scale production techniques. These units are closely linked with regional marketing systems.

Expansion of farm holdings has been promoted through legislation, including revisions in the Land Law that allow farmers to expand their land base by relaxing limits on farm size, and by low-interest loans, which are available for consolidation of land and for the acquisition of land by cooperatives (4, pp. 23-26). These programs have had very little effect on average farm size.

### Dairy Sector

Japan's dairy industry is relatively new. Milk cattle were introduced during the Tokugawa Shogunate (1603-1867), probably by the Dutch. "White" cattle of a milking breed were reportedly kept and bred 50 miles from Yedo (now Tokyo) around the 1730's. At that time, the milk was evaporated and used as a drug in treating tuberculosis and syphilis (48, p. 15). The first American Consul, Townsend Harris, was offered locally produced cow's milk in 1857 and the first dairy farm was probably established in the early 1860's near the port of Yokohama. Demand for milk in the early days of the Meiji Restoration (1868-1912) came mainly from American and European traders staying at Japanese seaports. In response, dairy production developed in close proximity to these ports (39, p. 567). Milk and dairy products did not enter the daily diet of Japanese people until well into the 20th century, partly because of the Buddhist aversion to consuming livestock products.

During the early 20th century, milking herds were kept mainly in suburban areas, and were fed brewery residues, brans, beet pulp, and some feed mixtures. Ranches in frontier areas like Tohoku and Hokkaido raised and sup-

plied milk cows which were bought in late pregnancy. Their offspring were either slaughtered for veal or sent back as early as possible to rural areas where they were pastured (48, p. 16). It was not until around World War I that the technology of processing dairy products allowed dairies to develop and prosper in the more remote areas. Hokkaido and Tohoku are today among the most sparsely populated regions—yet they account for almost 50 percent of Japan's dairy herd and provide about 70 percent of the country's pasture and forage area. Most of Hokkaido's current milk production is for processing.

**Structural Characteristics.** Japan's dairy herd, mostly Holstein animals, has expanded steadily, with the exception of a decline between 1971 and 1974. While average herd size increased from 3.3 animals in the sixties to 10.8 in the seventies, the number of dairy farms dwindled from 410,000 in 1960 to 105,800 in 1981 (table 17).

Table 16—Japanese imports of beef and veal

Calendar year	Total	United States	Australia	New Zealand	Ryukyu Islands
1,000 metric tons					
1960	6	—	3	3	—
1961	5	—	3	3	—
1962	5	—	3	2	—
1963	5	—	3	1	—
1964	6	—	5	1	—
1965	11	—	8	3	—
1966	13	—	9	3	1
1967	14	—	10	2	1
1968	14	—	10	2	1
1969	19	—	15	3	—
1970	23	—	20	3	—
1971	42	1	37	4	—
1972	58	1	53	4	1
1973	127	10	107	9	1
1974	54	8	42	3	1
1975	45	4	37	4	1
1976	94	12	77	5	1
1977	85	7	72	4	1
1978	101	13	78	8	1
1979	130	24	100	3	1
1980	122	22	93	4	1
1981	122	26	87	6	1

— = None or negligible.

<sup>1</sup>Not applicable. Ryukyu (Okinawa) became a part of Japan in 1972.

Source: Ministry of Finance, *Japan Exports and Imports*, various issues.

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Dairy bull calves are usually sold at a few days of age to feedlots where they are raised and fattened to slaughter weight (325-350 kg) in 18 months. Some dairies raise steers until they are 6 to 12 months of age before selling. Heifers are occasionally raised and fattened for beef, depending on the demand for replacement cows. Culled cows are often put on grain for a few months before slaughter.

Milk production per cow increased over the past two decades with improved management and increased use of concentrates. Annual yields per dairy cow rose from 5.3 tons in 1965-69 to 5.8 tons in 1975-79 (table 17). Formula feed consumed per animal rose from 530 kg per year in 1960-65 to 1,101 kg in 1975-80.

Feed and labor costs represent about 80 percent of the total cost of milk production. About 60 percent of the total is for feed with more than half purchased commercially and the rest produced on the farm. In northern Japan, where land is cheaper, commercially purchased feed is less important. Large cooperative grazing farms are used. Such farms receive young heifers from local farmers, raise and breed them, and then return them to their owners. The cattle are pastured on hilly lands for a daily rate during the summer months. Rates are higher in the winter when the animals are confined and fed silage and hay.



About one-third of Japan's domestic beef supply comes from fattened dairy steers.

**Government Policies.** The goals of Japan's dairy policy are to assure an adequate supply of reasonably priced milk and dairy products for consumers, to maintain dairy farmers' income, and to promote the country's self-sufficiency in dairy products (89 percent in 1978; see table 49 for projections). The country pursues these goals through price, trade, and other policies.

The dairy farmer receives a pooled price, which depends on the Prefectural price of fluid milk and the support price of manufactured milk. The price of fluid milk is negotiated annually among farmers, dairy cooperatives, and milk companies at the Prefectural level, taking into consideration demand factors and intraprefectural competition. A guaranteed price for manufactured milk is set annually by the Government, taking into consideration costs of production, and is substantially lower than the fluid milk price (table 18). Since 1966, special premiums have been paid for high butterfat content. The amount of milk eligible for deficiency payment is limited, but it is not clear how firmly these limits are applied (12, p. 119). The pooled price differs from one Prefecture to another depending on the proportion of milk sold to the fluid market and for processing. In Prefectures where a relatively large percentage goes to the fluid market, the pooled price is higher.

Dairy cooperatives sell milk to processors at a standard transaction price, determined in part by demand for dairy products. This price is lower than the support price, necessitating a Government deficiency payment to make up the difference. Processors sell designated products such as butter, powdered products, and condensed milk at stabilization indicative prices, which are adjusted periodically to reflect changes in demand and processing costs. The Livestock Industry Promotion Council, through import quotas and stock adjustments, maintains the wholesale price between 90 and 104 percent of the stabilization indicative prices for each product.

The domestic dairy price depends on regulation of trade in most dairy products. The drinking milk market is naturally protected by location and the perishability of milk. Manufactured dairy products, which are more easily transported and stored, are strictly protected since world prices are much lower than domestic Japanese prices (tables 19 and 20).

Imports of dairy products are limited by quotas and tariffs. Import quotas, which are adjusted semiannually, lim-

It imports of evaporated and condensed milk, powdered milk, whey, butter, processed cheese, lactose, and miscellaneous preparations containing mainly milk, like infant formula. A tariff quota allows duty-free imports of natural cheese not to exceed twice the level of domestic production. The purpose is to encourage the production of processed cheese using a blend of domestic and imported material that will be competitive with imported processed cheese that enters with a 35-percent tariff.

Ad valorem tariffs, ranging from 25-35 percent, are applied to most dairy product imports. Casein is the only product that is imported without restriction.

Other policies are generally consistent with the overall goals of the country's dairy policy. Incentives have been extended from time to time to encourage the upgrading of the dairy herd by importing breeding stock. Under surplus conditions (as in recent years), the Government paid incentives to farmers to cull cows to reduce milk production. The riceland diversion program has given some farmers the opportunity to shift land from rice to feed crops, which has been an effective feed subsidy for some dairy farmers. The LIPC, along with dairy associations and milk product makers, is subsidizing construction of a natural cheese plant in Hokkaido that will increase Japan's present 10,000-ton capacity by about 25 percent and reduce the market for imports (45, vii).

Table 17—Milk production, Japan

Year	Dairy farms	Total dairy cows	Number of cows that have calved and are in milk	Average herd size	Raw milk production			Annual milk production per cow
					Total	Fresh	Processed	
	Number	----- 1,000 head -----		Head	----- 1,000 metric tons -----			Metric tons
1960	410,420	824	NA	2.0	1,887	987	742	NA
1961	413,000	885	NA	2.1	2,114	1,105	845	NA
1962	415,710	1,002	NA	2.4	2,437	1,188	1,067	NA
1963	417,640	1,145	NA	2.7	2,761	1,397	1,173	NA
1964	402,470	1,238	NA	3.1	3,020	1,644	1,181	NA
1965	381,600	1,289	634	3.4	3,221	1,771	1,259	5.1
1966	360,660	1,310	665	3.6	3,409	1,974	1,248	5.1
1967	346,900	1,376	692	4.0	3,566	2,120	1,265	5.2
1968	336,700	1,489	735	4.4	4,016	2,323	1,505	5.5
1969	324,440	1,663	816	5.1	4,509	2,482	1,835	5.5
1970	307,600	1,804	885	5.9	4,761	2,623	1,962	5.4
1971	279,300	1,856	912	6.6	4,820	2,664	1,997	5.3
1972	242,900	1,819	918	7.5	4,939	2,803	1,988	5.4
1973	212,300	1,780	909	8.4	4,908	2,943	1,831	5.4
1974	178,600	1,752	900	9.8	4,868	2,976	1,766	5.4
1975	180,100	1,787	910	11.2	4,961	3,130	1,713	5.5
1976	147,100	1,811	928	12.3	5,282	3,314	1,830	5.7
1977	136,500	1,888	988	13.8	5,735	3,548	2,067	5.9
1978	129,400	1,979	1,013	15.3	6,117	3,682	2,310	6.0
1979	123,300	2,067	1,072	16.8	6,463	3,857	2,468	6.0
1980	NA	NA	1,070	NA	6,502	3,986	2,334	6.1
1981	105,800	2,104	1,075	19.9	6,620	4,126	2,307	6.2

NA = Not available.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, various issues.

Table 18—Dairy prices, Japan

Japan fiscal year	Producer price of milk	Guaranteed price for manufactured milk	Standard transaction price	Deficiency payment	Quantity eligible for deficiency payment
-----Yen per kilogram-----					Million metric tons
1966	39.20	37.03	31.81	5.22	NA
1967	44.50	39.79	34.79	5.00	NA
1968	46.20	42.52	36.58	5.94	1.071
1969	47.60	43.52	37.03	6.49	1.350
1970	48.30	43.73	37.10	6.63	1.455
1971	51.90	44.48	37.42	7.06	1.554
1972	53.50	45.48	37.78	7.70	1.594
1973	60.50	48.51	40.49	8.02	1.501
1974	81.40	70.02	53.41	16.61	1.380
1975	91.20	80.29	57.57	22.72	1.380
1976	99.70	86.41	62.34	24.07	1.380
1977	101.60	88.87	64.29	24.58	1.580
1978	101.90	88.87	64.30	24.57	1.830
1979	101.30	88.87	64.30	24.57	1.930
1980	100.50	88.87	64.30	24.57	1.930

NA = Not available.

Sources: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, various issues; Livestock Industry Promotion Corporation, *LIPC*, Feb. 1975; Australian Bureau of Agriculture Economics, *Japanese Agricultural Policies: Their Origins, Nature, and Effect on Production and Trade*, Canberra, 1981.

Table 19—Butter prices, Japan

Japan fiscal year	(A) Standard transaction price (producer) <sup>1</sup>	(B) Stabilization Indicative price (wholesale) <sup>2</sup>	(C) Retail price (Tokyo) <sup>3</sup>	(D) Import unit values <sup>4</sup>	(A)/(B) × 100	(B)/(C) × 100	(B)/(D) × 100
	-----Yen per kilogram-----				-----Percent-----		
1966	31.8	573	800	324	5.6	72	177
1967	34.8	612	800	315	5.7	77	194
1968	36.6	647	800	244	5.7	81	265
1969	37.0	647	800	222	5.7	81	291
1970	37.1	647	800	222	5.7	81	291
1971	37.4	647	844	295	5.8	77	219
1972	37.8	647	884	366	5.8	73	177
1973	40.5	698	911	271	5.8	77	258
1974	53.4	914	1,013	384	5.8	90	238
1975	57.6	999	1,262	462	5.8	79	216
1976	62.3	1,160	1,369	410	5.4	85	283
1977	64.3	1,253	1,422	330	5.1	88	380
1978	64.3	1,253	1,524	311	5.1	82	403
1979	64.3	1,253	1,520	378	5.1	82	331

<sup>1</sup>The standard transaction price is paid to producers. If this price is lower than the support price, the difference is made up by a deficiency payment.

<sup>2</sup>The indicative price applies to the wholesale price of butter. The LIPC imports or makes adjustments in its stocks of butter to maintain the wholesale price between 104 and 90 percent of this price.

<sup>3</sup>Office of the Prime Minister, *Monthly Statistics of Japan*, various issues.

<sup>4</sup>Ministry of Finance, *Japan Exports and Imports*, annual issues. Price includes commodity, insurance, and freight (c.i.f.).

Table 20—Prices of nonfat dry milk, Japan

Japan fiscal year	(A)	(B)	(C)	(D)	$\frac{(A)}{(B)} \times 100$	$\frac{(B)}{(C)} \times 100$	$\frac{(B)}{(D)} \times 100$
	Standard transaction price (producer) <sup>1</sup>	Stabilization indicative price (wholesale) <sup>2</sup>	Retail price (powdered milk) in Tokyo <sup>3</sup>	Import price <sup>4</sup>			
----- Yen per kilogram -----							
1965	NA	NA	729	76			
1966	31.8	338	731	108	9.4	46.2	313
1967	34.8	366	733	119	9.5	49.9	308
1968	36.6	388	653	99	9.4	59.4	320
1969	37.0	388	635	62	9.5	61.1	626
1970	37.1	388	631	71	9.6	61.5	546
1971	37.4	388	711	120	9.6	54.6	323
1972	37.8	388	709	184	9.7	54.7	211
1973	40.5	388	741	146	10.4	52.4	266
1974	53.4	462	840	231	11.6	55.0	200
1975	57.6	462	1,027	241	12.5	45.0	192
1976	62.3	506	1,267	121	12.3	39.9	418
1977	64.3	506	1,200	83	12.7	42.2	610
1978	64.3	501	1,258	78	12.8	39.8	642
1979	64.3	501	1,242	121	12.8	40.3	414

NA = Not available.

<sup>1</sup>The standard transaction price is paid to producers. If this price is lower than the support price, the difference is made up by a deficiency payment.<sup>2</sup>The indicative price applies to the wholesale price of nonfat dry milk. The LIPC imports or makes adjustments in its stocks of nonfat dry milk to maintain the wholesale price between 104 and 90 percent of this price.<sup>3</sup>Office of the Prime Minister, *Monthly Statistics of Japan*, various issues.<sup>4</sup>Ministry of Finance, *Japan Exports and Imports*, annual issues. Price includes commodity, insurance, and freight (c.i.f.).Table 21—Japan's supply and distribution of dairy products<sup>1</sup>

Japan fiscal year	Production	Imports	Exports	Change in stocks	Supplies for domestic consumption	Utilization			Annual per capita consumption
						Feed	Waste	Food	
-----1,000 metric tons-----									Kg
1960	1,939	606	6	—	2,539	37	107	2,395	22.3
1961	2,180	391	12	—	2,559	42	115	2,402	24.9
1962	2,528	562	14	—	3,076	47	135	2,894	28.4
1963	2,843	831	15	—	3,659	54	158	3,447	32.8
1964	3,067	799	16	—	3,850	58	169	3,623	35.5
1965	3,271	507	—	— 37	3,815	57	72	3,686	37.4
1966	3,321	580	—	—	3,901	135	184	3,582	41.7
1967	3,662	984	—	135	4,491	65	87	4,339	43.3
1968	4,141	630	—	65	4,706	68	89	4,549	44.8
1969	4,575	568	—	135	5,008	62	94	4,852	47.3
1970	4,789	561	—	— 5	5,355	58	102	5,195	50.1
1971	4,840	528	—	— 103	5,471	46	106	5,319	50.7
1972	4,938	705	—	— 29	5,672	45	109	5,518	51.9
1973	4,902	1,032	—	27	5,907	43	115	5,749	52.9
1974	4,875	1,037	—	36	5,876	44	112	5,720	52.0
1975	5,010	787	—	— 328	6,125	41	117	5,967	53.3
1976	5,370	1,068	—	103	6,335	43	120	6,172	54.6
1977	5,847	1,016	—	178	6,685	50	126	6,509	57.0
1978	6,261	1,044	—	291	7,014	51	132	6,831	59.3
1979	6,464	1,109	—	106	7,467	136	141	7,190	61.9
1980	6,501	1,026	8	— 42	7,561	142	141	7,278	62.2

— = None or negligible.

<sup>1</sup>Fluid basis.Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, food balance sheets in annual issues.

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Other policies are seemingly at odds with the country's dairy policy, particularly policies affecting the imports of certain dairy products. Large amounts of nonfat dry milk (NFDM) under liberal quotas are imported for the School Lunch Program and for livestock feed. Formidable interest groups back the continuation of these imports to keep the Government cost of the School Lunch Program and feed prices as low as possible. Such imports continue despite a surplus in domestic dairy products (table 21).

### Pork Sector

Japanese peasants trapped wild boar as early as the sixth century, but with the advent of Buddhism in the seventh century, the eating of meats, including pork, was generally discouraged. The Okinawans and residents of southern Japan tried to preserve what they considered to be a delicacy (7, p. 6). During the Tokugawa Shogunate (1603-1867), when Japan traded principally with the Chinese and Dutch, hogs were imported in small numbers for breeding purposes. Until the 1850's, most hog production

took place in southern Japan where sweetpotatoes were in ample supply and served as a feedstuff. During the Meiji Restoration (1868-1912), hog production started to expand and spread throughout the country. In 20 years (1887 to 1907), the hog population increased by about seven times (7, p. 7). The Yorkshire and Berkshire breeds, well suited for confined feeding, were the preferred breeds from the late 1800's to the 1960's. By the seventies, the Landrace and crossbreeds were most prevalent.

**Structural Characteristics.** Hog raising, like other livestock enterprises in Japan, has been characterized by a trend toward fewer and larger operations. The average herd size increased from 4 hogs in 1960-65 to 46 in 1975-79, while the number of operators declined from 800,000 in 1960 to 156,000 in 1979 (table 22). Hog operations have generally been concentrated near urban areas in central Honshu and on the southern island of Kyushu. In recent years, pollution and zoning ordinances have forced operators to locate farther from cities.

Table 22—Composition of hog inventory, Japan

Calendar year	Producers	Swine					Average herd size
		Total	Under 6 Months	6 months and over			
				Total	Females for breeding	Others	
	Number	-----1,000 head-----					Head
1960	799,120	1,918	1,140	778	246	531	2.4
1961	907,780	2,604	1,662	942	420	522	2.9
1962	1,025,260	4,033	2,395	1,638	529	1,108	3.9
1963	802,560	3,296	1,925	1,371	418	953	4.1
1964	711,200	3,461	2,189	1,272	465	807	4.9
1965	701,580	3,976	2,619	1,357	535	822	5.7
1966	714,300	5,158	3,456	1,702	698	1,005	7.2
1967	649,500	5,975	3,996	1,980	729	1,251	9.1
1968	530,600	5,535	3,793	1,742	651	1,090	10.4
1969	461,030	5,429	3,776	1,653	659	995	11.8
1970	444,500	6,335	4,422	1,912	816	1,096	14.3
1971	398,300	6,904	4,959	1,945	841	1,104	17.3
1972	339,700	6,985	5,087	1,890	853	1,045	20.6
1973	303,700	7,313	5,289	2,024	977	1,047	24.1
1974	277,400	8,018	5,898	2,140	1,009	1,130	28.9
1975	223,400	7,684	5,602	2,082	911	1,171	34.4
1976	195,600	7,459	5,478	1,981	962	1,019	38.1
1977	178,900	8,132	5,979	2,153	1,028	1,125	45.5
1978	165,200	8,780	6,474	2,306	1,093	1,213	53.2
1979	156,300	9,491	7,009	2,482	1,168	1,314	60.7

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, various issues.

Pork production expanded by 13 percent per year during 1960-79, a rate second only to that of chicken production among livestock activities. Only during 1970-75 did the rate fall below 10 percent. Advances in management and technology, as well as profitable conditions, have raised the litter size, raised the slaughter weight, reduced the fattening period, increased the use of formula feed, and improved the efficiency of feed conversion.

Despite rapid growth in Japanese pork production, consumption has risen even faster. Self-sufficiency has declined from 99 percent in 1960-65 to 88 percent in 1975-79 (table 23). Policymakers apparently feel that Japan can improve its self-sufficiency in pork in future years. Land is not a serious constraint and wholesale prices have remained competitive with import prices (table 24). Projections made in 1975 indicate that Japan's self-sufficiency in pork will reach 99 percent by 1985. Less ambitious projections, released in November 1980, indicate 96-percent self-sufficiency by 1990.

Feed cost is one of the chief costs in Japanese pork production, particularly with increased commercialization of the industry and greater reliance on formula feed. Use of formula feed has risen from an average of 282 kg per animal in 1960-65 to 677 kg in 1975-80, a level that nearly fulfills the total nutritional requirements of an average animal.

Hogs are produced in complete farrow-to-finish operations or divided into separate feeder pig and hog-finishing units. No information is available on the dimensions of either. Cost of production data reported on each phase of the production cycle indicate that the most important single cost in feeder pig production is feed (commercially purchased or self-supplied) accounting for nearly 60 percent of total costs. Labor accounts for an estimated 25 percent.

In hog-finishing operations, the most important single expense is for feeder stock. The larger operations spend

Table 23—Japan's supply and distribution of pork

Japan fiscal year	Domestic production	Imports	Exports	Change in stocks	Supplies for domestic consumption	Domestic utilization				Annual per capita consumption
						Waste	Gross food	Ratio	Net food	
-----1,000 tons-----								Percent	1,000 tons	Kilograms
1960	149	6	—	—	155	3	152	82	125	1.3
1961	240	1	—	—	241	5	236	82	194	2.1
1962	322	—	—	—	322	7	315	82	258	2.7
1963	271	8	—	—	279	6	273	82	224	2.3
1964	314	2	—	—	316	6	310	82	254	2.6
1965	385	—	—	—	385	8	377	82	309	3.1
1966	542	—	—	32	510	10	500	82	410	4.1
1967	546	—	—	-23	569	11	558	82	458	4.6
1968	511	18	—	-11	540	11	529	82	434	4.3
1969	525	36	—	—	561	11	550	82	451	4.4
1970	691	17	—	—	708	14	694	70	486	4.7
1971	755	29	—	—	784	16	768	70	538	5.1
1972	780	89	—	—	869	17	852	70	596	5.6
1973	884	128	—	—	1,012	20	992	70	694	6.4
1974	966	71	—	—	1,037	21	1,016	70	711	6.5
1975	891	208	—	41	1,058	21	1,037	70	726	6.5
1976	1,096	187	—	15	1,268	25	1,243	70	870	7.7
1977	1,189	161	—	-23	1,373	27	1,346	70	942	8.3
1978	1,323	155	—	10	1,468	29	1,439	70	1,007	8.7
1979	1,465	176	—	15	1,626	33	1,593	70	1,115	9.6
1980	1,430	207	—	-9	1,646	33	1,613	70	1,129	9.6

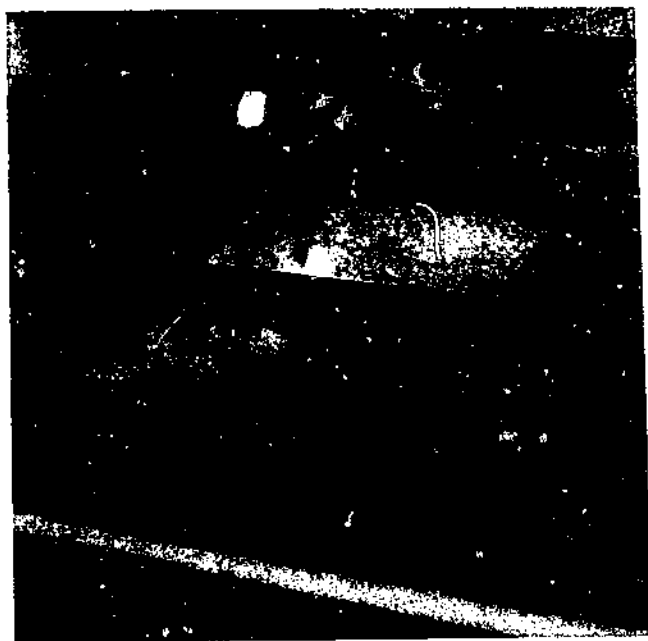
— = None or negligible.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, food balance sheets in annual issues.

## Japan's Feed-Livestock Economy

more on this item than do the smaller ones, indicating their greater dependence on the feeder pig market. Feed costs are fairly uniform, about 35 percent of total costs, although smaller operations use less purchased feed and more that is self-supplied. Labor costs are estimated at 8-10 percent for these operations.

In Japan, as in other countries, various intermediaries between the producer and consumer provide marketing services that add costs (value) to the retail price of the product. The size of the margin is a function of marketing efficiency (competition) as well as the amount and quality of the services embodied in the product after it leaves the farm. Japan's marketing system is often cumbersome, with numerous intermediaries and small retail outlets. The pork producer in Japan receives about 30 percent of the consumer price, compared with 50-60 percent in the United States. The relative share of the consumer price received at each market level has been fairly constant over time. The producer and wholesale shares have declined slightly since 1960 and the retail share has increased slightly, but these shifts have not been very great.



A confined hog operation in Yamanashi Prefecture. The average size of a Japanese pig herd increased greatly in the past 20 years, from about 3 animals in 1960 to about 60 in 1980. The average U.S. pig herd is about 300 animals. Japanese consumption of pork in 1980 was about 9.6 kg per person, compared with 32 kg in the United States.

**Government Policies.** The Government intervenes in the pork sector more so than in the poultry sector but less than in the beef and dairy sectors. Government objectives are to stabilize prices, to maintain producer income, and to raise self-sufficiency through price, stockholding, and trade policies.

The Law on Stabilization of Livestock Product Prices (1961) authorizes MAFF to set annual wholesale floor and ceiling prices for domestic pork carcasses. When domestic pork prices approach the floor level, MAFF may have the LIPC purchase stocks of domestic pork and hold them in storage, or finance the storage of pork by agricultural cooperatives. As prices approach the predetermined ceiling price, stocks are released to the market. Voluntary action may also lead to reduced market supplies. In 1979, producers requested processed meat manufacturers to reduce voluntarily their use of imported pork.

Table 24—Pork prices, Japan

Calendar year	A Producer price	B Wholesale, carcass	C Retail, dressed pork	D Import unit value	$\frac{B}{D} \times 100$
-----Yen per kilogram-----					Percent
1960	207	346	642	178	194
1961	163	304	615	159	191
1962	167	278	569	239	116
1963	232	389	724	303	128
1964	214	373	753	281	133
1965	216	373	745	219	170
1966	190	325	694	281	116
1967	217	361	714	491	74
1968	277	438	849	394	111
1969	286	481	960	437	110
1970	237	397	909	439	90
1971	269	431	930	412	105
1972	285	456	992	449	102
1973	301	493	1,120	507	97
1974	382	559	1,240	640	87
1975	501	743	1,550	734	101
1976	451	747	1,680	835	89
1977	458	732	1,590	831	88
1978	427	691	1,570	834	83
1979	373	615	1,500	846	73
1980	415	627	1,450	852	74
1981	456	692	1,530	853	81

Source: Ministry of Agriculture, Forestry, and Fisheries, *The Meat Statistics of Japan*, Jan. 1982.



The Government recognizes the potential impact of imports on domestic producers and controls imports as a part of its price stabilization policy. Japan's pork imports increased greatly between 1968 (when imports constituted about 3 percent of total pork supply) and 1979 (11 percent) with supplies coming mainly from the United States, Canada, Taiwan, and Denmark (table 25). During the sixties, import quotas and a flexible tariff system were administered. Since October 1971, pork imports have been controlled with a variable levy. The level of protection is determined by the standard import price (also called the minimum import price—MIP) which is midway between the floor and ceiling prices for carcass pork. Unless the levy is waived, pork imports are subject to the larger of a duty or a levy equal to the difference between the import price (c.i.f.) and the standard import price.

If the Japanese want to encourage imports of carcass pork they replace the standard import price with pro-

claimed prices, which are usually lower, and waive the duty on pork imports when import prices are above the proclaimed price. Lower proclaimed prices reduce the protective effect of the variable levy. In the case of pork cuts, however, proclaimed prices have been set higher than the standard import price, thus discouraging imports of higher value pork cuts.

The Government generally obtained the desired effect in imposing or waiving the duty during the seventies. Waiving the duty in 1972 and 1973 led to dramatic upsurges in pork imports. Pork imports more than doubled in 1972 and doubled again in 1973. When the duty was reinstated (Sept. 1973 through Oct. 1976), pork imports fell off almost as dramatically as they had risen earlier. The U.S. share of total pork imports dropped sharply when the duty was reapplied. The other principal suppliers also exported smaller volumes but the impact was not so severe. European community subsidies and Canadian trading arrangements partially offset the adverse effects of the duty.

Table 25—Japanese imports of pork

Calendar year	Total	United States	Australia	Ryukyu Islands	Canada	Taiwan	South Korea	Denmark
1,000 metric tons								
1960	6	1	—	1	3	—	—	—
1961	1	1	1	—	—	—	—	—
1962	—	—	—	—	—	—	—	—
1963	7	6	—	—	—	—	—	—
1964	4	—	4	—	—	—	—	—
1965	—	—	—	—	—	—	—	—
1966	—	—	—	—	—	—	—	—
1967	—	—	—	—	—	—	—	—
1968	10	9	—	—	—	1	—	—
1969	43	29	4	—	2	6	1	—
1970	17	8	1	1	3	5	—	—
1971	27	14	—	2	9	2	—	—
1972	68	22	11	1	19	11	4	—
1973	126	41	13	1	20	34	2	—
1974	42	6	1	1	12	16	3	1
1975	125	43	3	1	26	8	8	24
1976	149	55	2	1	27	26	5	17
1977	108	24	—	1	35	18	5	17
1978	104	26	—	1	31	15	—	22
1979	132	33	—	1	33	15	—	41
1980	108	30	—	1	30	17	—	20
1981	184	39	—	—	43	20	—	72

— = None or negligible.

<sup>1</sup>Not applicable. The Ryukus (Okinawa) became a part of Japan in 1972.

Source: Ministry of Finance, *Japan Exports and Imports*, annual issues.

**Egg Sector**

A thriving layer industry had developed by the end of the Taisho era (1925) but World War II reduced the industry from 50 million birds to 15 million. After the war, flock owners throughout the country organized an association (which became the Japan Poultry Association) to help resolve problems confronting the industry, particularly those of improving breeding stock, assuring chick and feed supply, and catching up with the West in managerial techniques.

**Structural Characteristics.** Egg producers have experienced the most rapid structural change since 1960 of any of Japan's livestock industries. The number of producers declined dramatically and average flock size grew very rapidly, averaging 20 percent per year. Production is

distributed across the country but is more concentrated near the population centers of central Honshu and Kyushu.

Egg production expanded rapidly in the sixties, then slowed in the seventies in response to stable per capita consumption (table 26). Since the price of feed, the most important input in egg production, rose more rapidly than egg prices over the 1960-79 period, profitability was maintained primarily through economies of scale as well as managerial and technical advances. The industry rapidly shifted away from the labor intensive practices of 20 years ago, when most eggs were gathered by hand and hens were housed under a farmer's house or in a make-shift structure nearby. The cage system, introduced in the late fifties, was rapidly adopted by large and small pro-

Table 26—Japan's supply and distribution of eggs

Japan fiscal year	Domestic production	Imports	Exports	Supplies for domestic consumption	Domestic utilization					Annual per capita consumption
					Seed	Waste	Gross food	Ratio	Net food	
-----1,000 tons-----					Percent		1,000 metric tons		Kilograms	
1960	547	—	7	540	17	10	513	89	457	4.9
1961	728	—	8	720	19	14	687	89	611	6.5
1962	780	—	6	774	20	15	709	93	658	6.9
1963	852	—	1	851	26	17	808	89	719	7.5
1964	991	—	1	990	27	19	944	89	840	8.6
1965	1,023	2	—	1,025	29	20	976	89	869	8.8
1966	1,079	5	—	1,084	36	21	1,027	89	914	9.2
1967	1,173	23	—	1,196	39	23	1,134	89	1,009	10.1
1968	1,367	36	—	1,403	45	27	1,331	89	1,185	11.7
1969	1,523	31	—	1,554	76	30	1,448	89	1,289	12.6
1970	1,761	47	—	1,808	52	35	1,721	89	1,532	14.8
1971	1,799	46	—	1,845	53	36	1,756	89	1,563	14.9
1972	1,795	37	—	1,832	56	36	1,740	89	1,549	14.6
1973	1,815	44	—	1,859	58	33	1,765	89	1,571	14.5
1974	1,793	41	—	1,834	57	36	1,741	89	1,549	14.1
1975	1,806	55	—	1,861	61	36	1,764	89	1,570	14.0
1976	1,861	51	—	1,912	64	37	1,811	89	1,612	14.3
1977	1,901	59	—	1,960	70	38	1,852	89	1,648	14.4
1978	1,980	56	—	2,036	72	39	1,925	89	1,713	14.9
1979	1,991	44	—	2,035	74	39	1,922	89	1,711	14.7
1980	1,990	49	—	2,039	75	39	1,925	89	1,713	14.6

— = None or negligible.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, food balance sheets in annual issues.

ducers alike. Egg production became more efficient as hens produced more and heavier eggs and required less feed to do so.

The principal costs in egg production are feed, labor, and the cost of purchasing and maintaining pullets before they produce. These three categories represent about 95 percent of total production costs. Feed, which is mostly purchased formula feed, represents about two-thirds of total production cost. Use of formula feed over the period has remained constant at 44-46 kg per year. Efficiency in converting feed has increased, offsetting rising feed prices.

Japan's self-sufficiency in egg production is the highest of any of its livestock activities, varying between 97 and 100 percent over the period. Official projections, which are plausible given the factorylike nature of the industry, indicate continued high levels of self-sufficiency through 1990.

The marketing of eggs in Japan involves commercial distributors, cooperatives, and feed-manufacturing companies. In the forties and fifties, *botefuri* gathered eggs from numerous small egg producers and transported them to wholesalers who delivered the eggs along with those collected from larger farms, to city markets. There they consigned the eggs to the large receiver markets for auction to city wholesalers. The auction system of trading eggs has since been abandoned; the receiver markets now purchase and sell eggs on their own account. Urban wholesalers purchase eggs daily at receiver markets and distribute them to retail outlets, institutional users like restaurants and hotels, and industrial users like bakeries and mayonnaise producers (6).

Cooperatives in each Prefecture also collect eggs from members, large and small, and eventually sell them to urban markets.

Formula feed manufacturers, through feed agents, play a marketing role by collecting eggs at farms on backhauls from feed deliveries. The feed companies act as collection points in major city markets, selling eggs to large buyers. Supermarkets buy almost exclusively from feed companies.

**Government Policies.** Government involvement in the egg sector has been more indirect than in the beef, dairy, and pork industries. Growth in specialization and scale of operation, however, has made producers increasingly vulnerable to price fluctuations, prompting occasional Government help. The Government intervened under the Adjustment and Guidance of Egg Production and Marketing Act in 1966 to help organize the industry and to promote

egg price stability. Prices were stabilized through pricing, stockholding, and production adjustment policies. Stable producer prices are guaranteed to subscribers through the Egg Price Stabilization Fund established in 1966 (table 27). The fund was created with contributions from agricultural cooperatives, Prefectural governments, and the LIPC. When market prices fall below a guaranteed price, the fund covers the difference. Subscribers pay a small fee per kilo of eggs sold to maintain the fund. About 40 percent of egg production is currently covered by this program.

Certain trade policies are enforced from time to time to support domestic egg prices but these are usually of a voluntary nature. "Administrative guidance" is used with importers and processors to slow down or limit imports.<sup>7</sup> There are no limits on imports of eggs or egg products, but tariffs restrict trade to some extent. The tariff on fresh eggs is 20 percent and on most egg products is either 25 percent or ¥60 per kg, whichever is greater. The tariff on egg albumen will be reduced from 20 to 10 percent by 1987 as a result of the Tokyo round of multilateral trade negotiations (MTN).

The Government also encourages stockholding when market prices are weak. In the sixties, the LIPC subsidized storage and interest costs of producer organizations when egg prices dropped. The National Fluid Egg Manufacturers and Stockpiling Company was established in 1971 with capital from the Ministry of Agriculture and Forestry (predecessor of MAFF), Prefectural governments, and producer organizations. When prices fall below a predetermined level, the company buys eggs and manufactures liquid egg, which is stockpiled and released when prices strengthen.

When prices are weak, the Government also intervenes to limit or curtail expansion of existing flocks as well as to reduce flocks through stepped-up culling. Owners of the larger layer flocks (more than 3,000 birds) are usually targeted. MAFF influences their behavior by restricting Government and cooperative subsidies of one sort or another, by using the moral suasion of "administrative guidance," and by tying compensatory payments from the price stabilization fund to producer compliance.

<sup>7</sup>Administrative guidance (*gyoseishido*) consists of recommendations, advice, or directions issued by a Japanese Government agency but lacking any coercive legal power.

## Japan's Feed-Livestock Economy

### Broiler Sector

Before World War II, Japan's supply of poultry meat came primarily from culled layers. Chickens raised specifically for meat were almost entirely unknown in urban areas until 1930, when a merchant raised cockerels for Chinese restaurants in the Tokyo area (8, p. 3).

World War II brought a sudden end to the rooster business because feed was scarce and the Government insisted that duck was a more efficient source of protein. A wealthier class emerged after the War which created a new market for chicken meat. By the early fifties, a growing restaurant demand for chicken had developed and, in the sixties, home consumption of chicken began to expand (8, p. 13).

**Structural Characteristics.** Since the early sixties, the number of farms raising broilers in Japan has declined steadily. In 1964, there were twice as many farms raising broilers as there are today. At the same time, the total number of broiler chickens raised increased more than nine times. Broiler numbers stood at a little over 13 million in 1964 with most chicken meat coming from culled layers; by 1979, there were 125 million broilers. Culled layers represented only 10 percent of chicken meat production. The average number of broilers per farm increased from 1,850 in 1965-70 to more than 12,000 in 1979. Geographically, broiler production is concentrated in the central part of Honshu and southward. About one-third of production is concentrated on the southern island of Kyushu.

Table 27—Egg prices, Japan

Calendar year	A Producer price <sup>1</sup>	B Wholesale price <sup>2</sup>	C Retail price (Tokyo) <sup>3</sup>	D Floor price <sup>4</sup>	E Import unit value <sup>5</sup>	$\frac{B}{E} \times 100$
Yen per kilogram						
1961	NA	NA	221	NA	NA	NA
1962	185	191	229	NA	NA	NA
1963	192	202	242	NA	NA	NA
1964	167	179	227	NA	NA	NA
1965	190	187	219	NA	152	123
1966	189	202	240	160	153	132
1967	190	193	228	162	157	123
1968	180	199	241	160	158	126
1969	186	190	226	160	160	119
1970	172	192	267	160	172	112
1971	176	188	229	160	174	108
1972	194	198	235	163	167	119
1973	217	217	259	168	192	113
1974	278	279	335	202	292	96
1975	268	303	348	273	309	98
1976	274	277	330	265	273	101
1977	264	304	365	267	288	102
1978	227	242	312	259	276	88
1979	251	243	314	215	270	90
1980	309	300	382	NA	315	95

NA = Not available.

<sup>1</sup>Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, various issues.

<sup>2</sup>Bank of Japan for 1962-73; Ministry of Agriculture, Forestry, and Fisheries, *Monthly Statistics*, various issues, for 1974-79.

<sup>3</sup>Office of the Prime Minister, *Japan Statistical Yearbook*, various issues.

<sup>4</sup>Egg price stabilization scheme introduced in 1966.

<sup>5</sup>Includes egg in shell; fresh, chilled, or frozen (excluding hatching eggs) powdered whole eggs; egg yolks; etc. Ministry of Finance *Japan Exports and Imports*, various issues.

As in egg production, domestic broiler producers have supplied more than 95 percent of the country's consumption requirements (table 28). There has been a slight decline in self-sufficiency since 1960, with imports making up 6 percent of total supplies in 1979. Imports of poultry meat come mainly from the United States, China, and Thailand (table 29).

The major costs involved in broiler meat production are for feed, chicks, and labor. Other less significant costs include those for light, heat, water and power, buildings, and equipment. Feed represents the largest single cost, over two-thirds of the total, but has declined somewhat through the seventies. In 1974, when world grain prices were very high, feed costs amounted to 73 percent of total production costs but have subsequently declined to

about 67 percent. The costs of chicks and labor are significant, averaging 16 and 8 percent, respectively. Economies of scale and technical advances have helped offset declining real producer prices over the years (table 30).

Before 1965, chick supply, feed supply, and broiler raising typically were carried on as separate and discrete activities. Today, a typical broiler operation encompasses all these activities. Trading companies like Mitsui, Mitsubishi, and Marubeni are increasing their share of broiler production as are food companies and agricultural cooperatives. Hatcheries and feed mills, owned by or affiliated with integrated broiler companies, sell chicks and feed to broiler producers. The same companies purchase, process, and market the 8- to 10-week-old birds. Integrated op-

Table 28—Japan's supply and distribution of chicken meat

Japan fiscal year	Domestic production	Imports	Exports	Change in stocks	Supplies for domestic consumption	Domestic utilization				Annual per capita consumption
						Waste	Gross food	Ratio	Net food	
-----1,000 metric tons-----						Percent	1,000 metric tons	Kilograms		
1960	44	—	—	—	44	1	43	77	33	.4
1961	97	—	—	—	97	2	95	77	73	.8
1962	121	—	—	—	121	2	119	77	92	1.0
1963	142	5	—	—	147	3	144	77	111	1.2
1964	181	4	—	—	185	4	181	77	139	1.4
1965	205	8	—	—	213	4	209	77	161	1.6
1966	261	7	—	—	268	5	263	77	203	2.0
1967	303	10	—	—	313	6	307	77	236	2.4
1968	336	18	—	—	354	7	347	77	267	2.6
1969	423	20	—	—	443	9	434	77	334	3.3
1970	505	12	—	—	517	10	507	77	390	3.8
1971	571	30	1	—	600	12	588	77	453	4.3
1972	638	27	1	—	664	14	650	77	501	4.7
1973	706	26	1	—	731	15	716	77	551	5.1
1974	730	21	—	—	749	15	734	77	565	5.1
1975	756	28	3	—	781	16	765	77	589	5.2
1976	834	40	2	—	872	17	855	77	658	5.8
1977	944	48	3	6	983	20	963	77	742	6.5
1978	1,022	66	3	—	1,085	22	1,068	77	819	7.1
1979	1,095	69	3	-5	1,166	23	1,143	77	880	7.6
1980	1,113	80	4	2	1,187	24	1,163	77	896	7.7

— = None or negligible.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, food balance sheets in annual issues.

Table 29—Japanese imports of poultry meat

Calendar year	Total	United States	China	Denmark	Bulgaria	Hungary	Thailand
1,000 metric tons							
1963	3	3	—	—	—	—	—
1964	6	5	—	—	—	—	—
1965	6	5	—	—	—	—	—
1966	8	5	1	1	—	—	—
1967	8	5	1	2	—	—	—
1968	16	6	2	4	2	1	—
1969	20	6	2	5	3	3	—
1970	11	5	2	1	1	2	—
1971	27	7	5	3	5	4	—
1972	29	8	7	3	5	5	—
1973	25	9	9	2	2	3	—
1974	25	11	5	4	1	2	1
1975	22	12	6	1	—	—	—
1976	38	24	5	1	—	1	2
1977	48	33	5	—	—	1	4
1978	62	39	9	—	—	1	9
1979	72	41	12	—	—	1	14
1980	72	42	12	—	—	—	16
1981	99	60	14	—	—	—	25

— = None or negligible.

Source: Ministry of Finance, *Japan Exports and Imports*, annual issues.

Table 30—Chicken prices, Japan

A B C D						A B C D					
Calendar year	Producer price	Wholesale price	Retail price	Import unit value	$\frac{B}{D} \times 100$	Calendar year	Producer price	Wholesale price	Retail price	Import unit value	$\frac{B}{D} \times 100$
----- Yen per kilogram ----- Percent						----- Yen per kilogram ----- Percent					
1960	154	245	483	183	134	1970	192	234	767	271	86
1961	150	234	502	261	90	1971	199	261	712	241	108
1962	148	248	686	312	79	1972	184	236	724	236	100
1963	158	247	718	265	93	1973	231	268	801	284	94
1964	143	228	721	249	92	1974	267	310	960	366	85
						1975	291	341	1,000	373	91
						1976	295	353	1,110	366	96
						1977	295	349	1,040	357	98
1965	198	253	718	270	94	1978	256	298	1,030	300	99
1966	186	244	724	274	89	1979	241	277	993	342	81
1967	197	243	728	253	96						
1968	206	248	744	245	101	1980	261	299	1,140	352	85
1969	181	234	748	268	87	1981	277	324	1,200	369	88

Source: Ministry of Agriculture, Forestry, and Fisheries, *The Meat Statistics of Japan*, Jan. 1981; Ministry of Finance, *Japan Exports and Imports*, various issues.

erations have contributed considerably to the rapid development of Japan's broiler industry.

**Government Policies.** There are no Government-funded programs for the broiler industry. The Government aids producers through research as well as disease prevention and treatment programs.

There is a price stabilization fund for broilers similar to that for eggs that was set up in 1970 by the National Sales Federation of Agricultural Cooperatives (*Zenhanren*) and the National Purchase Federation of Agricultural Cooperatives (*Zenkoren*). It differs from the egg fund in that there is no Government participation.

From time to time, MAFF has used "administrative guidance" (*gyoseishido*) to influence production and trade decisions that might affect broiler prices. Large broiler producers were urged in 1975, for example, to reduce production to assure greater profitability for smaller and less efficient producers.

Poultry imports are affected to some extent by tariffs, which range from 10 percent on chicken livers and turkey to 20 percent on chicken meat. The 1978 MTN agreement will reduce the tariff on chicken legs from 20 to 10 percent and on turkeys from 10 to 5 percent by 1987.

### Japan's Fishery Industry

Prospects for the livestock industry are closely tied to developments in fisheries. Fish, as mentioned previously, is a traditional food and is central to Japan's diet, whereas livestock products, although growing in popularity, still are less important. The popularity of fish in Japan is no accident. Many miles of coastline and favorable currents—the warm *Kuroshio* from the south and the cold *Oyashio* from the north—create an ideal environment for many species of fish and other marine life. The Japanese fishing industry exploits these as well as more distant fishery resources for a growing and increasingly affluent population.

World War II severely damaged Japan's fishing industry; not until the early fifties did Japan's total fish catch reach prewar levels. Japanese fishing hauls since 1960 have risen by about 3 percent per year. Growth was especially rapid during the late sixties and early seventies, when the country exploited more distant fisheries, mainly Alaskan pollack off the coasts of Alaska, western Canada, the northwestern United States, and the northeastern Soviet Union. Since 1972, Japan's fish catch has stabilized between 10 million and 11 million tons, or about 15 percent of the world catch (which has also stabilized at between 66 million and 72 million tons).

Conservation of oceanic resources and questions of resource distribution were discussed at the third U.N. Conference on the Law of the Sea in 1973. Shortly afterward, more than 80 coastal nations followed the practice of several Latin American countries in claiming 200-mile jurisdictional zones over fishery resources. Enforcement of such zones has been disruptive to Japan since a third of its fish catch had previously been taken within 200 miles of other countries. A flexible public policy that incorporates elements "common to the experiences of the centrally planned economies" as well as those "common to some market economies" (2, p. 189) has helped Japan's fishery industry meet the challenge of the 200-mile zones. Changes in the structure of Japan's fishery industry and in the Government's role are described below.

Japanese fisheries, which account for about 1 percent of the country's GNP, have undergone changes in structure, resembling those in the livestock industry in some ways. The number of firms engaged in fishing declined, while their average size increased in terms of the number and gross tonnage of vessels. In 1960, there were about 230,000 fishery firms, with an average of 1.7 vessels averaging 4.6 tons; in 1979, there were about 220,000 firms with an average of 2 vessels, each weighing about 6.1 tons. The number of vessels in Japan's fishing fleet increased by less than 1 percent per year but gross tonnage increased more rapidly as larger vessels were used to exploit more distant fisheries.

Distant fisheries, both within the 200-mile zones of other countries and on the high seas, became extremely important to Japan during the sixties and early seventies, but declined thereafter because of rising energy costs and the advent of the 200-mile zones.<sup>4</sup> Coastal and offshore fisheries have now returned to their previous prominence as the country's principal sources of fish.<sup>5</sup> Marine aquaculture, although relatively limited, has grown more rapidly than any other source since 1960; but it still represents only 8 percent of the total catch by weight and 16 percent by value. Fresh water inland resources and whaling are even more limited (table 31).

<sup>4</sup>Distant fisheries include mother ship enterprises, large trawl operations in the East China Sea, distant water trawling, tuna longline, skipjack pole-and-line, North Pacific Ocean tanner crab, longline and gill net fishing. Major target species include Alaskan pollack, flat fish, tuna, skipjack, salmon, trout, and tanner crabs (37, p. 3).

<sup>5</sup>Coastal fisheries include shellfish and seaweed collection, set net and beach seine operations, and enterprises using non-powered boats of less than 10 gross tons. Offshore fisheries include near-shore operations with powered boats of more than 10 gross tons, shellfish and seaweed collection, set net and beach seine operations. The dominant species caught by this industry are mackerel, sardine, anchovy, and squid (37, p. 3).

## Japan's Feed-Livestock Economy

Changes in the location of Japan's fishing grounds have affected the composition of the fish catch and the kind of equipment used. Sardine and mackerel are the most common species caught, accounting for about a third of the current catch.

Changes in wholesale prices have reflected the changing supply and demand conditions for various fish. Hauls of cheap fish have tripled in the past two decades and producer prices have declined somewhat in real terms (37, p. 13). Production growth slowed somewhat in the seventies with the decline in catches of Alaskan pollack more than offset by increases in sardine, mackerel, and saury (37, p. 15).

In contrast, production of table fish declined from 2 million to 1.5 million tons since 1960, while producer prices tripled in real terms. Species contributing to the decline include horse mackerel and herring. Luxury fish production has been relatively stable since 1960 with real prices more than doubling (table 32).

Larger operations are apparently in a cost-price squeeze because of higher energy costs, the advent of 200-mile fishing limits, and the relatively low price of fish species

taken from foreign coastal zones. Rates of return on investment and profit margins were generally more favorable before 1973 than afterward for all sizes of firms. Average total costs, the most important of which are labor and energy, rose by 24 percent in 1974 because of higher oil prices (37, p. 10). The smaller firms seem to have adjusted more easily while intermediate and larger firms did less well in terms of profit margin growth and return on investment (37, p. 51).

While Japan seems to have had little problem maintaining a supply of cheap fish, shortages of higher value fish, both from distant fisheries and from coastal areas, have led to increased dependence on imports. Japan's self-sufficiency in fish production declined from an average of 105 percent in 1960-65 to 93 percent in 1979. Imports exceeded exports in 1968 and 1973 and consistently after 1975 (table 33).

The Japanese Government has intervened in a number of ways recently to compensate the industry for a declining catch in foreign waters. First, the Government made the fishing issue a more visible priority by renaming the Ministry of Agriculture and Forestry (MAF) the Ministry of Agriculture, Forestry, and Fisheries (MAFF) in July 1978. In



The fleet shown here is tied up at a pier in Kushiro, Hokkaido. Fish are still by far the most important source of protein in the Japanese diet, accounting for about 45 per-

cent of total animal protein. The Japanese annually consume more than 40 kg per person, compared with 6 kg in the United States.



the reorganization that followed, Akira Matsuura of the Japan Fisheries Agency (JFA) was promoted to General Affairs Counselor in the Ministry Secretariat and given the responsibility of coordinating efforts related to the trade of agriculture, forestry, and fishery products with foreign countries. The overall work force of the fisheries agency was increased, and the number of its departments and divisions was expanded. A new department was set up to promote the development of coastal and inland fisheries and aquaculture.

The JFA has always had the role within the Ministry of managing the country's fishery resources. Its regulatory function, which is shared with Prefectural governments, has been exercised through the power of licensure. This has led to control of the number and size of fishing vessels as well as the seasons of the year and the areas in which fishing is allowed. More recently, with limited access to foreign waters and an increased threat of industrial pollution to home waters, Agency involvement in developing coastal resources has intensified.<sup>10</sup> A national 7-year plan that began in 1976 earmarked ¥ 200 billion (25, p. 27) for such activities as:

- Creating artificial habitats in bays and inland seas suitable for breeding and growth of fish and other marine products.
- Propagating fish in on-land facilities for eventual release into coastal waters.
- Expanding salmon-hatching facilities.
- Rehabilitating coastal areas damaged by pollution.

Most of these projects are administered by Prefectures with subsidies from the national Government.

Second, the Government established its own 200-mile zone in July 1977 and has sought to protect its interests in more tightly regulated foreign waters. Before 1977, about 25 percent of Japan's total catch was taken from the coastal waters of the United States and the Soviet Union (table 34). Fishery negotiations with both countries have taken place once or twice a year since 1977. The Japanese have succeeded in maintaining a large quota in U.S. waters (in excess of 1 million tons). However, this quota could shrink as a result of the U.S. Fisheries Promotion Act passed in December 1980, which provides for gradual reduction of foreign access to U.S. waters as the U.S. fishery industry takes greater advantage of U.S. coastal resources. Proposed increases in access fees to U.S. waters will also reduce foreign fishing by making it more expensive.

Japan has maintained a reciprocal agreement with the Soviet Union which allows Soviet access to Japanese waters in exchange for Japanese access to Soviet waters, including those around the disputed Northern Territories (the Kuril Islands, occupied by the Soviet Union since the end of World War II). Recent quotas have been 600,000-800,000 tons for both sides. Special negotiations are held on salmon, a migratory species whose ownership is claimed by the country in whose rivers the fish spawn.

Third, the Government is promoting the consumption of lower grade seafood such as sardines and krill, which are

<sup>10</sup>Thermal, industrial wastes, and nonpoint agricultural pollution are among the more important kinds of pollution. Industrial wastes, for example, have caused "red tide" blooms along Japan's inland sea that have reduced marine aquaculture production. The "red tide" occurs when industrial waste and sewage cause the mass breeding of red plankton. The oxygen depletion that results often causes large fish losses. In Hokkaido, livestock urine seeps into nearby rivers killing artificially hatched salmon.

Table 31—Japan's fish catch, by location

Location	1960	1965	1970	1975	1976	1977	1978	1979	1980 (est.)
1,000 metric tons									
Offshore	2,515	2,788	3,279	4,469	4,656	4,924	5,559	5,488	4,788
Coastal	1,893	1,861	1,889	1,935	2,000	2,107	1,990	1,953	1,992
Aquaculture	285	380	549	773	850	861	917	883	892
Distant fisheries	1,410	1,733	3,429	3,168	2,949	2,657	2,134	2,035	2,090
Other	90	146	169	200	201	208	228	231	222
Total	6,193	6,908	9,315	10,545	10,656	10,757	10,828	10,590	11,092
Number									
Whales	19,649	26,986	16,887	13,427	9,632	9,299	5,924	4,918	5,191

Source: Ministry of Agriculture, Forestry, and Fisheries, *Fisheries Statistics of Japan*, 1979; 1980 data are estimates released May 29, 1981.

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expected to be in more plentiful supply. About 70-75 percent of the total fish supply is used for human consumption and, of that amount, 47-48 percent is lost in processing (table 33). If some of this waste could be reduced through more efficient processing and marketing, the same size catch would yield more food.

Fourth, the Japanese Government has spent substantial amounts to promote favorable relations with other coastal countries, mainly in the Pacific area. Technical assistance and grant aid have been extended for fishery projects in various countries (25, pp. 29, 30). In 1977, the Overseas Fishery Cooperation Foundation (OFCF) was set up to provide low-interest loans for Japanese joint ventures in other countries. By March 1980, loans had been made totaling about \$100 million for 82 projects in 26 countries (25, p. 32). The Government-supported Marine Fishery Resources Development Center, established in 1971, has collaborated with other countries in

surveying new fishery grounds for potential development and commercialization (25, p. 33).

**Table 32—Japan: Change in production and prices of fish, 1960-77**

Type of fish <sup>1</sup>	Production	Real producer price
	Percent per year	
Cheap	7.0	- 1.8
Table	- 1.9	7.2
Luxury	.4	4.6
Total	2.7	2.2

<sup>1</sup>Species of fish are grouped according to their producer prices (37, pp. 12, 13). Cheap fish include sardines, mackerel, and Alaskan pollack; table fish include crab, herring, squid, and cod; luxury fish include tuna, shrimp, salmon, and trout.

**Table 33—Japan's supply and distribution of fish and shellfish**

Japan fiscal year	Supplies for domestic consumption				Domestic utilization			Annual per capita consumption
	Production	Imports	Exports		Feed	Gross food	Ratio	Net food
	----- 1,000 metric tons -----						Percent	1,000 metric tons
								Kilograms
1960	5,803	100	520	5,383	983	4,400	59.0	2,596
1961	6,284	135	524	5,895	1,136	4,759	59.0	2,808
1962	6,363	205	654	5,914	1,091	4,823	59.0	2,845
1963	6,273	438	598	6,113	1,150	4,963	58.0	2,879
1964	5,989	572	716	5,845	1,380	4,465	55.0	2,456
1965	6,502	655	680	6,477	1,429	5,048	57.0	2,877
1966	6,666	625	767	6,524	1,361	5,163	56.0	2,891
1967	7,316	605	727	7,194	1,649	5,545	56.0	3,095
1968	8,150	927	811	8,266	2,329	5,937	55.2	3,277
1969	8,171	750	783	8,138	2,220	5,918	53.2	3,148
1970	8,778	745	908	8,615	2,266	6,349	52.4	3,327
1971	9,323	551	949	8,925	2,128	6,797	50.9	3,459
1972	9,632	798	1,067	9,363	2,388	6,975	51.2	3,572
1973	10,063	1,079	991	10,151	2,895	7,256	51.4	3,730
1974	9,962	779	996	9,745	2,261	7,484	51.5	3,854
1975	9,897	1,071	990	9,978	2,467	7,511	51.6	3,876
1976	9,974	1,136	1,029	10,081	2,473	7,608	51.8	3,939
1977	10,065	1,848	852	10,319	2,815	7,504	51.8	3,887
1978	10,335	1,479	1,046	10,850	3,036	7,754	52.8	4,094
1979	9,948	1,707	1,015	10,736	3,190	7,546	52.7	3,977
1980	10,396	1,689	1,023	10,704	2,995	7,709	52.8	4,070

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, food balance sheets in annual issues.

Table 34—Japan's fish catch by region

Item	1974		1975		1976		1977	
	1,000 mt	Percent	1,000 mt	Percent	1,000 mt	Percent	1,000 mt	Percent
Within foreign 200-mile zones	4,256	39.4	3,744	35.5	3,496	32.8	2,897	26.9
United States	1,585	14.7	1,410	13.4	1,348	12.7	1,187	11.0
Soviet Union	1,630	15.1	1,396	13.2	1,227	11.6	698	6.5
Canada	26	.2	21	.2	25	.2	18	.2
China	180	1.7	152	1.4	118	1.1	178	1.7
North and South Korea	209	1.9	241	2.3	207	1.9	173	1.6
Australia	18	.2	12	.1	8	.1	9	.1
New Zealand	78	.7	80	.8	166	1.6	244	2.3
Other	530	4.9	432	4.1	395	3.7	390	3.6
Within Japan's 200-mile zone	5,236	48.4	5,503	52.2	5,682	53.3	6,360	59.1
Waters of the Northern Territories <sup>1</sup>	221	2.0	300	2.8	275	2.6	209	1.9
High seas and fresh water	1,316	12.2	1,298	12.3	1,478	13.9	1,500	13.9
Total	10,808	100.0	10,545	100.0	10,656	100.0	10,757	100.0
World catch	71,340	*	71,004	*	74,717	*	73,501	*

\* = Not applicable.

<sup>1</sup>The ownership of the four islands known as the Northern Territories is claimed by both the Soviet Union and Japan.

Source: Ministry of Agriculture, Forestry, and Fisheries, unpublished data.

Fifth, Japan has adjusted its trade policy to allow greater trade in marine products. Japan has limited trade through import quotas on six categories of fish and marine products, a tariff quota on fishmeal, and ad valorem tariffs ranging from 5 to 15 percent on many marine products.<sup>11</sup> Protection of Japan's fishery industry, like protection of its agriculture, is a sensitive political issue. More than 400,000 individuals are directly involved in fishing and many others in supporting industries. But with its total catch leveling off because of limited access to foreign waters, Japan has relied more heavily on trade, particularly since 1975. Some countries have called for liberalization of trade in marine products as a quid pro quo for Japanese access to their coastal waters. The MTN agreement (1978) brought about a phased reduction of tariffs through 1987 on 22 marine products.

<sup>11</sup>Import quotas apply to smoked herring, wet or dried edible seaweed, prepared edible seaweed, and the following fishes, whether live, fresh, chilled, frozen, salted in brine, or dried: herring, cod (including Alaskan pollack) and its roe, yellowtail, mackerel, jack mackerel, sardine, saury, squid (including cuttlefish), scallop, and shellfish adductor (ligament).

### Japan's Feed Supply

The rapid growth in Japan's livestock sector during 1960-80 would not have been possible without adequate and reasonably priced supplies of animal feed. Feed encompasses a wide range of animal foods from grasses and forages to grains, protein meals, and food byproducts. Since what is considered feed, as opposed to human food or just plain waste, changes with economic conditions, it is difficult to assess a country's feed supply at any given time. Japan's feed supply is perhaps somewhat easier to assess than that of other countries since much of its feed is imported and marketed commercially. Most of Japan's limited and high-priced land has been cultivated in high-income crops such as rice, vegetables, and fruit rather than in low-income grasses and feed crops.

Japan's land has been less and less able to supply the required nutrients for its expanding livestock population. Domestically produced pasture, forage crops, and farm and food processing byproducts, which provided 60 percent of feed requirements in the early sixties, now provide about 30 percent and have shown virtually no growth

## Japan's Feed-Livestock Economy

in 20 years (table 35). Imports have become increasingly important and now provide two-thirds of Japan's nutritional requirements for its livestock.

This section examines the primary sources of animal nutrition in Japan and important governmental policies that affect feed supply and prices.

### Formula Feed

Formula feed has become the most important source of animal nutrition to Japan's livestock producers, representing about 60 percent of total feed supply (in terms of total digestible nutrients—TDN) and 80 percent of total concentrates.<sup>12</sup> Formula feed consumption per animal increased for every major livestock category as producers became more commercialized and demanded feeds of higher quality and higher energy value (tables 36 and 37).

<sup>12</sup>Formula feed includes partially complete and complete mixed feed. A complete feed, from a nutrient standpoint, supplies all requirements necessary for maintaining animal health.

The changing needs of livestock producers, the end use, and the price all affect the composition of formula feed. In general, grain, soybean meal, and animal protein meals are used more now than they were 20 years ago, while brans and fishmeal are used less. Poultry and pork rations have always been relatively high in grain. Beef and dairy rations use less grain and more bran. Dairy feed, which is low in grain and high in protein, supplements other available sources of nutrition, like pasture and silage (table 38).

Prices have affected the ingredient mix of formula feed. Japanese mills, like all modern mills, use linear programming techniques to produce rations at the lowest cost. According to one study, corn, sorghum, brans, and barley have been the principal price-dependent elements in Japan's formula feed production. Soybean meal is treated as a residual ingredient supplying the balance of protein and TDN not supplied by the price-dependent ingredients and those that are relatively fixed in the ration (3).

Table 35—Japan's total feed supply

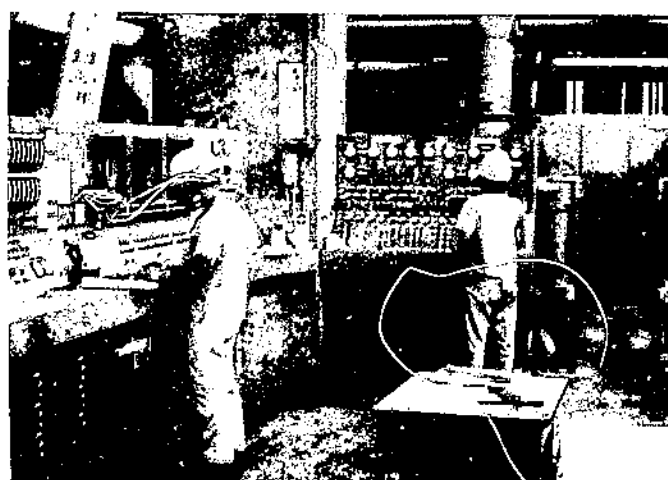
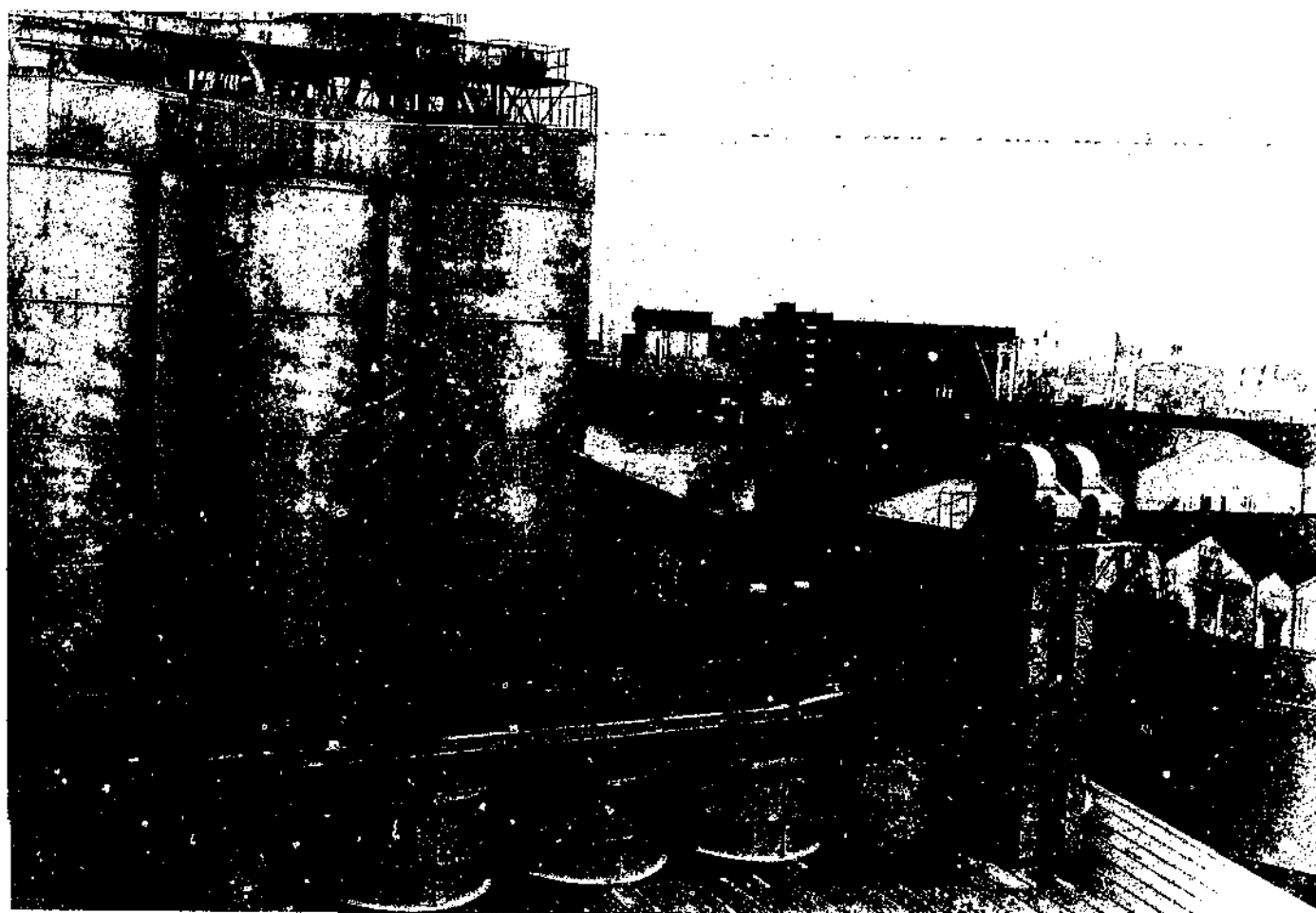
Calendar year	(A) Total utilization	(B) Roughage	(C) Total concentrate feed	(D) Domestically produced material <sup>1</sup>	(E) Imported material processed <sup>2</sup>	(F) Imported material	Self-sufficiency $\left( \frac{B+D}{A} \times 100 \right)$
	----- 1,000 metric tons <sup>3</sup> -----						Percent
1960	10,423	4,877	5,671	1,683	2,090	1,898	63
1965	13,359	4,519	8,840	2,771	1,136	4,932	55
1970	18,394	4,656	13,739	2,297	2,176	9,266	38
1971	18,740	4,625	14,115	3,323	2,287	8,506	42
1972	20,253	4,737	15,516	3,153	2,475	9,888	39
1973	20,549	4,538	16,011	2,605	2,358	11,048	35
1974	20,026	4,784	15,242	2,077	2,526	10,639	34
1975	19,867	4,793	15,074	2,060	2,639	10,375	34
1976	21,402	4,815	16,587	1,944	2,690	11,952	32
1977	22,782	4,879	17,903	1,844	2,805	13,255	30
1978	24,114	5,181	18,933	1,792	3,102	14,039	29
1979	25,529	5,175	20,354	1,888	3,181	15,286	28
1980	25,640	5,165	20,475	1,963	3,261	15,251	28
1981	26,206	5,495	20,711	2,347	3,327	15,037	30
1990	32,730	9,410	23,320	1,960	4,010	17,350	35

<sup>1</sup>Grain and byproducts, fishmeal, and nonfat dry milk.

<sup>2</sup>Imported products, like soybeans, that are crushed in Japan.

<sup>3</sup>In terms of total digestible nutrients.

Source: Japan Feed Association, *Yearly Report on Concentrate Feed*, various issues; and Ministry of Agriculture, Forestry, and Fisheries, *The Long-Term Prospects for the Demand and Supply of Agricultural Products*, Nov. 1980.



A modern formula feed mill in Yokohama; like all modern mills, it uses linear programming techniques to produce least-cost rations. Grain is unloaded from the docks and stored in silos (top picture). Operator (bottom left)



monitors the mixing of different livestock rations. Grains are fed from the silos and combined with other ingredients in the central mixing bin (bottom right).

**Table 36—Average annual formula feed consumption per animal, Japan**

Type of livestock	1960-65	1965-70	1970-75	1975-80	1980
<i>Kilograms</i>					
Beef cattle	15	230	789	1,088	1,223
Swine	282	500	627	677	640
Broilers	NA	NA	5.2	5.4	5.4
Layers	45.9	45.0	43.9	45.7	46.0
Dairy cattle	530	823	1,021	1,101	1,088

Note: February inventory numbers and annual feed amounts are used in all cases except for broilers.

NA = Not available.

Source: Japan Feed Association, *Feed Monthly*, various issues; Ministry of Agriculture, Forestry, and Fisheries, *Meat Statistics of Japan*, Jan. 1981.

Japan's formula feed industry has expanded along with increased demand for formula feed with little foreign competition. The number and size of bonded mills increased rapidly in the sixties.<sup>13</sup> The early seventies brought on adjustment as a depressed livestock sector reduced feed sales and forced smaller mills out of business. The number of bonded mills remained about the same through the seventies.

The increased concentration of the industry, higher non-ingredient costs (land, labor, and capital), higher quality ingredients, and increased uncertainty about the future led to increases in feed prices that at times outpaced price increases of imported ingredients. Feed prices paid by livestock producers are now, in some instances, 60-70 percent higher than similar feeds in the United States, compared with a 10-20 percent difference in the sixties. Higher quality imported ingredients like corn, sorghum, and soybean meal represented about 62 percent of formula feed ingredients in 1965 and 74 percent in 1979. Ingredient costs that once accounted for 90 percent of formula feed costs (17, p. 11) now account for 75-80 percent (45, ii). Greater concentration in the industry is evident

<sup>13</sup>The Japanese Government requires that all formula feed manufacturers who wish to become an authorized or bonded mill must have a Government license. The Government has two points of control over mill operations. First, when a manufacturer wants to establish an operation using imported feed materials, it must receive an operating license. Second, an established feed maker that wants to open a new mill or expand an old one must have a license to do so. (5, p. 1-21, 22).

**Table 37—Average annual growth in use of formula feed, Japan**

Type of livestock	1960-65	1965-70	1970-75	1975-79	1979
---- Percent change ----					1,000 metric tons
Total formula feed	23.2	13.0	2.3	7.8	22,438
Beef cattle	NA	62.6	12.0	13.2	2,536
Swine	NA	17.3	2.9	9.2	6,911
Broilers	NA	27.0	9.0	9.3	3,302
Layers	NA	7.4	-1.2	2.6	7,229
Dairy cattle	NA	16.7	1.0	6.4	2,350

NA = Not available.

Source: Japan Feed Association, *Feed Monthly*, various issues.

from increased production and lack of growth in the number of bonded mills. Zennoh (a national federation of co-operatives) alone controls more than 40 percent of the market. Its board members review the market situation each quarter and, in consultation with the Ministry of Agriculture, set prices for the following quarter. The rest of this oligopolistic industry usually follows suit. High feed prices contribute to relatively high costs of livestock production—costs are two to five times higher than in the United States, depending on the type of livestock. High feed and total costs have made it essential that the Government protect domestic livestock producers from foreign competition.

#### Simple and Other Feeds

Other concentrates such as simple feeds (two ingredients such as flaked corn and soybean meal) and farm and food-processing byproducts became less important to Japan's livestock producers over the past 20 years. Formula feeds replaced such products as barley bran, sweet potatoes, and white potatoes as producers demanded feeds that provided more rapid weight gain, more efficient conversion, and lower labor requirements. The Government encouraged the shift by allowing only bonded formula feed mills to import ingredients duty-free. Non-bonded mills that specialized in simpler feeds were forced to accept higher import prices for their raw materials.

Nonetheless, the use of simple feeds increased through the seventies as more and more producers sought to mix their own rations to meet specialized needs. Barley, corn,

Table 38—Japan: Components of formula feed by livestock category

Years	Grains	Wheat and rice brans	Vegetable protein meal	Fishmeal and solubles	Nonfat dry milk and other animal meals	Other <sup>1</sup>	Total
1,000 metric tons <sup>2</sup>							
<b>All livestock feed:</b>							
1960-65	3,139 (55.3)	533 (9.4)	794 (14.0)	358 (6.3)	53 (0.9)	801 (14.1)	5,678 (100.0)
1965-70	6,762 (59.3)	632 (5.5)	1,814 (15.9)	507 (4.4)	114 (1.0)	1,577 (13.8)	11,406 (100.0)
1970-75	10,384 (62.1)	681 (4.1)	2,627 (15.7)	639 (3.8)	147 (0.9)	2,253 (13.5)	16,731 (100.0)
1975-79	12,901 (64.8)	683 (3.4)	2,881 (14.5)	699 (3.5)	339 (1.7)	2,401 (12.1)	19,904 (100.0)
<b>Dairy feed:</b>							
1963-65	162 (22.2)	160 (22.0)	182 (24.9)	4 (0.5)	5 (0.7)	217 (29.7)	730 (100.0)
1965-70	345 (28.0)	192 (15.5)	357 (28.9)	5 (0.4)	12 (1.0)	322 (26.1)	1,233 (100.0)
1970-75	621 (33.5)	222 (12.0)	491 (26.5)	5 (0.3)	24 (1.3)	489 (26.4)	1,852 (100.0)
1975-78	763 (36.9)	245 (11.9)	500 (24.2)	3 (0.1)	24 (1.1)	531 (25.7)	2,066 (100.0)
<b>Beef cattle feed:</b>							
1964-65	31 (43.7)	14 (19.7)	13 (17.6)	—	—	12 (16.9)	71 (100.0)
1965-70	211 (53.7)	50 (12.6)	68 (17.4)	—	—	60 (15.3)	393 (100.0)
1970-75	886 (62.3)	130 (9.2)	157 (11.0)	1 (0.1)	1 (0.5)	245 (17.2)	1,422 (100.0)
1975-78	1,184 (59.8)	171 (8.6)	186 (9.4)	3 (0.1)	10 (0.5)	425 (21.5)	1,981 (100.0)
<b>Poultry feeds:</b>							
1963-65	3,247 (64.4)	246 (4.9)	654 (13.0)	344 (6.8)	44 (0.8)	511 (10.1)	5,046 (100.0)
1965-70	4,511 (66.0)	150 (2.2)	957 (14.0)	407 (6.0)	74 (1.1)	732 (10.7)	6,831 (100.0)
1970-75	5,819 (66.0)	129 (1.5)	1,293 (14.7)	479 (5.4)	89 (1.0)	1,013 (11.5)	8,822 (100.0)
1975-78	5,483 (67.4)	113 (1.2)	1,317 (13.7)	515 (5.3)	194 (2.0)	998 (10.4)	9,620 (100.0)
<b>Swine feeds:</b>							
1963-65	637 (50.0)	188 (14.7)	155 (12.2)	41 (3.2)	6 (0.4)	248 (19.5)	1,275 (100.0)
1965-70	1,598 (59.0)	227 (8.4)	376 (13.9)	84 (3.1)	17 (0.6)	407 (15.0)	2,709 (100.0)
1970-75	3,019 (66.4)	197 (4.3)	674 (14.8)	145 (3.2)	29 (0.6)	483 (10.6)	4,547 (100.0)
1975-78	3,785 (69.8)	141 (2.6)	790 (14.6)	162 (3.0)	86 (1.6)	456 (8.4)	5,420 (100.0)

— = None or negligible.

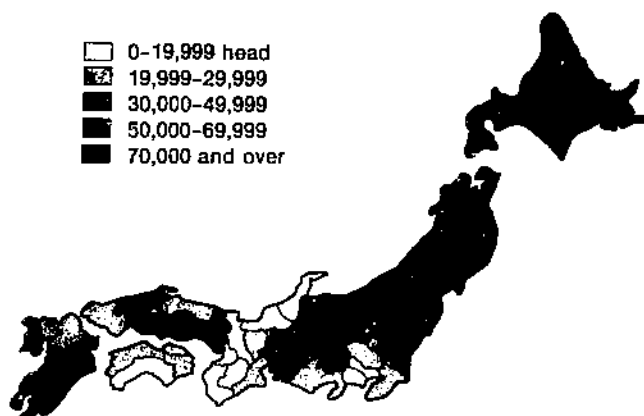
<sup>1</sup>For example, other brans, alfalfa meal pellets, and molasses.<sup>2</sup>Numbers in parentheses are percentages.

Figure 1

# Distribution of Livestock, by Prefecture, and Fisheries

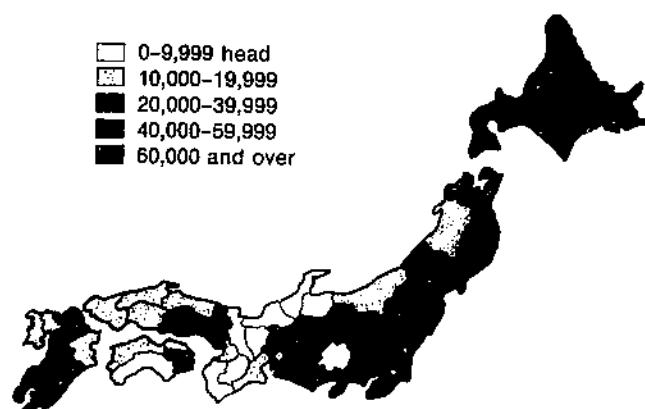
## Beef Cattle

- 0-19,999 head
- 19,999-29,999
- 30,000-49,999
- 50,000-69,999
- 70,000 and over



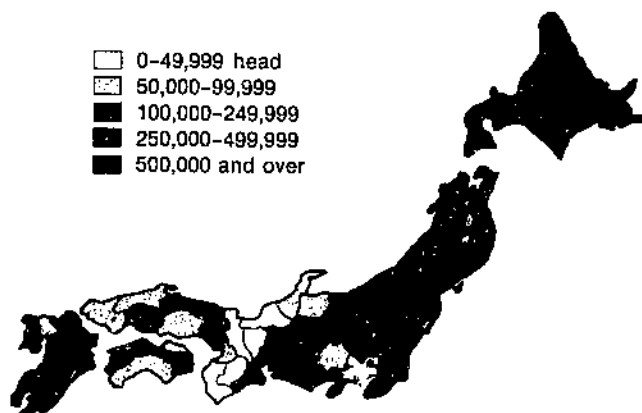
## Dairy Cattle

- 0-9,999 head
- 10,000-19,999
- 20,000-39,999
- 40,000-59,999
- 60,000 and over



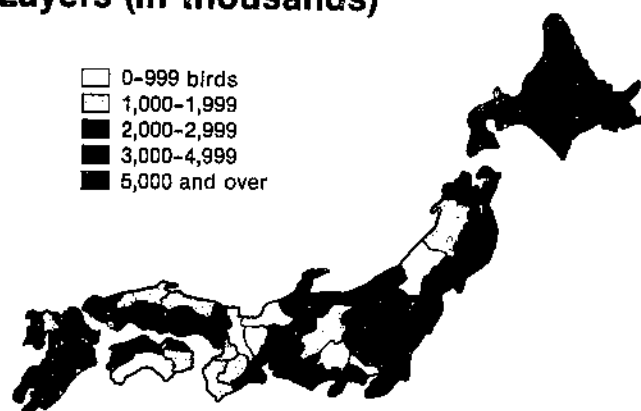
## Hogs

- 0-49,999 head
- 50,000-99,999
- 100,000-249,999
- 250,000-499,999
- 500,000 and over



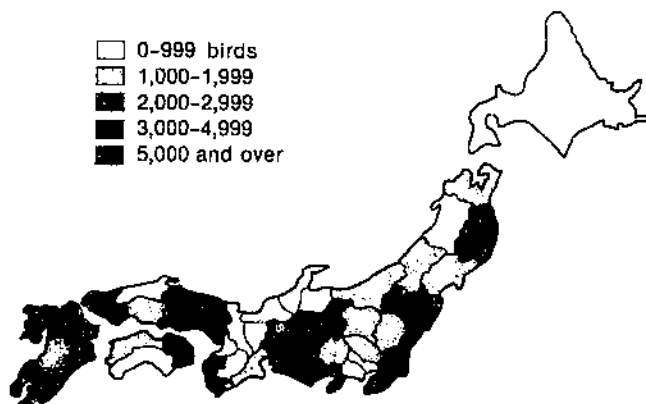
## Layers (in thousands)

- 0-999 birds
- 1,000-1,999
- 2,000-2,999
- 3,000-4,999
- 5,000 and over



## Broilers (in thousands)

- 0-999 birds
- 1,000-1,999
- 2,000-2,999
- 3,000-4,999
- 5,000 and over



## Fisheries

- 0-9,999 establishments
- 10,000-14,999
- 15,000-24,999
- 25,000-34,999
- 35,000 and over

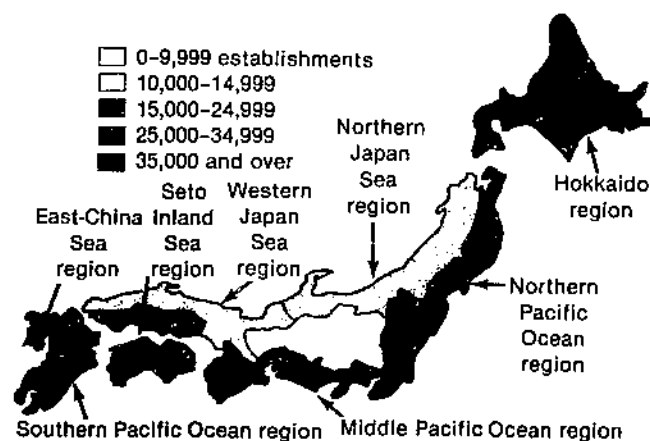


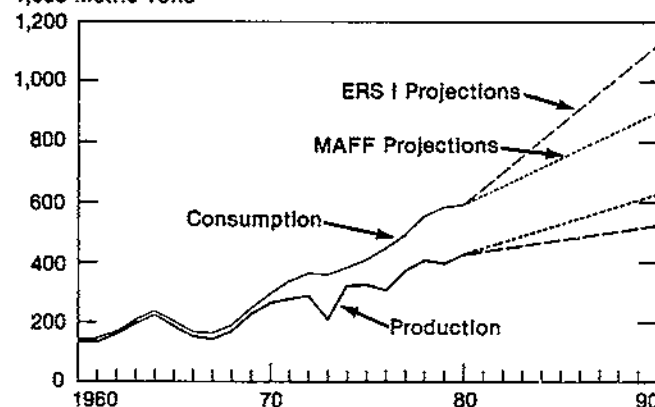


Figure 2

# Production and Consumption of Livestock Products and Fish in Japan

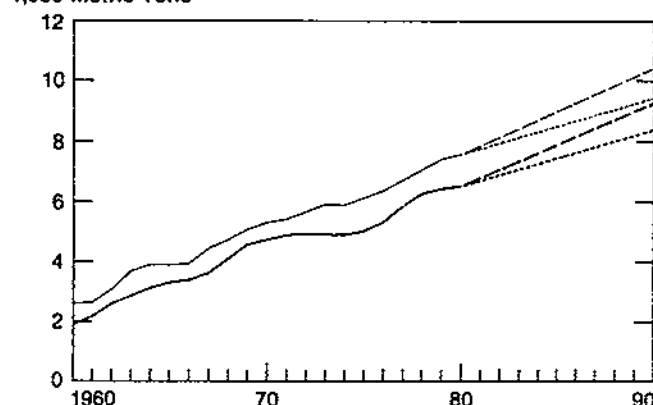
## Beef and Veal

1,000 Metric Tons



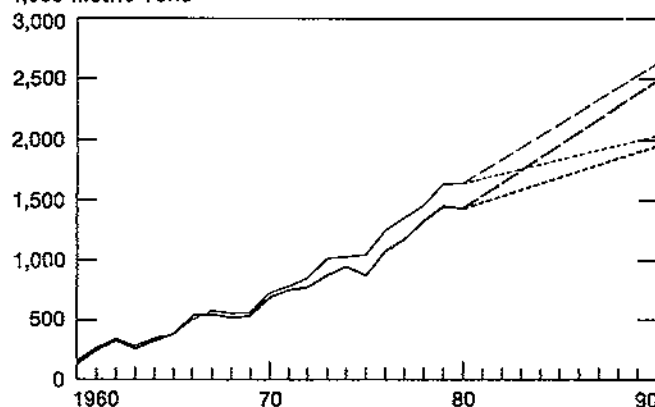
## Dairy Products

1,000 Metric Tons



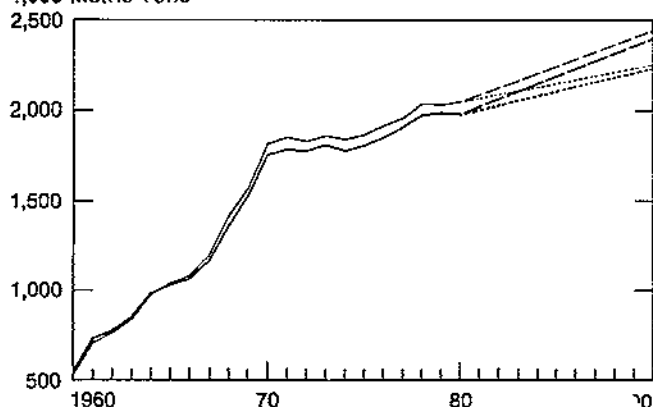
## Pork

1,000 Metric Tons



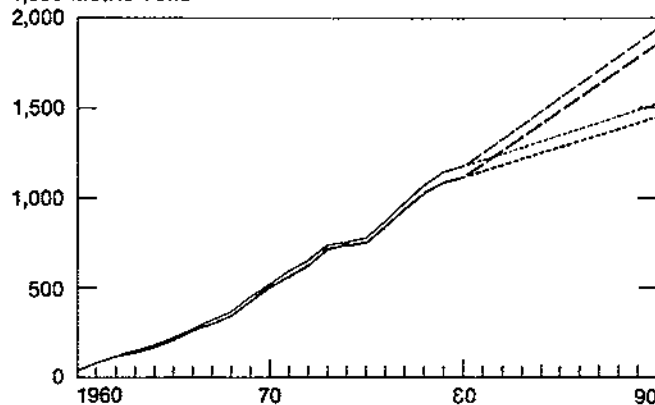
## Eggs

1,000 Metric Tons



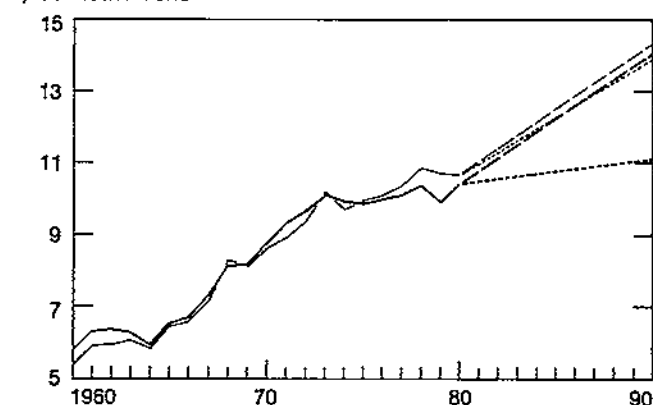
## Chicken

1,000 Metric Tons



## Fish

1,000 Metric Tons



For explanation of projections, see section titled "The Future of Japan's Food-Livestock Economy," in this report.

and wheat bran are the most commonly used in such a manner.

Steam-flaked corn has become important in the last 5 years. MAF issued a regulation in 1976 permitting plants that specialized in simple feed production to import corn duty-free so long as it was denatured with soybean meal, fishmeal, or bran (such a combination is known as *nishukon*). Until then, imported corn that was not used in formula feed was restricted to some extent by a tariff quota—primarily designed to protect Hokkaido potato farmers and the domestic potato starch industry (45, iv). Imports in excess of the quota were subject to a duty of ¥15,000 per ton in 1981.

Next to concentrates, roughages are the most important sources of animal nutrition in Japan, but today they are much less important overall than they were 20 years ago. Japan's limited amount of land precludes extensive cultivation in relatively low-value forage crops and pasture.

Total pasture area in Japan, both permanent and annual (double cropped), quadrupled between 1960 and 1979 to almost 800,000 hectares, about 15 percent of the country's arable area (table 39). Harvested forage crop area, on the other hand, declined through the midseventies and has expanded only recently, spurred by strong

Government encouragement. Expansion in area and new higher yielding seed lifted production to almost 9 million tons in 1979.

Roughages are consumed primarily by ruminants and horses, whose total number has changed little since 1960. Dairy cattle inventories increased steadily over the period, but inventories of beef cattle, sheep, goats, and horses all declined. Expanded pasture and forage area, combined with a fairly constant number of grazing animals, led to an increased supply of roughage per animal. The country's 1979 forage and pasture area produced about 9.2 tons of roughage per grazing animal, close to half their annual nutrient needs.<sup>14</sup> Other, less important, sources of domestic roughage are rice straw, potatoes, and beet pulp.

Roughage imports are becoming increasingly important, particularly in supplying dairy herds outside of Hokkaido and northern Honshu. Imports of beet pulp, alfalfa meal

<sup>14</sup>This is based on the assumptions that the annual nutrient requirement for a grazing animal is 2,500 kg of TDN, and that the TDN content of green roughage (pasture and forage) is 12 percent.



Japan's limited land base precludes its raising much of its own livestock feed, like this corn in Ibaraki Prefecture. Imports account for about 70 percent of Japan's

feed supply; 60-70 percent of Japan's coarse grain imports come from the United States.

and pellets, hay cubes, and baled hay are all under an automatic approval system and are duty-free (tables 40 and 41).<sup>15</sup>

Growth in trade has been rapid and is attributed to: the general shortage of land, reduced yields on diverted paddy land which is often marginal and relatively inaccessi-

ble, and below normal yields in Hokkaido and northern Honshu because of periodic extreme winter weather (45, iii).

<sup>15</sup>Imports of baled hay have been restricted recently by plant quarantine regulations in order to prevent entry of Hessian fly pupae. Under the automatic approval (AA) system, licenses to import are issued freely by certain Government-authorized banks (46).

Table 39—Grazing animals and land in pasture and forage, Japan

Calendar year	A	B	C	D	E	F	A D	E A
	Grazing animal units	Area in pasture	Pasture production <sup>1</sup>	Area in forage and pasture	Total forage and pasture production <sup>1</sup>	Yield		
	Million head <sup>2</sup>	1,000 ha	Million mt	1,000 ha	Million mt	Metric ton/ha	Animals per hectare	Metric ton/head
1960	3,972	153	NA	476	NA	NA <sup>3</sup>	8.3	NA
1961	3,936	183	4.1	508	NA	NA	7.7	NA
1962	3,981	215	4.7	552	10.1	18.3	7.2	2.5
1963	4,038	249	6.0	564	10.9	19.3	7.2	2.7
1964	3,910	276	6.8	579	12.6	21.8	6.8	3.2
1965	3,550	303	8.3	596	14.3	24.0	6.0	4.0
1966	3,198	324	8.8	614	14.9	24.3	5.2	4.7
1967	3,203	356	11.3	629	17.6	28.0	5.1	5.5
1968	3,402	398	13.2	663	19.7	29.7	5.1	5.8
1969	3,674	435	14.8	682	21.3	31.2	5.4	5.8
1970	3,749	484	17.5	717	24.0	33.5	5.2	6.4
1971	3,758	557	18.6	734	24.7	33.7	5.1	6.6
1972	3,680	601	22.6	757	28.8	38.0	4.9	7.8
1973	3,693	643	23.2	803	28.9	36.0	4.6	7.8
1974	3,730	672	25.4	826	31.7	38.4	4.5	8.5
1975	3,699	691	25.4	840	31.7	37.7	4.4	8.6
1976	3,769	704	25.2	853	31.4	36.8	4.4	8.3
1977	3,915	723	27.5	876	34.7	39.6	4.5	8.9
1978	4,043	758	28.8	930	37.0	39.8	4.3	9.2
1979	4,180	774	29.0	953	38.0	39.9	4.4	9.1
1990 <sup>3</sup>								
MAFF's projections	6,430 <sup>4,5</sup>	NA	NA	1,550 <sup>4</sup>	60.5	39.0 <sup>6</sup>	4.1	9.4
ERS projections I	5,644 <sup>4,7</sup>	NA	NA	1,283	50.0	39.0 <sup>6</sup>	4.4	8.9
ERS projections II	6,359 <sup>4,7</sup>	NA	NA	1,445	56.4	39.0 <sup>6</sup>	4.4	8.9

NA = Not available.

<sup>1</sup>Green basis.

<sup>2</sup>Horses and cattle equal 1 and sheep and goats equal 0.1. Swine and poultry are not included.

<sup>3</sup>For explanation of projections, see section titled "The Future of Japan's Feed-Livestock Economy," in this report.

<sup>4</sup>From *The Long-Term Prospects for the Demand and Supply of Agricultural Products*, Government of Japan, November 1980.

<sup>5</sup>Includes only cattle.

<sup>6</sup>Average for 1975-79.

<sup>7</sup>Calculations are derived from production estimates in table 49.

## Japan's Feed-Livestock Economy

**Table 40—Japan's imports of fodder and roughages, by commodity**

Calendar year	Beet pulp	Forage products	Alfalfa meal and pellets	Total
1,000 metric tons				
1960	—	—	—	—
1961	—	—	—	—
1962	20	—	—	20
1963	12	—	—	12
1964	5	—	154	159
1965	13	—	234	247
1966	27	—	313	340
1967	27	—	319	346
1968	92	2	318	412
1969	48	7	402	457
1970	—	8	482	490
1971	45	22	398	465
1972	51	59	437	547
1973	23	87	456	566
1974	52	130	384	566
1975	107	94	292	493
1976	267	172	326	765
1977	318	194	306	818
1978	417	254	324	995
1979	543	377	359	1,279
1980	579	392	306	1,277
1981	472	313	248	1,033

— = None or negligible.

Source: Ministry of Finance, *Japan Exports and Imports*, annual issues.

### Government Policies

Government policies are typically designed to control grain price fluctuation through state trading and stockpiling, supply/purchase agreements, diversification of supply sources, and a price stabilization fund. Such policies are carried out through direct Government intervention as well as through collaborative arrangements with the private sector.

**State Trading.** The Government's Food Agency, by authority of the Stabilization Law for Demand and Supply of Feed (1953), directly controls the purchase, storage, and sale of wheat, barley, and rice. Although each of these grains was considered a staple food grain under the Food Control Act of 1942, they have also been used as feed-

**Table 41—Japan's imports of fodder and roughages, by country of origin<sup>1</sup>**

Calendar year	United States	Canada	China (PRC)	Other	Total
1,000 metric tons					
1960	—	—	—	—	—
1961	—	—	—	—	—
1962	4	—	—	16	20
1963	7	—	—	5	12
1964	155	2	1	1	159
1965	238	2	6	1	247
1966	321	20	—	—	340
1967	316	3	24	3	346
1968	360	—	25	27	412
1969	409	—	20	28	457
1970	457	15	1	17	490
1971	355	50	18	42	465
1972	404	58	13	72	547
1973	448	56	18	44	566
1974	379	98	22	67	566
1975	299	72	22	100	493
1976	401	121	39	204	765
1977	460	144	35	179	818
1978	652	180	20	143	995
1979	646	225	37	371	1,279
1980	981	172	43	81	1,277
1981	777	116	37	103	1,033

— = None or negligible.

<sup>1</sup>Includes alfalfa meal and pellets, beet pulp, and cubed and baled forage products.

Source: Ministry of Finance, *Japan Exports and Imports*, annual issues.

stuffs either on a continuing basis (wheat and barley) or from time to time (rice).

The Food Agency controls the prices of these grains and their milling byproducts through its state trading function and is in a position to influence the price of simple and formula feeds to the extent that these grains and byproducts are used. The Government's influence in this area is diminishing because these food grains and their byproducts are not used as much as they were before. Rice, wheat, barley and their byproducts made up 22 percent of formula and simple feeds in 1970 and 18 percent in 1979. An exception was the first surplus rice program (1971-73) which subsidized the feed use of rice and increased the Government's control of feed prices.

In terms of feed use, the most important of these staple grains is barley, which has been used consistently over the period. Most imported barley is used for feed, principally as a finishing ration for beef and dairy cattle. It is often flaked or crushed and sold directly to livestock producers. A smaller amount is mixed into formula feed (table 42 and app. table 4). The Food Agency generally subsidizes the sale of feed barley as part of the Government's policy to promote livestock production, particularly beef (45, vi).

The Government has also controlled the feed use of whole wheat and wheat bran, again because of its mandate to control wheat as a food staple and close substitute to rice (table 43). The sale of whole wheat for feed rations has never been very great because of its high cost; furthermore, if it is used as a primary ingredient in ruminant rations, its high starch content can cause digestive problems.

Wheat bran, on the other hand, has been used more widely. Since the late fifties, the Government has authorized and directed certain mills to produce wheat bran for livestock feed, principally dairy (29, 42). The *Zosan* system, initiated in 1959, was designed to increase bran production as a byproduct at general mills by lowering the flour yield to between 40 and 45 percent (compared with a 75-78 percent normal milling yield). The *Senkan* system, initiated in 1958, authorized a small number of mills to produce wheat bran as a primary product. The bran produced from these mills is higher in starch and lower in protein than regular wheat bran. The Government is able to direct the more effective use of lower grade wheat and encourage the feeding of bran by subsidizing its price. The bran produced under the *Zosan* and *Senkan* systems is sold at a fixed Government price and marketed primarily through dairy associations.

Rice occasionally has been used as a feed under the Gov-

Table 42—Japan's supply and distribution of barley

Japan fiscal year	Production	Imports	Exports	Stock change	Total utilization	Feed	Industrial use	Seed and waste	Gross food	Net food	Annual per capita consumption
----- 1,000 metric tons -----											Kilograms
1960	2,301	30	1	189	2,141	540	210	83	1,308	758	8.1
1961	1,976	—	—	-254	2,230	961	257	66	926	536	5.7
1962	1,726	—	1	-251	1,976	836	290	60	790	455	4.8
1963	759	414	1	-317	1,489	497	289	47	655	375	3.9
1964	1,202	580	—	64	1,718	648	355	44	671	364	3.7
1965	573	1,072	2	-42	1,685	862	507	19	297	163	1.5
1966	503	1,138	—	-105	1,746	898	517	17	314	171	1.5
1967	325	1,488	1	-30	1,842	982	583	12	256	136	1.3
1968	216	1,817	—	-93	2,126	1,133	669	14	310	142	1.3
1969	233	2,038	—	139	2,132	1,129	699	14	290	128	1.1
1970	221	2,117	—	143	2,135	1,176	719	14	286	126	1.1
1971	210	2,258	—	215	2,253	1,238	732	13	270	120	1.1
1972	206	2,238	—	92	2,352	1,288	792	13	259	115	1.0
1973	326	2,052	—	-2	2,380	1,325	855	14	186	83	.7
1974	407	2,132	—	77	2,462	1,420	864	16	162	74	.7
1975	221	2,117	—	143	2,195	1,176	719	14	286	126	1.1
1976	210	2,258	—	215	2,253	1,238	732	13	270	120	1.1
1977	206	2,238	—	92	2,352	1,288	792	13	259	115	1.0
1978	326	2,052	—	-2	2,380	1,325	855	14	186	83	.7
1979	407	2,132	—	77	2,462	1,420	864	16	162	74	.7
1980	385	2,087	—	-86	2,558	1,518	848	17	175	80	.7

— = None or negligible.

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, annual issues.

ernment's surplus disposal programs, while its milling by-products (rice bran and rice bran oilcake) are used more consistently. During 1971-73, more than 3.5 million tons of surplus rice were sold to formula feed manufacturers. The feed price of rice was set consistent with the price of corn and sorghum in 1971 and 1972, and was set lower than the price of its substitutes in 1973, when world grain prices were rising rapidly.

**Stockpiling Policy.** Stockpiling has been a part of the nation's feed supply policy for some time. The Feedstuff Supply and Demand Stabilization Act of 1952 endorsed stockpiling as a means "to stabilize supply, demand, and prices of feedstuffs—ultimately to serve the promotion of the livestock industry." The Government stockpiles, however, have been small in relation to annual feed consumption.

Rapid increases in commodity prices and uncertainty about future grain supplies in the early seventies led to a

new Government program to increase Government-held stocks of barley, and to subsidize the expansion of privately held stocks of corn and sorghum. The target for 1980, set forth in 1976, to expand barley stocks by 450,000 tons and corn and sorghum stocks by 500,000 tons, was largely achieved. Feed barley reserves were drawn down beginning in 1979 because of large surplus rice stocks that could be converted to feed. By the end of 1980, barley stocks under the program were 277,000 tons and corn and sorghum stocks totaled about the prescribed 500,000 tons (45, v and vi). Government feed grain reserves are expected to expand to a total of 1.3 million tons by 1983—still less than a month's supply.

Other stockpiling ideas have been proposed but not implemented. Stockpiling grains in the United States was considered, but the lower storage and construction costs were outweighed by technical and legal problems. The use of surplus bulk carriers as floating grain storage facilities was also studied but never realized.

Table 43—Japan's supply and distribution of wheat

Japan fiscal year	Production	Imports	Exports	Stock change	Total utilization	Feed	Industrial use	Seed and waste	Gross food	Net food	Annual per capita consumption
----- 1,000 metric tons ----- Kilograms											
1960	1,531	2,660	47	179	3,965	468	235	137	3,125	2,406	25.8
1961	1,781	2,660	71	180	4,190	616	225	142	3,207	2,437	25.8
1962	1,631	2,490	93	- 244	4,272	646	233	139	3,254	2,473	26.0
1963	716	3,412	73	- 235	4,290	520	230	136	3,404	2,587	26.9
1964	1,244	3,471	68	142	4,505	534	240	138	3,593	2,731	28.1
1965	1,287	3,532	88	100	4,631	530	261	140	3,700	2,849	29.0
1966	1,024	4,103	79	65	4,983	543	269	146	4,025	3,099	31.3
1967	997	4,238	87	42	5,106	592	257	151	4,106	3,162	31.5
1968	1,012	3,996	114	- 198	5,092	567	257	149	4,119	3,172	31.3
1969	758	4,537	81	- 31	5,245	667	264	146	4,163	3,209	31.3
1970	474	4,621	47	- 159	5,207	701	276	136	4,092	3,192	30.8
1971	440	4,726	55	- 95	5,206	632	267	138	4,169	3,252	31.0
1972	284	5,269	57	173	5,323	707	272	136	4,028	3,282	30.9
1973	202	5,369	38	35	5,498	708	335	139	4,316	3,366	31.0
1974	232	5,485	26	174	5,517	619	354	144	4,409	3,439	31.2
1975	241	5,715	34	344	5,578	390	317	149	4,522	3,527	31.5
1976	222	5,545	44	63	5,660	576	332	150	4,602	3,590	31.7
1977	236	5,662	4	133	5,761	637	315	154	4,655	3,631	31.8
1978	367	5,679	2	183	5,861	669	352	159	4,681	3,651	31.7
1979	541	5,544	4	61	6,020	683	420	168	4,749	3,704	31.9
1980	583	5,564	5	88	6,054	647	390	178	4,839	3,774	32.2

Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, annual issues.

**Feed Price Stabilization Fund.** In 1975, before the stockpiling program was undertaken, the Government set up a semiprivate agency, the Mixed Feed Supply and Stabilization Organization (MFSSO), to administer a feed price stabilization program designed to reduce short-term fluctuations (over a period of months) in feed prices paid by livestock producers. The MFSSO's fund was the fourth of its kind, but the first involving Government participation. The other funds were those established by Zennoh in 1968, other cooperatives such as Zen-rakuren (the National Federation of Dairy Cooperative Associations) in 1968, and the Japan Feed Manufacturers Association in 1973.

Government participation in the fund involves an annual contribution to the MFSSO. The three privately organized funds are requested to reserve an equivalent amount in addition to their own stabilization funds. (Contributions to the Government's parent fund are based on each organization's share of the mixed feed market). Producers, feed manufacturers, and, in some cases, Prefectural cooperative organizations pay a tax into the fund based on their volume of business. The MFSSO fund is linked directly with the three industry funds so that accumulated reserve funds can be made available to subscribers when needed. The industry funds are paid out during times of minor price fluctuations while the Government-subsidized fund is used under more adverse conditions. In 1978, the accumulated Government fund represented about 6 percent of producer feed costs that year.

**Supply-Purchase Agreements.** Since Japan imports much of its annual feed requirements, stabilizing the import supply has been an important Government objective in its efforts to sustain and promote the country's livestock industry. Stable feed grain imports have also been linked to the notion of food security.

Supply stability has been achieved at least in part through bilateral supply-purchase agreements or understandings. The most important of these was the Butz-Abe understanding of 1975-78 regarding trade in grain and soybeans. Other informal purchase arrangements have been made with Canada and Australia for trade in barley and wheat (tables 44-46).

The Butz-Abe understanding grew out of a meeting on August 12, 1975, between the U.S. Secretary of Agriculture and the Japanese Minister of Agriculture and Forestry. The details of the understanding were specified in a USDA letter written on November 7 to the Japanese Minister, outlining "trade targets for the coming three years for grains and soybeans." In the letter, the United States agreed to supply Japan with certain minimum levels of grain and soybeans as discussed during the

meeting in August. The approximate annual amounts specified were 3 million tons of wheat, 3 million tons of soybeans, and 8 million tons of feed grain. The Japanese also suggested an annual review of the quantity targets.

At least two developments in the early seventies motivated this arrangement. First, as a result of worldwide shortfalls in grain production in 1972, U.S. wheat exports increased by 80 percent, and corn exports increased by 50 percent over the previous year, with especially large volumes going to the Soviet Union and its satellites. This represented a shift in the pattern as well as the amount of U.S. trade. Until 1972, U.S. agricultural exports to the centrally planned economies, with the exception of Eastern European countries, were negligible. The Soviet Union, which was 42nd as a market for U.S. wheat in 1971, rose to first in 1972 and again in 1973. The situation was similar for coarse grains. The Soviet Union purchased no coarse grains from the United States in 1970 and became the second most important market in 1972 and 1973. Japan, on the other hand, had been a stable market for U.S. agricultural commodities, purchasing large quantities of feed grains, wheat, and soybeans for many years.

The soybean embargo in 1973 was the second precursor to the Butz-Abe understanding. Soybeans were in short supply in 1973. As an inflation-fighting measure, the U.S. Secretary of Commerce imposed an embargo on the export of soybeans, cottonseed, and meal and oil products from these commodities on June 27, 1973. The embargo was lifted on July 2 at which time a licensing procedure was administered that limited the exports of those commodities until all controls were lifted on September 21. The soybean embargo and the tripling of oil prices in 1973 are still mentioned as the two most important shocks to the Japanese economy during the early seventies. While the tripling of oil prices had a real and lasting effect on the Japanese economy, the effect of the soybean embargo was largely psychological. The embargo was viewed as a symbol of Japan's vulnerability to discontinuities in agricultural trade resulting from policies in major exporting countries, despite the fact that Japan was able to import a record volume of soybeans from the United States in 1973.

Since the Butz-Abe understanding expired in 1978, no similar arrangement has replaced it. The Carter-Ohira communique of May 1979 called for annual U.S.-Japan agricultural meetings which have taken place in November 1979, December 1980, October 1981, and September 1982.

There was speculation that the second meeting would lead to a long-term supply-purchase agreement on grains and oilseeds similar to the above-mentioned Butz-Abe

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understanding. The *Nihon Keizai Simbun* in November 1980 hinted at the possibility "that Japan [would] seek a revival of the past Japan-U.S. agreement on long-term grain transactions when the two nations hold their regular farm product talks in Washington in early December." The House Ways and Means subcommittee on trade in its September 1980 *United States-Japan Trade Report* similarly suggested that "the U.S. consider the possibility of offering the Japanese an extremely long-term commitment for the right and obligation to purchase, at current market prices, set quantities of various foods. Such a commitment would help reduce Japan's concern about sources of food supply and about the need for costly new programs to increase domestic self-sufficiency."

But no agreement emerged. Instead, the talks centered on the exchange of information, particularly that relating

to the current supply/demand situation for major commodities in both countries and in the rest of the world, as well as the likely direction of each country's agricultural policy in the eighties. References were made to the traditional concerns of both sides. The Japanese emphasized their extreme dependence on agricultural imports, concern over the current tightness of grain and soybean supplies and rising commodity prices, and apprehension over the possible recurrence of an embargo like the one in 1973 that stopped U.S. exports of soybeans for about a week. The U.S. delegation assured the Japanese that adequate and fairly priced supplies would continue and that the United States would continue to stabilize world commodity markets through its farmer-owned reserve system, agreements with unpredictable markets such as the Soviet Union and China, and its commitment to production adjustments via the market; the delegation also noted, however, that real commodity prices were apt to rise

Table 44—Japan's imports of coarse grains  
by country of origin<sup>1</sup>

Calendar year	United States	Canada	Australia	Argentina	Thailand	South Africa	Other	Total
1,000 metric tons								
1960	229	2	2	428	314	254	175	1,404
1961	763	18	4	286	460	446	123	2,100
1962	1,429	5	17	53	237	868	119	2,728
1963	1,922	39	12	93	429	779	318	3,592
1964	2,620	84	123	238	726	626	327	4,744
1965	3,859	245	175	206	596	30	517	5,628
1966	4,505	209	72	198	825	—	584	6,393
1967	3,965	394	213	195	736	742	1,044	7,289
1968	4,441	298	160	90	652	1,591	962	8,194
1969	5,383	81	266	1,052	478	667	1,244	9,171
1970	6,588	622	513	1,757	562	399	385	10,826
1971	4,261	767	1,492	1,368	895	734	552	10,069
1972	5,455	836	1,277	596	884	1,360	566	10,974
1973	9,461	990	788	584	404	605	322	13,154
1974	9,096	741	1,517	816	959	416	528	14,073
1975	7,381	1,032	1,558	867	818	1,037	413	13,108
1976	8,585	1,004	1,722	1,107	995	892	311	14,616
1977	10,003	1,031	1,474	2,408	495	795	131	16,337
1978	11,019	844	921	2,512	403	1,417	281	17,397
1979	12,151	939	1,428	2,480	515	959	178	18,650
1980	15,636	703	1,108	98	230	913	19	18,707
1981	15,296	941	880	58	5	1,444	15	18,639

— = None or negligible.

<sup>1</sup>Includes corn, sorghum, barley, oats, rye, and millet.

Source: Ministry of Finance, *Japan Exports and Imports*, annual issues.



along with rising input prices. The U.S. delegation also noted that the U.S. embargo of Soviet grain shipments was not casually implemented but was an action taken in response to "naked armed intervention."

But Japan's needs were less urgent than in the early and midseventies. The Japanese felt that a new agreement could have had an adverse short-term effect on prices, forcing them even higher than they already were. Furthermore, Japan desired to keep its options open as its agriculture was entering a period of transition and adjustment with slower growth in the livestock sector.

**Diversification of Supply.** The Japanese Government's efforts to diversify its sources of supply predate the 1972-73 period of tight grain supplies. They appear to have had only a slight effect, if any, in reducing de-

pendence on the United States. Long-term interest-free Government loans were initially extended in the middle and late sixties to Japanese trading companies to promote production of corn and sorghum in Indonesia, Thailand, and Cambodia (45, i). Other investments were made in Australia and Brazil. In general, the returns on these projects were not very good because of poor soil conditions, insect damage, low productivity, and the small scale of the operations.<sup>16</sup> Despite these efforts at import diversification, the United States maintained a fairly constant share of Japan's coarse grain imports during 1965-79, falling below 50 percent only twice (1971 and 1972).

Major Japanese trading companies shifted their policy in the late seventies away from agricultural production in

<sup>16</sup>*Nihon Nogyo Simbun* (newspaper), August 6, 1980.

Table 45—Japan's imports of coarse grains

Calendar year	Corn	Sorghum	Barley	Oats	Rye	Millet	Total
1,000 metric tons							
1960	1,354	45	—	2	3	—	1,404
1961	1,831	146	—	4	119	—	2,100
1962	2,316	400	—	4	7	1	2,728
1963	2,645	750	172	5	8	12	3,592
1964	3,229	953	471	10	4	77	4,744
1965	3,434	1,431	635	13	46	69	5,628
1966	3,598	2,247	447	12	74	15	6,393
1967	3,960	2,584	603	21	101	20	7,289
1968	5,144	2,314	634	24	66	12	8,194
1969	5,489	2,859	677	86	28	32	9,171
1970	6,018	3,789	768	135	73	43	10,826
1971	5,007	3,811	865	197	160	29	10,069
1972	6,052	3,505	1,004	204	170	39	10,974
1973	7,771	3,742	1,322	110	151	57	13,153
1974	7,940	4,474	1,418	169	28	44	14,073
1975	7,470	3,794	1,598	141	54	49	13,106
1976	8,383	4,227	1,756	150	39	55	14,610
1977	9,068	5,181	1,735	169	141	43	16,337
1978	10,534	5,112	1,490	143	60	58	17,397
1979	11,407	5,355	1,519	207	98	64	18,650
1980	12,830	4,219	1,416	177	18	47	18,707
1981	13,590	3,301	1,568	114	18	48	18,639

— = Less than 500 tons.

Source: Ministry of Finance, *Japan Exports and Imports*, annual issues.

Table 46—Japan's imports of oilseeds

Calendar year	Soybeans	Rapeseed	Cottonseed	Sesame	Copra
1,000 metric tons					
1961	1,158	24	100	22	80
1962	1,293	42	150	28	88
1963	1,544	94	168	33	108
1964	1,607	82	205	34	86
1965	1,847	108	217	33	94
1966	2,168	218	266	38	108
1967	2,170	222	216	40	112
1968	2,421	257	246	39	126
1969	2,591	292	244	34	109
1970	3,244	345	297	53	127
1971	3,212	416	248	41	122
1972	3,396	514	180	51	124
1973	3,634	693	159	56	174
1974	3,244	679	123	50	86
1975	3,334	668	116	39	90
1976	3,554	726	95	52	111
1977	3,602	776	95	55	98
1978	4,260	832	92	54	90
1979	4,132	1,129	72	63	56
1980	4,401	1,067	91	63	65
1981	4,197	1,169	66	50	74

— = Less than 500 tons.

Source: Ministry of Finance, *Japan Exports and Imports*, annual issues.

developing countries toward greater investment in the U.S. grain trade through the purchase of grain storage and handling facilities.

**Trade Liberalization.** Trade liberalization measures have facilitated imports of some feedstuffs and reduced costs to formula feed mills and livestock producers. There are still feedstuffs that are protected, mainly dairy products like nonfat dry milk and whey, and grains like barley and wheat, which are considered staples. Other protected feedstuffs are oats, fishmeal, and corn imported by non-bonded mills. Most other feedstuffs, including roughages, are under an automatic approval system and have a small tariff or none at all.

Japan's feed grain market is much less protected now than it was 20 years ago, when the country was trying to stem the outflow of foreign exchange. In the early sixties, such feedstuffs as sorghum, soybean meal, rapeseed meal, and molasses were under a foreign fund allocation system limiting imports on a value basis. In 1964, import restrictions on sorghum for feed were liberalized and sorghum rapidly became the second most important ingredient in formula feed.

Demand for a greater variety of food and a desire to move toward freer trade under the General Agreement on Tariffs and Trade (GATT) reduced the number of Japan's import quotas from 118 to 33 between 1968 and 1971 (23). Many of the eliminated quotas had applied to agricultural items, including soybean meal. There are currently 27 import quota items, 22 of which are agricultural and marine products, but nonfat dry milk, whey, and food grains (rice, wheat, and barley) are the only feedstuffs so controlled. The Customs Tariff Act of 1968 reduced or eliminated tariffs on raw materials for compound feed including corn, sorghum, soybean meal, nonfat dry milk, blood meal, rye, oats, beef tallow, molasses, and manioc. Concessions resulting from the Tokyo Round of Multilateral Trade Negotiations (MTN) bound the zero duties on feather meal and soybeans in 1978.

**Increased Domestic Production of Feedstuffs.** The Government has encouraged increased domestic production of feed grains and roughages through incentives to expand area and to use improved seeds. Expansion of the area planted to feed and forage crops was subsidized under all three of the Government's rice diversion programs in the seventies. Farmers receive large incentive payments for planting feed crops on rice paddy area. They are also paid for double-cropping a feed crop with rice or for switching upland fields to an annual, perennial, summer, or winter feed crop.

At a number of Government research centers, forage seeds more suited to Japan's climate are being developed. Such seeds are often sent for multiplication overseas where land is more plentiful and cheaper.

### The Future of Japan's Feed-Livestock Economy

If the past is prologue to the future, then the preceding sections should serve as a basis for a look at the future of Japan's livestock industry and its feed requirements. Many simplifying assumptions were used to make an otherwise complicated task more comprehensible. I have included alternative projections of 1990 consumption, production, and trade of livestock products—one set of projections made by MAFF, two sets made by me. Finally, feed demand is projected using estimates of livestock production and feed conversion rates.

Future growth in Japanese consumption of livestock products will depend primarily on income and population growth, changes in prices, and Government policy. Real personal expenditures are expected to increase at a more moderate rate in the eighties than in the past, especially before 1972. An annual growth rate of about 4.5 percent is likely. Population growth slowed from 1.4 percent per year during 1970-75 to 0.9 percent in 1975-79. A rate of 0.8 percent should persist through the eighties (table 47). Per capita personal consumption expenditures should, therefore, grow by about 3.7 percent per year through 1990.<sup>17</sup>

Total Japanese consumption of livestock products will be stimulated by increases in both population and real income. The extent to which consumers increase their expenditures on livestock products will depend on how they respond to increases in real income. Measures of income elasticities of demand for livestock products with respect to income per capita have varied considerably from study to study. In table 48, three alternative sets of projections of the demand for livestock products and fish in 1990 are compared. The first set shows official Japanese (MAFF) projections published in November 1980. The second set (*ERS projections I*) contains projections based on income elasticity measures considered to be more likely than the ones implicit in the MAFF projections. The last set (*ERS projections II*) is based on the same assumptions as *ERS projections I*, except that per capita fish consumption remains unchanged through 1990, while the loss of protein from fish is made up from other livestock products so as to achieve the same animal protein intake level as in *ERS projections I*. Relative prices and government policies are assumed to remain constant through the period.

<sup>17</sup>These assumptions are taken from MAFF's *The Long-Term Prospects for the Demand and Supply of Agricultural Products*, Nov. 1980.

Table 47—Japan: Demand Indicators

Item	1960-65	1965-70	1970-75	1975-79	1980-79	1980-90 <sup>1</sup>
<i>Annual percent change</i>						
Population	1.0	1.3	1.4	0.9	1.1	0.8
Real GNP	9.7	11.6	5.1	5.8	8.0	NA
Real private consumption expenditures:						
Total	8.9	9.2	6.0	4.8	7.4	4.5
Per capita	7.8	7.9	4.5	3.9	6.2	3.7

NA = Not available.

<sup>1</sup>Projected; taken from MAFF's *The Long-Term Prospects for the Demand and Supply of Agricultural Products*, Nov. 1980.

Table 48—Japan: Alternative projections of demand for livestock products and fish, 1990

Item	1978 consumption		MAFF's 1990 projections <sup>1</sup>		ERS projections I		ERS projections II	
	Total <sup>2</sup>	Per capita	Implied demand elasticities	Consumption	Implied demand elasticities	Consumption	Implied demand elasticities	Consumption
	1,000 mt	Kg		1,000 mt		1,000 mt		1,000 mt
Total meats	3,470	20.8	0.6	4,930	27.0	1.1	6,245	34.2
Beef and veal	560	3.3	.9	890	4.8	1.4	1,130	6.1
Pork	1,470	8.7	.6	2,030	11.1	1.1	2,613	14.1
Poultry	1,090	7.1	.6	1,510	9.1	1.1	1,932	11.5
Dairy products	7,010	59.3	.5	9,495	73.0	.7	10,483	80.7
Eggs	2,040	14.9	0	2,250	15.0	.2	2,430	16.2
Fish	4,094	35.5	.3	5,040	40.0	.4	5,342	42.4
<i>Grams</i>								
Per capita daily food supply:								
Protein intake	*	81	*	*	84	*	*	84
From livestock products	*	21	*	*	25	*	*	33
From fish	*	18	*	*	20	*	*	18
<i>Calories</i>								
Calorie intake	*	2,505	*	*	2,500	*	*	2,500
From livestock products	*	294	*	*	356	*	*	473
From fish	*	107	*	*	121	*	*	107

\* = Not applicable.

<sup>1</sup>Projections published in MAFF's *The Long-Term Prospects for the Demand and Supply of Agricultural Products*, Nov. 1980.<sup>2</sup>Derived from per capita consumption and population levels (115 million in 1978 and 126 million in 1990) and a constant percentage used to convert net food to total gross consumption (0.68 for beef, 0.68 for pork, 0.75 for chicken, 0.97 for dairy, 0.84 for eggs, and 0.37 for fish).

## Japan's Feed-Livestock Economy

According to official MAFF projections, per capita caloric intake will remain constant between 1980 and 1990, and protein intake will increase by 4 percent. Per capita meat consumption will increase by 15 percent. The income elasticities implied by these projections, particularly those for meats, appear too low.<sup>18</sup> The only elasticities that are in line with recent estimates are those for eggs, dairy products, and fish.

*ERS projections I* draw on research by Kester (30), Lopez (36), and others (38). The income elasticity measures used

<sup>18</sup>MAFF's projections for 1985, published in 1975, also seem to underestimate the income elasticity of demand for meats (42, p. 34).

to project meat consumption are nearly twice those used in MAFF's calculations, implying a level of meat consumption about 1 million tons greater than MAFF's. Annual per capita meat consumption is projected to reach 34 kilos in 1990, more than 50 percent greater than in 1978 and substantially higher than MAFF's forecast of 27 kilos (table 48). Even at 34 kilos, Japanese consumption would be well below levels in other developed countries, even for such Asian neighbors as Hong Kong and Singapore.

The *ERS projections II* are the same as the *ERS projections I*, except for assumptions related to fish consumption. Fish have been central to the Japanese diet for centuries. In the past 20 years, despite unprecedented

Table 49—Japan: Production and self-sufficiency rates for major livestock products

Item	Self-sufficiency							Production
	1960	1965	1970	1975	1976	1977	1978	1978
	Percent							1,000 mt
Beef and veal	95.9	94.5	88.9	80.3	68.7	74.6	73.2	406
Pork	96.1	100.0	97.6	84.2	86.4	86.6	90.1	1,323
Chicken	100.0	96.2	97.7	96.8	95.6	96.0	94.2	1,022
Dairy products	76.4	85.7	89.4	81.8	84.8	87.5	89.3	6,261
Eggs	101.3	99.8	97.4	97.0	97.3	97.0	97.2	1,980
Fish	109.6	100.4	101.9	99.2	98.9	97.5	95.3	10,335

Item	MAFF's 1990 projections <sup>1</sup>		ERS projections I <sup>2</sup> (1990)		ERS projections II <sup>2</sup> (1990)	
	Self-sufficiency	Production	Self-sufficiency	Production	Self-sufficiency	Projection
	Percent	1,000 mt	Percent	1,000 mt	Percent	1,000 mt
Beef and veal	70.7	630	46.8	529	46.6	596
Pork	95.6	1,940	95.6	2,498	95.6	2,799
Chicken	96.7	1,490	96.7	1,868	96.7	2,112
Dairy products	88.7	8,420	88.7	9,298	88.7	10,485
Eggs	98.7	2,220	98.7	2,398	98.7	2,695
Fish	80.0	11,100	97.7	14,100	91.8	11,100

<sup>1</sup>Projections published in MAFF's *The Long-Term Prospects for Demand and Supply of Agricultural Products*, Nov. 1980.

<sup>2</sup>Derived from alternative demand projections I and II and applying MAFF's self-sufficiency rates for all livestock except beef.

Source: Food balance sheets.

income growth, per capita fish consumption remained fairly constant, growing at an annual rate of only 1 percent compared with 8 percent for meat. Over the 1975-79 period, average annual per capita fish consumption declined. If we assume that per capita fish consumption through 1990 will remain unchanged, then per capita fish consumption will be below levels projected by MAFF and in the *ERS projections I*. To maintain animal protein intake at levels projected in the *ERS projections I*, 6.9 kilos less of fish consumption per person per year would have to be made up by increased consumption of livestock products. In the *ERS projections II*, the protein deficit resulting from less fish consumption is made up by increasing the consumption of every other livestock product by about 13 percent. This would raise total per capita meat consumption to 38.6 kilos for 1990.

#### Livestock Sector

Three sets of production projections are made that closely parallel the demand projections: the official MAFF ones as well as two alternatives closely associated with the *ERS* consumption projections I and II.

The MAFF 1990 production projections imply self-sufficiency rates of 71 percent for beef, 96 for pork, 97 for chicken, 89 for dairy, and 99 for eggs, which are consistent with the historical record. In all cases except beef, the same rates are used in deriving production and net trade from the *ERS* consumption projections I and II (table 49). For beef, self-sufficiency rates of about 47 percent are derived from the assumption that, in future years, beef production will be closely tied to milk production, a function of yield per cow and number of cows. Milk production in 1990 would, therefore, imply a certain dairy herd size, which in turn would imply a certain cull rate for older cows and standing inventory of dairy steers and replacement heifers. The slaughter rate of culls and steers and their average weights would give us an estimate of dairy beef production for that year. Total beef production would depend on dairy beef's share, which, in recent years, has ranged from 60 to 70 percent. For 1990, I assume that 65 percent of total beef will come from dairy animals—a reasonable assumption given the inefficiencies in the Wagyu Sector, its lack of growth, and the unlikelihood of greater Government protection.<sup>19</sup>

<sup>19</sup>The following assumptions, based on 1975-79 values, are made about the relationship of milk and beef production in 1990: 1) milk yields will be 6.1 tons per milk cow, 2) milk cows will represent 40 percent of the dairy herd, 3) dairy steers and culled cows will represent 22 percent and 8-9 percent, respectively, of the dairy herd, 4) slaughter rates for dairy steers and culls will be 80 and 170 percent, respectively, 5) average slaughter weights for dairy steers and culls on a carcass basis will be 340 kg and 310 kg, respectively, and 6) beef from dairy steers and culls will represent 65 percent of total beef supply.

Beef will become very much a byproduct of milk production. Since under both the *ERS projections I* and *II* the demand for milk is expected to grow less than the demand for beef, the gap between production and consumption of beef is expected to widen. Consequently, beef imports will grow.

The MAFF 1990 self-sufficiency rates for pork, chicken, and eggs, which are all slightly higher than 1975-79 average rates, are reasonable, since these industries are relatively more competitive against imports, use little land, and will become more competitive with further structural changes in the eighties. These MAFF self-sufficiency rates, therefore, are applied to the *ERS* consumption projections I and II. The import market for these products will vary from year to year but will shrink over the decade (table 50).

#### Fisheries

The future of Japan's fish supply is uncertain. Developments in recent years point to a tight supply situation for both Japan and the rest of the world at least over the next decade. Japan's fish catch could grow by as much as 2.5

Table 50—Japan: Projections of production, consumption, and trade of livestock products<sup>1</sup>

Item	1980	1985		1990	
		I	II	I	II
1,000 metric tons					
Beef and veal:					
Production	418	471	499	529	596
Consumption	580	810	860	1,130	1,278
Net imports	174	339	361	601	682
Pork:					
Production	1,476	1,920	2,032	2,498	2,799
Consumption	1,677	2,090	2,213	2,613	2,928
Net imports	155	170	181	115	129
Chicken:					
Production	1,145	1,462	1,555	1,868	2,112
Consumption	1,222	1,537	1,634	1,932	2,184
Net imports	72	75	79	64	72
Eggs:					
Production	1,999	2,189	2,321	2,398	2,695
Consumption	2,066	2,241	2,375	2,430	2,730
Net imports	67	52	54	32	35
Milk:					
Production	6,501	7,775	8,256	9,298	10,485
Consumption	7,561	8,903	9,454	10,483	11,821
Net imports	1,026	1,128	1,198	1,185	1,336

<sup>1</sup>*ERS projections I and II* from tables 47 and 48.

percent per year, attaining a level of 14.1 million metric tons by 1990. Attaining such a volume, however, depends on the country's ability to develop its coastal resources to offset the effects of industrial pollution, and to maintain its catch in distant fisheries. Marine aquaculture now accounts for about 900,000 metric tons per year, about 8 percent of the total catch. Growth in aquaculture has been rapid, but the upper limit is probably in the neighborhood of 2.5 million metric tons.<sup>20</sup> Based on the growth trend since 1975, 1990 production will reach 1.2 million metric tons.

Coastal and offshore resources will continue to provide the greatest part of the country's future catch. Growth in the offshore catch was very rapid during the seventies, offsetting the decline in distant fisheries. If both the coastal and offshore catch grow at the 1975-79 trend rate, 1990 production from these areas will reach 10.9 million metric tons (offshore, 8.84 million metric tons; coastal, 2.03 million metric tons).

The most uncertain source will be Japan's traditional distant fisheries. Some new areas will probably be developed and become commercially important, but foreign control over them will make Japan's access and catch unpredictable. An unlikely political breakthrough on the Northern Territories would open up a vast area rich in resources and in close proximity to Japan. At any rate, distant fisheries should continue to provide Japan with at least 2 million metric tons through 1990.

The uncertainty of the fish catch makes Japan's self-sufficiency in fish equally uncertain. MAFF projects a 1990 fish catch of about the same as 1978, with a sharp increase in imports to meet demand. If the past few years are viewed as an adjustment period, and if the total ocean yield can grow, as projected by a number of researchers (7, p. 231), there is no reason why the sophisticated Japanese fishing industry cannot catch 14.1 million metric tons of fish by 1990. A reclassification of marine life heretofore considered inedible (such as krill) is a likely possibility and would help in attaining such a level.

### Feed Supply

Future Japanese sources of animal nutrition will be principally imported concentrates, supplemented by domestic pasture and forage products. Future feed demand will

depend on future livestock production. To the previously discussed projections of livestock product supplies, we can apply estimated grain and protein meal conversion rates to project a consistent level of grain and protein meal demand. The ensuing discussion focuses on feed grain and protein meal demand because they will represent about two-thirds of total feed supply (TDN) by 1990, and because most of it will be imported. Grain/product conversion rates are projected to 1985 and 1990 for five livestock categories (table 51), using 1975-79 rates as a baseline, and assuming that pasture area and forage crop production grow in proportion to cattle inventories. The conversion rates are expected to fall for chicken, egg, and milk production. This is consistent with likely structural

Table 51—Japan: Feed conversion rates for livestock products

Item	1970	1975	1980	1985	1990
<i>Kg feed/kg products</i>					
Beef and veal: <sup>1</sup>					
Total concentrates <sup>2</sup>	4.18	5.61	8.08	9.98	11.68
Grain	2.84	3.99	5.72	7.15	8.41
Protein meal <sup>3</sup>	.44	.33	.56	.69	.81
Pork:					
Total concentrates	5.36	4.36	4.34	4.63	4.59
Grain	3.35	3.00	3.17	3.47	3.44
Protein meal	.94	.83	.86	.92	.91
Chicken:					
Total concentrates	2.07	3.13	2.90	2.91	2.78
Grain	2.02	2.06	1.99	2.03	2.01
Protein meal	.66	.70	.63	.63	.60
Eggs:					
Total concentrates	4.00	3.65	3.68	3.42	3.30
Grain	2.63	2.41	2.52	2.33	2.26
Protein meal	.85	.82	.81	.75	.73
Milk:					
Total concentrates	.42	.44	.43	.42	.40
Grain	.17	.20	.21	.22	.23
Protein meal	.09	.08	.07	.07	.07

<sup>1</sup>Substantial beef comes from culled dairy cows. Some dairy feed is, therefore, converted to beef.

<sup>2</sup>Includes formula and simple feeds.

<sup>3</sup>Protein meal includes rice bran oilcake, soybean meal, other vegetable oilcakes, fishmeal, fish solubles, nonfat dry milk, and other animal meals (e.g., feather and blood meal). Rates include only protein meal used in formula feed and are computed on a soybean meal equivalent basis.

Sources: *Shiryo Geppo* (Feed Monthly) and *The Meat Statistics of Japan*.

<sup>20</sup>Cultured fishing "could produce as much as 10 to 20 metric tons per one km<sup>2</sup> of available sea area that could thus be utilized" (50, p. 282).

Table 52—Japan: Projected grain demand in 1990

Item	Livestock production in 1980	Grain demand	MAFF projections <sup>1</sup>		ERS projections I <sup>2</sup>		ERS projections II <sup>3</sup>	
			Livestock production	Grain demand <sup>2</sup>	Livestock production	Grain demand <sup>2</sup>	Livestock production	Grain demand <sup>2</sup>
1,000 metric tons								
Beef and veal	418	2,391	630	5,298	529	4,449	596	5,012
Pork	1,476	4,679	1,940	6,674	2,498	8,593	2,799	9,629
Chicken	1,145	2,279	1,460	2,935	1,868	3,755	2,112	4,145
Eggs	1,999	5,037	2,220	5,017	2,398	5,419	2,695	6,091
Dairy products	6,502	1,365	8,420	1,937	9,298	2,139	10,485	2,412
Total grain demand <sup>4</sup>	*	15,751	*	21,861	*	24,355	*	27,389
Average annual increment, 1980-90	*	*	*	611		860	*	1,164
Percent								
Average annual growth rate, 1980-90	*	*	*	3.3	*	4.5	*	5.7

\* = Not applicable.

<sup>1</sup>Based on MAFF's *The Long-Term Prospects for the Demand and Supply of Agricultural Products*, released by the Government of Japan, November 1980.<sup>2</sup>Computed using projections of livestock production from table 49 and 1990 grain/product rates from table 51.<sup>3</sup>See table 48 on consumption alternatives. Production is derived from consumption by using the Government's self-sufficiency targets in all cases except beef.<sup>4</sup>Includes only five main categories of livestock. There are other miscellaneous categories such as pet, fish, and horse feeds.

change in these industries and improvement in feed conversion efficiency. The rates for beef and pork, on the other hand, are expected to increase, which is consistent with a probable trend toward increased commercialization and confined feeding practices. Depending on the production projections used, total feed grain demand is expected to increase at an annual rate between 3.3 and 5.7 percent, or 0.6 to 1.2 million metric tons per year. These rates are below 1975-80 averages but somewhat above those of the 1970-75 recessionary period (table 52).

Most of the future demand for grain and other concentrates will be fulfilled by imports (table 53). Domestic grain production will be primarily limited to rice, wheat, and barley. Production of a feed-quality rice is under discussion but will probably be prohibitively expensive (the Government subsidy will have to be much larger to sell rice as a feed than as a food staple).

Protein meal rates are projected to remain fairly constant over the next decade. In most cases, this will mean that rations will have a somewhat higher proportion of protein meal by 1990. By applying protein meal conversion rates to projected levels of production (table 49), we see that protein meal demand growth will approximately parallel that of feed grain demand, that is, between 3.8 and 5.0 percent per year, or 193,000 to 270,000 metric tons per year (table 54).

Table 53—Japan: Projections for coarse grains

Item	1980	1985		1990	
		ERS projections		ERS projections	
		I	II	I	II
1,000 metric tons					
Domestic production <sup>1</sup>	400	474	474	577	577
Total consumption	19,197	24,089	25,307	29,659	32,762
Industrial uses <sup>2</sup>	3,086	3,827	3,827	4,747	4,747
Major live-stock feeds <sup>3</sup>	15,751	19,809	21,000	24,355	27,389
Other feeds <sup>4</sup>	360	453	480	557	626
Imports	18,863	23,615	24,833	29,082	32,185
Exports	—	—	—	—	—

— = None or negligible.

<sup>1</sup>Based on MAFF's *The Long-Term Prospects for the Demand and Supply of Agricultural Products*, November 1980.<sup>2</sup>Principally for the manufacture of corn syrup and starches. Projected to increase at 4.4 percent per year through 1990.<sup>3</sup>Computed from data in tables 50 and 51.<sup>4</sup>Includes pet, horse, fish, and other animal feeds.

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As in the case of grain, much of the protein meal supplies will come from imported material, mainly soybeans. At present, Japan produces soybeans, rapeseed, and peanuts, much of which is used directly for human consumption. On the other hand, Japan's fishmeal production has been an important feedstuff in the past, but will likely diminish in importance with rising fish prices and a likely tendency to make more efficient use of marine resources for food (table 55).

The extent to which Japan relies on imports of oilseeds or meals over the next decade will depend on relative conditions of the oil and meal markets. The derived demand for meal as a livestock feed is expected to increase more rapidly than demand for oil as a food. Uncertainty and the expected imbalance in demand growth for meal and oil will make Japanese crushers reluctant to expand capacity (unless they can count on export markets) and formula feed producers more dependent on imports of protein meal. There will also be a tendency for crushers to shift toward use of oilseeds with higher meal content (like soybeans, with 78-percent meal content compared with 60-65 percent for rapeseed).

Figure 3

### Imports of Coarse Grains by Japan

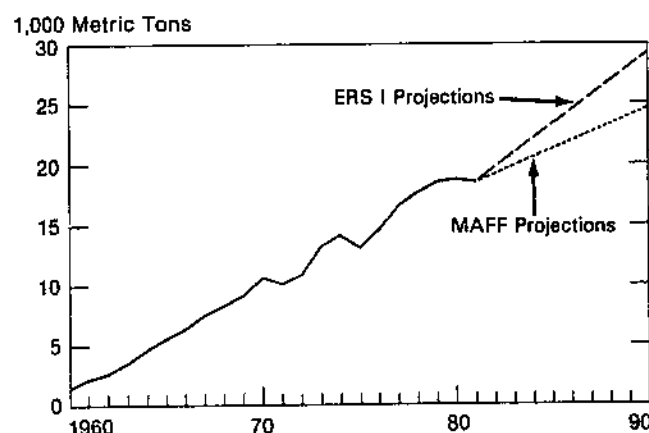


Table 54—Japan: Protein meal demand in 1990, various alternatives

Item	Livestock production 1980	Protein meal demand	MAFF 1990 projections <sup>1</sup>		ERS projections I <sup>2</sup>		ERS projections II <sup>3</sup>	
			Livestock production	Protein meal demand <sup>2</sup>	Livestock production	Protein meal demand <sup>2</sup>	Livestock production	Protein meal demand <sup>2</sup>
1,000 metric tons								
Beef and veal	418	234	630	510	529	428	596	483
Pork	1,476	1,296	1,940	1,765	2,498	2,273	2,799	2,547
Chicken	1,145	721	1,460	876	1,868	1,121	2,112	1,267
Eggs	1,999	1,619	2,220	1,621	2,398	1,751	2,695	1,967
Dairy products	6,502	455	8,420	589	9,298	651	10,485	734
Total protein meal utilization in formula feed	*	4,299	*	5,361	*	6,224	*	6,998
Average annual increment, 1980-90	*	*	*	106	*	193	*	270
Percent								
Average annual growth rate, 1980-90	*	*	*	2.2	*	3.8	*	5.0

\* = Not applicable.

<sup>1</sup>Based on MAFF's *Long-Term Prospects for the Demand and Supply of Agricultural Products*, November 1980.

<sup>2</sup>Computed using production projections from table 49 and 1990 protein meal/product rates from table 51.



## Projections

Expanded pasture and forage production is a major policy initiative of the Government as reflected in its projection that the area devoted to those uses will expand by more than 50 percent (to 1.55 million hectares) by 1990. The rice diversion program and incentives to expand double-cropping of rice with feed crops will help approach that goal. Attaining it, however, will be extremely costly and is most unlikely. Earlier MAFF projections were too optimistic. It is more likely that the expansion of pasture and forage

area will parallel increases in cattle inventories, maintaining a constant ratio between grazing animals and grazing plus fodder area. Under *ERS projections I and II*, total pasture and forage area will increase to about 1.3 million hectares (table 39).

There is a trade-off between forage products and concentrates to the extent that they are substitutes. During 1975-79, average per hectare forage production was 39

Table 55—Japan: Projections for oilseeds and protein meal

Item	1980	1985 projections		1990 projections	
		I	II	I	II
1,000 metric tons					
Oilseeds: <sup>1</sup>					
Production <sup>2</sup>	259	354	354	525	525
Imports <sup>3</sup>	5,899 (4,401)	6,665 (5,199)	6,977 (5,442)	7,473 (5,903)	8,307 (6,562)
Total utilization	6,158	7,019	7,331	7,998	8,832
Oilseeds not crushed <sup>4</sup>	1,283	1,215	1,215	1,289	1,289
Oilseeds crushed <sup>4</sup>	4,875	5,804	6,116	6,709	7,543
Protein meal (soybean equivalent):					
Production	4,233	4,907	5,119	5,656	6,240
Vegetable oilmeal (domestic and imported oilseeds) <sup>5</sup>	3,261	3,947	4,159	4,696	5,280
Fishmeal <sup>7</sup>	972	960	960	960	960
Imports <sup>3</sup>	534 (326)	758 (470)	909 (563)	1,150 (736)	1,412 (904)
Exports	63 (1)	— *	— *	— *	— *
Apparent utilization	4,704	5,665	6,028	6,806	7,652
Formula feed <sup>8</sup>	4,299	5,198	5,512	6,224	6,998
Other uses <sup>9</sup>	402	467	516	582	654

\* = Not applicable.

— = None or negligible.

Numbers in parentheses show the soybean component of the total amount.

<sup>1</sup>Includes soybeans, rapeseed, cottonseed, sesame, copra, linseed, palm kernel, and peanuts.

<sup>2</sup>Based on MAFF's *The Long-Term Prospects for the Demand and Supply of Agricultural Products* which projects expanded production and area for soybeans and peanuts.

<sup>3</sup>Oilseed imports are expected to increase more slowly than protein meal imports, reflecting conservative expansionary behavior on the part of crushers.

<sup>4</sup>Oilseeds not crushed are principally soybeans, peanuts, and sesame, which are consumed as food. Soybeans used in traditional Japanese dishes represent about 80 percent of this category. No growth is expected in this category.

<sup>5</sup>The crush rate for oilseeds is based on a weighted average of crush rate estimates for the oilseeds listed in footnote 1. The rate is expected to grow from 79 percent in 1980 to about 85 percent in 1990 because of no growth in the food category.

<sup>6</sup>The meal yield for crushed oilseeds is estimated at about 67 percent in 1980. This is expected to increase to about 70 percent in 1990 with more extensive use of soybeans.

<sup>7</sup>Fishmeal production is expected to show little or no growth in the 1980's because of higher real fish prices and more extensive use of low-grade fish for human consumption.

<sup>8</sup>Computed from data in tables 50 and 51.

<sup>9</sup>Includes protein meal used in simple feeds and for industrial purposes. Growth in this category is assumed to parallel that of protein meal utilization in formula feed.

tons of green matter or 4.7 tons of TDN (assuming a 12-percent TDN content for green roughage). Each additional hectare of forage, therefore, reduces demand for other sources of TDN by approximately 4.5 tons. Assuming a constant ratio of pasture and forage area per head of cattle, and assuming that pasture and forage yields in 1990 are the same as the 1975-79 average, these sources will continue to supply about 1 ton of TDN per head of cattle, which is less than half the nutritional requirements for an adult dairy cow. Total pasture and forage availability according to MAFF projections and according to ERS projections is shown in table 39.

### Conclusions and Implications for the United States

The evidence suggests that Japan will continue through the eighties as a sizable importer of feed grains, oilseeds, and livestock products because of the demand potential of a large affluent population combined with the very limited production potential of its land. The Japanese market will grow, but probably not as rapidly as in the last two decades. Continued expansion of feed imports will be caused by population and income growth, further westernization of diets, limited fish supplies, and declining self-sufficiency in some livestock products and feedstuffs.

Crowded on a rugged area slightly smaller than that of California, Japan's population of 118 million is about half that of the United States. Over the next decade, the population is expected to grow by just under 1 percent per year (compared with a little more than 1 percent per year in the seventies). Meanwhile, per capita income will probably rise by 3 to 4 percent per year—low by past standards (4 to 5 percent in the last decade)—but high compared with the rates projected for other industrialized countries. Population and income growth will ensure that Japan's demand for meat and other livestock products will be greater in the future.

The productivity of Japan's livestock sector, however, will continue to be severely limited. Official projections indicate that self-sufficiency in livestock products will improve modestly by 1990. However, these projections assume continued support for the inefficient beef sector—an expensive program likely to meet political opposition in coming years. It is more probable that self-sufficiency for relatively efficient livestock enterprises will improve while that for beef will decline, leading to greater dependence on beef imports. Furthermore, Japan's limited capacity to expand production of feedstuffs will assure continued dependence on imports.

The westernization of the diet could accelerate if the Japanese diet is unable to continue its historical depend-

ence on fish. The imposition of 200-mile fishing limits by many nations since 1977 threatens to restrict Japan's future supply of fish, currently its most important source of animal protein. Japan has increasingly depended on fish imports since 1972, when its annual catch leveled off between 10 million and 11 million tons. If the retail prices of fish and other marine products continue to rise at a more rapid rate than prices of livestock products, consumers will continue to substitute meat, eggs, and dairy products. The result would be a combination of growth in imports of finished livestock products and increased domestic livestock production, which in turn would require more imports of feed grains and oilseeds.

Future Japanese agricultural policies will also affect growth in the Japanese import markets for livestock products and for feedstuffs. Currently, Japan's livestock sector is protected from free market forces. High guaranteed prices, tariffs, import quotas, and input subsidies are required to keep land, labor, and capital in livestock production. Feedstuffs are imported more freely but are affected indirectly by protectionist livestock policies.

The importance of policy has been emphasized throughout this study even though the projections in the previous section were made under the assumption that policy and prices would remain constant through the eighties—an assumption necessary to simplify our view of the future. A sensitivity to possible policy changes, however, is important and should guide our thinking with respect to the future of Japan's agriculture and its livestock sector. For example, a dramatic relaxation in the Government's protectionist policy for beef could have a significant effect on Japan's production, consumption, and trade in beef. Although such a change was not anticipated in the projections it could happen given foreign pressure to liberalize trade and domestic pressure to reduce consumer prices. Japan will face three broad policy alternatives in the eighties with respect to its agricultural (including its livestock) sectors:

- Maintain the present policy, which sustains small-scale, high-cost agricultural production. This course is unlikely because of costly surplus problems (for some dairy products, rice, and mandarin oranges), the waning political influence of farmers, the increasing importance of consumer and urban-based groups, and pressure from foreign food suppliers for easing import restrictions.
- Make the Japanese market less restrictive to imports, a course favored by some Japanese consumer groups and foreign interests, but a course that would produce serious dislocation. Although Japanese society would theoretically experience a

net gain, producers would sustain immediate and sizable cuts in income. A rapid switch to laissez faire is highly unlikely.

- Follow a middle course, with Japan continuing to protect its agriculture as much as is politically possible, while gradually improving its efficiency and competitiveness.

The United States, as in the past, will have a major role in supplying Japan with the feed grains, oilseeds, fodders, and roughages required to support its livestock industries. The United States will also supply an important share of the finished livestock products required to supplement domestic production in meeting consumer demand (table 56).

Table 56—Japan: Projections of net imports of livestock products, grains, and oilseeds and the U.S. share

Item	1980	1985 projections		1990 projections	
		I	II	I	II
1,000 metric tons					
Coarse grains	18,863 (15,636)	23,615 (15,350)	24,833 (16,140)	29,082 (18,900)	32,185 (20,920)
Oilseeds	5,899 (4,289)	6,665 (5,000)	6,977 (5,232)	7,473 (5,680)	8,307 (6,315)
Soybeans	4,401 (4,226)	5,199 (4,940)	5,442 (5,170)	5,903 (5,610)	6,562 (6,235)
Protein meal <sup>1</sup>	471 (245)	758 (341)	909 (410)	1,150 (540)	1,412 (660)
Soybean meal	325 (239)	470 (329)	563 (395)	736 (515)	904 (630)
Livestock products:					
Beef and veal	174 (31)	339 (85)	361 (90)	601 (150)	682 (170)
Pork	155 (43)	170 (50)	181 (54)	115 (35)	129 (40)
Chicken	67 (41)	75 (45)	79 (47)	64 (40)	72 (43)
Eggs	67 (15)	52 (8)	54 (5)	32 (5)	35 (5)
Dairy products <sup>2</sup>	1,026 (10)	1,128 (23)	1,198 (24)	1,185 (24)	1,336 (27)

Numbers in parentheses refer to the U.S. shares. In most cases the average U.S. share for 1975-81 is assumed to hold for the projection period.

<sup>1</sup>Soybean meal equivalent basis.

<sup>2</sup>Fluid basis.

The unusually high U.S. share of Japan's coarse grain imports in 1980 and 1981 (more than 80 percent) will not be maintained through the rest of the decade. Historical trade patterns, altered as a result of the U.S. suspension of grain sales to the Soviet Union, should eventually be restored, with U.S. share of 65 percent to be expected. This would amount to 18.9 million to 20.9 million tons by 1990 based on the assumptions in the previous section (tables 52 and 53). Major U.S. competitors will be Australia (barley), Canada (barley), Argentina (sorghum), South Africa (corn), and Thailand (corn).

Growth in protein meal demand will parallel that for feed grain. Soybean meal will remain the most important protein meal used in formula and simple feeds. As the dominant supplier of soybeans and soybean meal, the United States will benefit from this development. The U.S. import share during the last half of the seventies was 95 percent for soybeans and 71 percent for soybean meal. Similar shares should prevail in future years. The greatest challenge could come from Brazil, which recently eliminated export quotas and other controls on soybeans and derivative products. China, a traditional supplier of food-quality soybeans, will not be an important competitor. U.S. exports of soybeans to Japan could reach 5.7 million to 6.2 million tons by 1990 assuming at least a 95-percent U.S. share in Japanese imports and growth in Japanese livestock production as described in the preceding section.

U.S. exports of soybean meal could grow even more rapidly than soybean exports. If Japanese crushers gauge their rate of crush according to expected increases in the domestic demand for oil, then the import demand for meal will likely grow more rapidly than that for beans since the income elasticity of demand for oil will probably be less than that for meal over the next decade. U.S. exports of soybean meal could reach 515,000 to 630,000 tons by 1990, assuming a 70-percent import share. This would be substantially different if Japan's crushers could economically export oil, something they have not done in the past.

Growth in the Japanese market for imported livestock products should be limited except for beef. The U.S. historical share of pork (30 percent for 1975-81), poultry meat (60 percent), eggs (15 percent), and dairy products (2 percent) should be maintained while that for beef (14 percent) could rise substantially, perhaps reaching 25 percent of the market. Recently implemented concessions resulting from the MTN have led to annual increases in Japan's imports of high-quality beef, a part of the beef made in which the United States is very competitive. As a result, U.S. exports have almost doubled and now represent 18-20 percent of total Japanese beef imports.

## Japan's Feed-Livestock Economy

Growth in beef imports will continue even without major policy changes. A Japanese dairy policy that seeks to eliminate surpluses of milk would limit growth in the supply of beef from dairy culls, dairy steers, and dairy heifers. Future expansion of the nondairy beef sector, dominated by the Wagyu breed, is likely to be limited by inherent inefficiencies. Slow growth in domestic beef production and a relatively rapid growth in beef demand will lead to an erosion in self-sufficiency and increased dependency on imports. Since the nondairy beef sector is relatively less efficient than the dairy sector and since Wagyu animals produce a higher quality beef than dairy animals, the share of imported high-quality beef should increase.

The agricultures of the United States and Japan will continue to be interconnected by trade. Although Japan's livestock industry is, in many ways, small and still in its formative stages, it depends on imported feedstuffs for at least three-quarters of its feed supply, making Japan one of the largest importers of feedstuffs in the world. The United States, with its comparative advantage and with its capacity to produce and market large amounts of grains and oilseeds, will maintain a prominent position in the Japanese market. Although efforts to increase U.S. exports of processed and higher value-added items will intensify, feedstuffs will continue to be the main component of this trade.

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## Appendix Tables

Appendix table 1—Japan: Demand elasticities for meat products and fish

Reference information			Elasticity of—			Statistical information	
Commodity and source	Time period		Income	Own-price	Cross-price	Equation <sup>1</sup>	R <sup>2</sup>
	Historical	Projection					
Beef/veal:							
FAO (1967)	1961-63	1975-85	1.00			DL	
FAO (1971)	1964-66	1970-80	.70			SL	
Filippello (1970)	1965		.50	− 1.24	.20 pork 1.14 poultry .44 fish		
Filippello (1970)		1980	.64	− .77	.15 pork .19 poultry .27 fish		
Gruen (1968)	1959-61	1980	1.20				
Japan (1974) <sup>2</sup>	1963		1.31			DL	0.99
	1965		1.16			DL	
	1967		1.20			DL	
	1969		.98			DL	
	1970		1.02			DL	
	1972		.88			DL	
	1973		.89			DL	.90
Japan (1974) <sup>2</sup>	1955-64		1.10	− .96		DL	.78
	1964-73		1.18	− 1.68		DL	.85
	1955-73		1.09	− 1.39		DL	.69
OECD (1968)	1961-63		.74			DL	.58
OECD (1968)		1975-85	.90			DL	
Sanderson (1978)	1963-74		1.78	− 2.18		L	.91
		1974-85	1.89			L	
Kester (1980)	1960-70		1.38	− .99	− .20 fish 1.02 pork 1.04 chicken	L	.97
	1960-78		1.69	− 1.53		DL	.73
		1978-82	1.5	− 1.2			
		1983-85	1.3	− 1.2			
Lopez (1981)	1965-79		1.74	− 1.27		DL	.88
Pork:							
FAO (1967)	1961-63	1975-85	1.20			SL	
FAO (1971)	1964-66	1970-80	.90			SL	
Filippello (1970)	1965		.72	− .72	.26 beef .17 poultry .09 fish		
Filippello (1970)		1980	.82	− .45	.14 beef .12 poultry .05 fish		
Japan (1974) <sup>2</sup>	1963		1.23			DL	0.97
Japan (1974) <sup>2</sup>	1965		1.17			DL	

See footnotes at end of table.

Continued

# Japan's Feed-Livestock Economy

Appendix table 1—Japan: Demand elasticities for meat products and fish—Continued

Reference information			Elasticity of—			Statistical information	
Commodity and source	Time period		Income	Own-price	Cross-price	Equation <sup>1</sup>	R <sup>2</sup>
	Historical	Projection					
Japan (1974) <sup>2</sup>	1967		.87			DL	
	1969		.75			DL	
	1970		.71			DL	
	1972		.67			DL	
	1973		.61			DL	.96
Japan (1974) <sup>3</sup>	1955-64		2.78	- 1.83		DL	.99
	1964-73		1.46	- 1.76		DL	.96
	1955-73		2.20	- 1.07		DL	.98
OECD (1968)	1961-63		1.47			DL	.68
OECD (1968)		1962-75	1.50			DL	
		1975-85	1.50			SL	
Sanderson (1978)	1963-74		1.04	- 1.41		L	.95
		1974-85	.95				
Kester (1980)	1960-75		.85	- .77	.63 beef .28 chicken	L	.99
	1960-78		1.16	- 2.05		SL	.92
		1978-82	1.1	- 1.7			
			1.0	- 1.7			
Lopez (1981)	1965-79		1.25	- 1.08		DL	.95
Poultry:							
FAO (1967)	1961-63	1975-85	1.70			SL	
FAO (1971)	1964-66	1970-80	.90			SL	
Filippello (1970)	1965		.95	- 1.16	.35 beef .11 pork .09 fish		
		1980	1.18	- .88	.20 beef .08 pork .05 fish		
Japan (1974) <sup>2</sup>	1963		.90			DL	
	1965		.73			DL	
	1967		.68			DL	0.87
	1969		.49			DL	
	1970		.53			DL	
	1972		.37			DL	
	1973		.31			DL	.50
Japan (1974) <sup>3</sup>	1955-64		3.10	- 1.19		DL	.99
	1965-73		.56	- 2.33		DL	.92
	1955-73		2.95	.04		DL	.99
OECD (1968)	1961-63		3.47			DL	.92
		1962-75	1.90			DL	
		1975-85	1.30			SL	

See footnotes at end of table.

Continued



## Appendix Tables

Appendix table 1—Japan: Demand elasticities for meat products and fish—Continued

Reference information			Elasticity of—			Statistical information	
Commodity and source	Time period		Income	Own-price	Cross-price	Equation <sup>1</sup>	R <sup>2</sup>
	Historical	Projection					
Sanderson (1978)	1963-74	1974-85	.97 .97	- 2.17		DL	.99
Kester (1980)	1960-75 1960-78	1978-82 1983-85	1.20 1.27 1.2 1.0	- .65 - 1.25 - 1.0 - 1.0	.65 pork	L L	.87 .86
Lopez (1981)	1965-79		1.10	- 1.09		DL	.99
Fish:							
FAO (1962)	1957-59	1970	0.50				
FAO (1962)	1961-63	1975-85	.30			LI	
FAO (1971)	1964-66	1970-80	.30			LI	
Filippello (1970)	1965		- .41	- 0.38	0.33 beef .21 pork .15 poultry		
Filippello (1970)		1980	- .13	- .44	.39 beef .29 pork .23 poultry		
Japan (1974) <sup>2,6,13</sup>	1963 1965 1967 1969 1970 1972 1973		.65 .73 .50 .52 .47 .39 .45			DL DL DL DL DL DL DL	0.83
Japan (1971) <sup>2,6,13</sup>	1955-62 1963-70 1955-70		.52 .72 .44	- 1.03 - .81 - .59		DL DL DL	.84 .78 .73
Japan (1974) <sup>2,6,14</sup>	1963 1965 1967 1969 1970 1972 1973		.60 .63 .60 .53 .44 .52 .54			DL DL DL DL DL DL DL	.97
Japan (1974) <sup>2,14</sup>	1955-64 1964-73 1955-73		.45 1.33 4.9, 14	- 1.25 - .88 .16		DL DL DL	
Kester (1980)	1960-75 1960-78 1960-69		.44 .64 .21	- .23 - .47 —	.24 beef .16 chicken	L L SL	
	1970-78		.18	—	.21 beef .14 chicken	SL	
	1960-78		.20		.22 beef .15 chicken	SL	

See footnotes at end of table.

Continued

Appendix table 1—Japan: Demand elasticities for meat products and fish—Continued

Reference information			Elasticity of—			Statistical information	
Commodity and source	Time period		Income	Own-price	Cross-price	Equation <sup>1</sup>	R <sup>2</sup>
	Historical	Projection					
		1978-82	.6	— .4			
		1982-85	.5	— .4			
Lopez (1981)	1960-78		.49			DL	.94
Mutton/lamb:							
FAO (1967)	1961-63	1975-85	1.40			SL	
FAO (1971)	1964-66	1970-80	.60			SL	
Gruen (1968)	1959-61	1980	3.00			SL	
Lopez (1981)	1965-79		.71	— 0.59		SL	0.65
Other meat:							
FAO (1967)	1961-63	1975-85	.80			SL	
FAO (1971)	1964-66	1970-80	.60			SL	
Japan (1971) <sup>5,6</sup>	1963		1.45			DL	.93
	1965		1.74			DL	.96
	1967		1.32			DL	.96
	1969		1.04			DL	.96
	1970		.68			DL	.85
Japan (1974) <sup>5,6</sup>	1973		.95			DL	.83
Japan (1974) <sup>3,7</sup>	1955-64		2.00	— 2.86		DL	
	1964-73		.88	— .30		DL	
	1955-73		1.27	— 3.13		DL	
Japan (1974) <sup>3,8</sup>	1956-65		2.43	— 3.24		DL	
	1964-73		1.14	* — 1.36		DL	
	1956-73		1.42	* — .39		DL	
OECD (1968) <sup>10</sup>		1975-85	1.00			DL	

See footnotes at end of table.

Continued

## Appendix Tables

Appendix table 1—Japan: Demand elasticities for meat products and fish—Continued

Commodity and source	Reference information		Elasticity of—			Statistical information	
	Time period		Income	Own-price	Cross-price	Equation <sup>1</sup>	R <sup>2</sup>
	Historical	Projection					
Total meat:							
FAO (1962)	1957-59	1970	1.70			SL	
FAO (1965)	1961-63	1975-85	1.12			SL	
FAO (1971)	1964-66	1970-80	.79			SL	
Japan (1974) <sup>2,5</sup>	1963		1.33			DL	
	1965		1.29			DL	0.93
	1967		1.13			DL	
	1970		.92			DL	
	1972		.84			DL	
	1973		.80			DL	.96
Japan (1971) <sup>3,5</sup>	1958-70		1.38	- 0.45		DL	.98
	1963-70		1.08	- .53		DL	.96
OECD (1968) <sup>11</sup>	1961-63		1.45			DL	.93
OECD (1968) <sup>12</sup>	1961-63		1.64			DL	.93
		1962-75	1.40			DL	
		1975-85	1.40			SL	
Sanderson (1978)	1963-74		1.17	- 1.33		L	
pork, poultry, beef)		1974-85	1.06				

<sup>1</sup>The functional form of an equation is identified with DL for double-logarithmic, SL for semilogarithmic, L for linear, and LI for log-inverse.

<sup>2</sup>Cross-section elasticity for all nonfarm households.

<sup>3</sup>For nonfarm households in cities larger than 50,000 population.

<sup>4</sup>R<sup>2</sup> less than 0.64.

<sup>5</sup>Processed meats—excludes pork, ham, and sausage.

<sup>6</sup>Consumption measured as expenditure.

<sup>7</sup>Ham.

<sup>8</sup>Sausage.

<sup>9</sup>Student t-value less than 1.0.

<sup>10</sup>Mutton/lamb, horsemeat, etc.

<sup>11</sup>Includes whale meat.

<sup>12</sup>Excludes whale meat.

<sup>13</sup>Fresh seafood.

<sup>14</sup>Salted and dried seafood.

Principal source: Myles J. Mielke, *Compilation and Analysis of Demand Elasticities for Livestock Products in the European Community and Japan: Based on Studies Using Historical Series from the 1950's to the 1970's with Projections up to 1985*, Foreign Demand and Competition Div. Working Paper, U.S. Dept. of Agriculture, May 1978. See detailed list of references at end of appendix table 3.

# Japan's Feed-Livestock Economy

Appendix table 2—Japan: Demand elasticities for dairy products

Reference information			Elasticity of—			Statistical information	
Commodity and source	Time period		Income	Own-price	Cross-price	Equation <sup>1</sup>	R <sup>2</sup>
	Historical	Projection					
Milk whole:							
Filippello (1967) <sup>6</sup>	1953/54-64/65		1.36	-0.91			
Filippello (1967) <sup>6</sup>	1953/54-64/65		1.70	-.27			
Filippello (1970)	1965		1.15	-.55			
Filippello (1970)		1980	1.45	-.74			
FAO (1962)	1957-59	1970	2.00			LI	
FAO (1967) <sup>7</sup>	1961-63	1975-85	.80			SL	
FAO (1971)	1964-66	1970-80	.50				
Gruen	1959-61	1980	2.10			SL	
IAER (1964)	1951-60	1965-75	2.10	-1.16		DL	0.96
Japan (1974)	1963		1.32			DL	
	1965		1.28			DL	.93
	1967		1.08			DL	
	1969		.71			DL	
	1970		.76			DL	
	1972		.62			DL	
	1973		.56			DL	.67
Japan (1974) <sup>3</sup>	1955-64		2.12	-1.16		DL	.99
	1964-73		.27	-2.01		DL	.80
	1955-73		1.51	<sup>4</sup> -.31		DL	.94
OECD (1968) <sup>9</sup>	1955-64		1.62			LI	.99
OECD (1968) <sup>10</sup>	1955-64		1.60			LI	
OECD (1968) <sup>8</sup>	1961-63		1.38			LI	
OECD (1968) <sup>10</sup>	1961-63		1.44			LI	
OECD (1968)		1975-85	1.40			SL	
Butter:							
FAO (1971) <sup>11</sup>	1964-66	1970-80	1.20			SL	
Gruen (1968)	1959-61	1980	1.80			SL	
IAER (1964)	1951-60	1965-75	.82	-1.37		DL	0.93
IAER (1964)	1951-60	1965-75	1.76	.88	-1.97 (bread/ rice) <sup>12</sup>	DL	.96
Japan (1974) <sup>3</sup>	1963		2.76			DL	
	1965		2.64			DL	.97
	1967		1.98			DL	
	1969		1.97			DL	
	1970		1.95			DL	
	1972		1.71			DL	
	1973		1.41			DL	.88
Japan (1974) <sup>3</sup>	1955-64		.77	-2.03		DL	
	1964-73		-1.28			DL	
	1955-73		1.68	<sup>4</sup> .73		DL	
OECD (1968)	1955-64		1.65			LI	.93
	1961-63		1.40			LI	
		1975-85	1.85			LI	

See footnotes at end of table.

Continued

## Appendix Tables

Appendix table 2—Japan: Demand elasticities for dairy products—Continued

Reference information			Elasticity of—			Statistical information	
Commodity and source	Time period		Income	Own-price	Cross-price	Equation <sup>1</sup>	R <sup>2</sup>
	Historical	Projection					
Cheese:							
FAO (1971)	1964-66	1970-80	1.00			SL	
Gruen (1968)	1959-61	1980	3.30			SL	
IAER (1964)	1951-60	1965-75	3.34	1.11		DL	0.97
Japan (1974) <sup>2</sup>	1963		2.82			DL	
	1965		2.69			DL	.91
	1967		1.48			DL	
	1969		1.18			DL	
	1970		1.37			DL	
	1972		1.11			DL	
	1973		.93			DL	.79
Japan (1974) <sup>3</sup>	1964-73		1.49	3.43		DL	
OECD (1968)	1955-64		2.89			SL	.95
	1961-63		2.23			SL	
		1975-85	2.30			DL	
Other milk products:							
Powered milk							
IAER (1964)	1951-60	1965-75	1.29	-3.27		DL	.86
Japan (1974) <sup>2</sup>	1965		-.25			DL	.02
Japan (1971) <sup>2,13</sup>	1955-62		1.13	-2.21		DL	.94
	1963-70		2.03	-.18		DL	.96
	1955-70		1.51	-.83		DL	.87
OECD (1968)	1955-64		2.23			DL	.96
OECD (1968)		1975-85	1.80			LI	
Condensed milk							
IAER (1964)	1951-60	1965-75	1.08	-1.34		DL	.73
Total milk products:							
FAO (1962)	1957-59	1970	2.00			SL	
FAO (1967)	1961-63	1975-85	.80			SL	
IAER (1964) <sup>13</sup>	1951-60	1965-75	1.58	-1.74		DL	0.97
IAER (1964) <sup>13</sup>	1951-60	1965-75	1.43	-1.68		DL	.97

See footnotes at end of table.

Continued

Appendix table 2—Japan: Demand elasticities for dairy products—Continued

Commodity and source	Reference information		Elasticity of—			Statistical information	
	Time period		Income	Own-price	Cross-price	Equation <sup>1</sup>	R <sup>2</sup>
	Historical	Projection					
Japan	1963		.97			DL	.95
	1965		.94			DL	
	1967		.76			DL	
	1969		.49			DL	
	1970		.52			DL	
	1972		.36			DL	
	1973		.34			DL	
							.73
Japan (1974) <sup>2, 13</sup>	1958-70		1.27	-.55		DL	.96
	1963-70		-.06	-1.93		DL	.95
OECD (1968) <sup>4</sup>	1957-64		<sup>14</sup> 1.63			DL	.97

<sup>1</sup>The functional form of an equation is identified with DL for double-logarithmic, SL for semilogarithmic, L for linear, and LI for log-inverse.

<sup>2</sup>Cross-section elasticity for all nonfarm households.

<sup>3</sup>For nonfarm households in cities larger than 50,000 population.

<sup>4</sup>Student t-value less than 1.0.

<sup>5</sup>Ordinary least-squares regression.

<sup>6</sup>Three-stage, least-squares regression.

<sup>7</sup>Excludes milk equivalent of butter.

<sup>8</sup>Milk and cream for human consumption.

<sup>9</sup>Includes school lunch program.

<sup>10</sup>Exclude school lunch program.

<sup>11</sup>Includes skim milk equivalent.

<sup>12</sup>Price ratio of bread to rice.

<sup>13</sup>Consumption measured as expenditure.

<sup>14</sup>Same elasticity for 1961-63.

<sup>15</sup>Consumption measured as per capita quantity.

Principal source: Myles J. Mielke, *Compilation and Analysis of Demand Elasticities for Livestock Products in the European Community and Japan: Based on Studies Using Historical Series from the 1950's with Projections up to 1985*, Foreign Demand and Competition Div. Working Paper, U.S. Dept. of Agriculture, May 1978. See detailed list of references at end of appendix table 3.

Appendix table 3—Japan: Demand elasticities for eggs

Reference information			Elasticity of—			Statistical information	
Commodity and source	Time period		Income	Own-price	Cross-price	Equation <sup>1</sup>	R <sup>2</sup>
	Historical	Projection					
Filippello (1970)	1965		0.20	- 0.06	0.32 fish .36 wheat - .13 rice		
Filippello (1970)		1980	.27	- .03	.21 fish .03 wheat - .07 rice		
FAO (1962)	1957-59	1970	1.00				
FAO (1967)	1961-63	1975-85	.80			SL	
FAO (1971)	1964-66	1970-80	.50			LI	
Japan (1974) <sup>2</sup>	1963		.66			DL	
	1965		.55			DL	0.97
	1967		.48			DL	
	1969		.34			DL	
	1970		.30			DL	
	1972		.23			DL	
	1973		.17			DL	.57
Japan (1974) <sup>3</sup>	1955-64		1.42	- .66		DL	.99
	1964-73		- .45	- .92		DL	.90
	1955-73		1.34	* - .003		DL	.95
OECD (1968)	1957-64		1.70			DL	.99
	1961-63		1.70			DL	
		1975-85	.80				
Lopez (1981)	1960-78 except 1966		.90			DL	.98

<sup>1</sup>The functional form of an equation is identified with DL for double-logarithmic, SL for semilogarithmic, L for linear, and LI for log-inverse.

<sup>2</sup>Cross-section elasticity for all nonfarm households.

<sup>3</sup>For nonfarm households in cities larger than 50,000 population.

<sup>4</sup>Student t-value less than 1.0.

Principal source: Myles J. Mielke, *Compilation and Analysis of Demand Elasticities for Livestock Products in the European Community and Japan: Based on Studies Using Historical Series from the 1950's with Projections up to 1985*, Foreign Demand and Competition Div. Working Paper, U.S. Dept. of Agriculture, May 1978. See detailed list of references following this table.

## Japan's Feed-Livestock Economy

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# Appendix Tables

Appendix table 4—Japan: Components of formula feed, all livestock

Japan fiscal year	Corn		Sorghum		Wheat		Barley		Rice		Other	
	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent
1960	1,371	47.5	50	1.7	—	—	—	—	—	—	—	—
1961	1,857	44.8	210	5.1	76	1.8	19	0.5	—	—	—	—
1962	2,286	45.4	410	8.2	43	.9	6	.1	—	—	36	0.7
1963	2,583	41.2	787	12.5	38	.6	31	.5	—	—	49	.8
1964	3,016	40.0	1,011	13.4	36	.5	83	1.1	—	—	130	1.7
1965	2,869	35.0	1,544	18.9	21	.3	125	1.5	—	—	145	1.8
1966	3,233	32.5	2,366	23.8	17	.2	97	1.0	—	—	111	1.1
1967	3,313	32.0	2,581	24.9	18	.2	87	.8	—	—	132	1.3
1968	4,284	37.6	2,275	20.0	17	.1	90	.8	—	—	99	.9
1969	4,765	35.5	2,939	21.9	43	.3	109	.8	—	—	169	1.3
1970	4,417	29.4	3,972	26.3	140	.9	129	.9	—	—	467	3.1
1971	3,949	25.1	3,615	23.0	125	.8	130	.8	1,405	8.9	366	2.3
1972	5,232	30.0	3,621	20.8	132	.8	148	.8	1,227	7.0	401	2.3
1973	6,332	34.9	3,895	21.5	122	.7	233	1.2	493	2.7	327	1.8
1974	6,093	35.7	4,197	24.6	45	.2	153	.9	—	—	399	2.4
1975	6,263	37.1	3,815	22.6	15	.1	157	.9	—	—	399	2.4
1976	6,787	36.3	4,613	24.7	58	.3	166	.9	—	—	285	1.5
1977	7,351	36.8	5,031	25.2	132	.7	165	.8	—	—	263	1.3
1978	8,164	38.5	5,105	24.1	163	.8	200	.9	—	—	256	1.2
1979	8,934	39.2	5,481	24.0	178	.8	204	.9	—	—	320	1.4
1980	10,359	46.2	3,689	16.6	145	.7	198	.9	—	—	198	1.3
	Wheat bran		Rice bran		Rice bran oilcake		Other brans		Alfalfa meal pellets		Soybean meal	
	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent
1960	302	10.5	—	—	137	4.8	1	1	105	3.6	157	5.4
1961	461	11.1	56	1.4	142	3.4	1	1	180	4.3	236	3.7
1962	443	8.8	66	1.3	175	3.5	1	1	206	4.1	319	6.3
1963	516	8.2	68	1.1	217	3.5	1	1	279	4.5	416	6.6
1964	579	7.7	78	1.0	241	3.2	1	1	344	4.6	521	6.9
1965	554	6.8	74	.9	241	2.9	1	1	423	5.2	623	7.6
1966	586	5.7	69	.7	258	2.6	263	2.6	289	2.9	806	8.1
1967	495	4.8	77	.7	278	2.7	272	2.6	289	2.8	858	8.3
1968	508	4.5	115	1.0	301	2.6	300	2.6	324	2.3	939	8.2
1969	541	4.0	136	1.0	341	2.5	380	2.6	366	2.8	1,239	9.2
1970	500	3.3	154	1.0	358	2.4	456	3.0	412	2.7	1,469	9.7
1971	495	3.2	135	.9	360	2.3	492	3.1	411	2.6	1,596	10.1
1972	555	3.2	160	.9	347	2.0	519	3.0	442	2.5	1,778	10.2
1973	596	3.3	172	.9	324	1.8	554	3.1	419	2.3	1,776	9.8
1974	509	3.0	168	1.0	333	1.9	536	3.1	378	2.2	1,709	10.0

See footnotes at end of table.

Continued

Appendix table 4—Japan: Components of formula feed, all livestock—Continued

Japan fiscal year	Wheat bran		Rice bran		Rice bran oilcake		Other brans		Alfalfa meal pellets		Soybean meal	
	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent
1975	495	2.9	145	.9	321	1.9	532	3.1	332	2.0	1,787	10.6
1976	545	2.9	142	.8	315	1.7	524	2.8	341	1.8	1,942	10.4
1977	521	2.6	139	.7	321	1.6	562	2.8	340	1.7	2,205	11.1
1978	551	2.7	140	.7	294	1.4	611	2.9	344	1.6	2,364	11.1
1979	578	2.5	151	.7	311	1.4	733	3.2	341	1.5	2,474	10.9
1980	633	2.9	158	.7	282	1.3	811	3.6	312	1.4	2,489	11.2
	Other vegetable oilcake		Fishmeal		Fish solubles		Skim milk powder		Other animal meals		Total	
	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 metric tons	Percent	1,000 tons	
1960	101	3.5	171	5.9	—	—	2	2	41	1.4	2,884	
1961	127	3.1	218	5.3	57	1.4	2	2	49	1.2	4,144	
1962	172	3.4	243	4.8	63	1.3	2	2	54	1.1	5,030	
1963	248	4.0	308	4.9	57	.9	2	2	47	.8	6,277	
1964	315	4.2	371	4.9	60	.8	2	2	58	.7	7,543	
1965	378	4.6	346	4.2	69	.8	2	2	69	.8	8,188	
1966	468	4.7	342	3.4	93	.9	15	.2	88	.9	9,945	
1967	495	4.8	382	3.7	91	.9	22	.2	95	.9	10,362	
1968	437	4.7	467	4.1	91	.8	32	.3	92	.8	11,403	
1969	608	4.5	502	3.7	90	.7	45	.3	96	.7	13,443	
1970	684	4.5	474	3.1	95	.6	45	.3	82	.6	15,097	
1971	665	4.2	511	3.2	84	.5	41	.3	76	.5	15,749	
1972	661	3.8	559	3.2	96	.6	41	.2	97	.6	17,425	
1973	635	3.5	587	3.2	95	.5	43	.2	116	.6	18,140	
1974	522	3.1	552	3.2	98	.6	31	.2	113	.7	17,075	
1975	434	2.6	588	3.5	97	.6	34	.2	160	.9	16,897	
1976	480	2.6	615	3.3	100	.5	57	.3	194	1.0	18,671	
1977	393	2.0	565	2.8	90	.5	98	.5	288	1.4	19,948	
1978	361	1.7	619	2.9	84	.4	101	.5	327	1.5	21,210	
1979	403	1.8	645	2.8	91	.4	104	.5	331	1.4	22,796	
1980	451	2.0	566	2.5	77	.3	81	.4	343	1.5	22,292	

— = None or negligible.

<sup>1</sup>Prior to 1966 "other brans" were included with "alfalfa meal pellets."<sup>2</sup>Prior to 1966 "skim milk powder" was included with "other animal meals."Source: Feed Association, *Shiryo Geppo* (Feed Monthly), various issues.

## Appendix Tables

Appendix table 5—Japan: Components of formula feed, beef

Japan fiscal year	Corn	Sorghum	Wheat	Barley	Rice	Other grains	Wheat bran	Rice bran	Rice bran oilcake
1,000 metric tons									
1964	5	16	—	13	—	2	15	2	4
1965	5	16	—	13	—	2	15	2	4
1966	7	32	—	15	—	5	21	3	4
1967	18	67	—	24	—	10	33	7	7
1968	53	124	—	38	—	16	47	16	11
1969	77	171	—	45	—	29	47	23	15
1970	75	277	7	58	—	79	50	33	23
1971	69	377	13	69	82	98	69	41	26
1972	156	452	13	91	85	107	83	52	28
1973	325	605	11	111 <sup>1</sup>	29	89	102	68	27
1974	301	573	3	92	—	99	85	59	30
1975	295	477	1	95	—	103	92	47	25
1976	369	676	4	107	—	89	121	61	29
1977	421	745	13	108	—	97	117	64	34
1978	459	724	15	135	—	98	119	62	30
1979	566	845	20	142	—	116	137	64	37
1980	852	621	20	137	—	95	165	71	37
	Other brans	Alfalfa meal pellets	Soybean meal	Other vegetable oilcake	Fish- meal	Fish solubles	Skim milk powder	Other animal meal	Total
1,000 metric tons									
1964	1	2	6	2	—	—	—	—	82
1965	1	3	7	3	—	—	—	—	82
1966	3	1	10	8	—	—	—	—	123
1967	6	5	20	16	—	—	—	—	240
1968	14	18	36	30	—	—	—	—	452
1969	19	27	48	43	1	—	—	—	599
1970	25	36	66	59	—	—	—	—	861
1971	32	51	88	62	1	—	—	—	1,180
1972	41	69	101	58	2	—	—	—	1,466
1973	61	86	75	53	2	—	—	1	1,815
1974	75	87	59	48	1	—	—	1	1,670
1975	80	67	69	45	2	—	—	1	1,539
1976	71	82	101	61	3	—	10	1	1,997
1977	79	85	115	59	3	—	11	—	2,168
1978	82	91	114	62	3	1	16	—	2,218
1979	123	106	134	71	3	1	16	1	2,595
1980	149	113	141	77	3	1	14	1	2,706

— = None or negligible.

<sup>1</sup>Included with alfalfa meal and pellets.Source: Japan Feed Association. *Shiryo Geppo* (Feed Monthly), various issues.

# Japan's Feed-Livestock Economy

Appendix table 6—Japan: Components of formula feed, dairy

Japan fiscal year	Corn	Sorghum	Wheat	Barley	Rice	Other grains	Wheat bran	Rice bran	Rice bran oilcake
1,000 metric tons									
1963	59	69	2	9	—	3	145	13	38
1964	44	70	2	32	—	8	143	15	40
1965	43	97	1	34	—	12	148	17	50
1966	47	144	2	24	—	9	168	18	59
1967	58	178	1	23	—	16	166	18	68
1968	113	226	—	20	—	19	173	29	75
1969	118	268	2	21	—	44	178	27	81
1970	91	331	11	24	—	94	180	28	83
1971	67	315	11	22	81	91	189	17	90
1972	129	339	11	20	76	90	207	22	84
1973	193	334	12	38	30	61	219	20	84
1974	190	354	5	24	—	41	199	18	93
1975	204	342	6	21	—	65	212	18	93
1976	211	427	4	21	—	49	215	18	96
1977	242	489	5	22	—	52	222	23	106
1978	298	504	5	30	—	54	249	23	101
1979	337	526	7	28	—	69	258	22	104
1980	448	383	8	28	—	65	263	24	95
	Other brans	Alfalfa meal pellets	Soybean meal	Other vegetable oilcake	Fish-meal	Fish solubles	Skim milk powder	Other animal meal	Total
1,000 metric tons									
1963	1	59	60	66	3	1	2	3	673
1964	1	66	69	70	2	1	2	5	713
1965	1	80	80	72	2	3	2	6	805
1966	86	18	95	130	2	2	3	3	937
1967	106	22	107	151	3	1	6	3	1,069
1968	137	33	136	178	5	1	9	4	1,328
1969	184	31	161	205	4	1	11	3	1,527
1970	210	37	178	230	4	1	20	2	1,734
1971	240	35	189	235	3	1	21	2	1,825
1972	260	35	206	227	4	1	22	3	1,963
1973	258	34	190	203	4	2	23	4	1,929
1974	253	30	184	183	2	1	15	4	1,803
1975	243	26	205	186	3	1	19	7	1,860
1976	249	25	221	173	2	1	14	5	1,980
1977	272	27	240	156	1	1	21	5	2,125
1978	295	32	270	154	1	—	19	5	2,297
1979	331	35	277	149	1	—	17	4	2,407
1980	340	40	258	160	1	—	14	4	2,345

— = None or negligible.

<sup>1</sup>Included with alfalfa meal and pellets.

<sup>2</sup>Included with other animal meals.

Source: Japan Feed Association, *Shiryo Geppo* (Feed Monthly), various issues.

## Appendix Tables

Appendix table 7—Japan: Components of formula feed, swine

Japan fiscal year	Corn	Sorghum	Wheat	Barley	Rice	Other grains	Wheat bran	Rice bran	Rice bran oilcake
1,000 metric tons									
1963	171	202	4	11	—	19	128	16	36
1964	228	261	5	28	—	36	172	22	34
1965	297	531	5	60	—	54	203	22	56
1966	422	920	7	47	—	64	221	28	76
1967	406	905	9	33	—	66	178	26	81
1968	575	784	9	26	—	47	180	30	84
1969	687	1,041	24	37	—	60	206	37	106
1970	751	1,468	63	41	—	150	191	42	131
1971	645	1,322	71	35	416	110	160	34	131
1972	1,010	1,492	83	32	353	132	180	43	113
1973	1,505	1,597	75	57	124	120	181	36	109
1974	1,496	1,660	32	34	—	120	136	36	102
1975	1,498	1,400	6	34	—	183	111	31	82
1976	1,686	1,693	45	35	—	135	124	27	80
1977	1,904	1,814	101	30	—	102	106	24	74
1978	2,314	1,910	126	32	—	91	112	28	65
1979	2,652	2,135	132	32	—	113	113	30	69
1980	2,907	1,435	100	31	—	112	121	27	50
	Other brans	Alfalfa meal pellets	Soybean meal	Other vegetable oilcake	Fish- meal	Fish solubles	Skim milk powder	Other animal meal	Total
1,000 metric tons									
1963	1	62	48	33	28	3	2	2	890
1964	1	74	65	42	36	3	2	6	1,116
1965	1	121	105	47	48	4	2	9	1,769
1966	84	97	159	95	66	5	2	10	2,561
1967	81	89	165	92	64	3	3	10	2,446
1968	64	84	169	87	80	2	8	8	2,449
1969	76	94	249	96	102	3	18	8	3,082
1970	102	107	344	115	121	3	19	7	3,948
1971	97	34	388	97	130	1	16	5	4,058
1972	91	110	483	98	151	3	16	8	4,721
1973	94	103	540	106	162	2	17	13	5,171
1974	72	81	536	82	148	1	13	18	4,868
1975	71	63	528	58	145	1	13	26	4,541
1976	63	68	624	61	163	3	33	33	5,206
1977	61	69	703	47	153	1	66	47	5,624
1978	64	76	801	38	178	2	65	59	6,307
1979	71	77	897	52	197	1	70	57	7,049
1980	74	68	847	59	168	1	52	56	6,416

— = None or negligible.

\*Included with alfalfa meal and pellets.

\*Included with other animal meals.

Source: Japan Feed Association, *Shiryo Geppo* (Feed Monthly), various issues.

Appendix table 8—Japan: Components of formula feed, poultry

Japan fiscal year	Corn	Sorghum	Wheat	Barley	Rice	Other grains	Wheat bran	Rice bran	Rice bran oilcake
<i>1,000 metric tons</i>									
1963	2,278	509	31	8	—	23	226	36	133
1964	2,662	662	2	13	—	80	240	36	147
1965	2,450	896	14	16	—	72	168	31	122
1966	2,683	1,265	8	6	—	30	142	19	102
1967	2,753	1,424	8	4	—	36	106	25	110
1968	3,459	1,136	6	4	—	14	100	38	125
1969	3,759	1,417	15	3	—	22	100	45	130
1970	3,478	1,890	57	5	—	137	76	49	118
1971	3,139	1,586	30	4	820	63	75	40	112
1972	3,909	1,336	32	4	712	70	84	42	121
1973	4,272	1,356	25	17	310	52	93	45	104
1974	4,073	1,610	23	4	—	35	88	52	106
1975	4,217	1,593	2	4	—	46	80	48	119
1976	4,479	1,812	5	3	—	10	84	34	109
1977	4,737	1,974	12	4	—	11	75	26	108
1978	5,031	1,959	17	4	—	11	81	25	98
1979	5,307	1,969	18	2	—	20	70	34	101
1980	6,036	1,246	15	2	—	25	84	34	99
	Other brans	Alfalfa meal pellets	Soybean meal	Other vegetable oilcake	Fish- meal	Fish solubles	Skim milk powder	Other animal meal	Total
<i>1,000 metric tons</i>									
1963	1	146	302	132	263	53	2	36	4,495
1964	1	187	375	179	319	56	2	44	5,370
1965	1	200	425	147	279	62	2	51	5,274
1966	75	171	534	202	266	86	3	74	6,061
1967	69	172	558	210	308	—	4	80	6,366
1968	73	186	589	223	372	—	1	78	6,956
1969	88	208	761	239	380	84	2	79	7,881
1970	113	230	873	274	342	91	2	72	8,458
1971	120	230	923	268	368	82	1	67	8,600
1972	122	226	978	274	393	92	—	84	9,173
1973	138	193	961	271	411	91	—	96	9,138
1974	133	178	922	209	393	95	—	89	8,653
1975	135	173	977	146	430	94	—	125	8,867
1976	138	162	987	184	441	95	—	154	9,404
1977	147	155	1,136	131	401	88	—	234	9,937
1978	188	140	1,164	108	429	80	—	262	10,273
1979	204	118	1,151	131	436	89	1	268	10,624
1980	245	87	1,228	154	387	75	1	282	10,713

— = None or negligible.

<sup>1</sup>Included with alfalfa meal and pellets.<sup>2</sup>Included with other animal meals.Source: Japan Feed Association, *Shiryo Geppo* (Feed Monthly), various issues.

Appendix table 9—Japan: Livestock inventories

Japan fiscal year	Hogs					Breeding chicks	Layers			Broilers
	Total	Under 6 months	Over 6 months				Total	Under 6 months	Over 6 months	
			Total	Sows	Others					
-----1,000 head-----					-----Million head-----					
1960 <sup>1</sup>	1,918	1,140	778	246	531	2	53	8	45	NA
1961	2,604	1,662	942	420	522	4	68	12	56	NA
1962	4,033	2,395	1,638	529	1,108	5	85	14	71	NA
1963	3,296	1,925	1,371	418	953	8	91	19	72	NA
1964	3,461	2,189	1,272	465	807	14	93	80	13	NA
1965	3,976	2,619	1,357	535	822	6	114	26	88	18
1966	5,158	3,456	1,702	698	1,005	6	109	28	81	22
1967	5,975	3,996	1,980	729	1,251	7	119	30	89	31
1968	5,535	3,793	1,742	651	1,090	7	133	35	98	35
1969	5,429	3,776	1,653	659	995	8	149	39	110	41
1970	6,335	4,422	1,912	816	1,096	9	161	43	118	54
1971	6,904	4,959	1,945	841	1,104	9	163	39	124	63
1972	6,985	5,087	1,898	853	1,045	10	154	33	121	68
1973	7,490	5,289	2,024	977	1,047	11	153	32	121	80
1974	8,018	5,878	2,140	1,009	1,130	9	152	31	121	89
1975	7,684	5,602	2,082	911	1,171	9	146	29	116	88
1976	7,459	5,478	1,981	962	1,019	10	147	30	118	93
1977	8,132	5,979	2,153	1,028	1,125	9	152	31	120	103
1978	8,780	6,474	2,306	1,093	1,213	9	157	33	124	116
1979	9,491	7,009	2,482	1,168	1,314	9	157	33	124	126
1980 <sup>2</sup>	9,998	NA	NA	1,152	NA	NA	NA	NA	NA	NA
1981	10,065	NA	NA	1,150	NA	NA	NA	NA	122	131

Japan fiscal year	Dairy cows			Beef cattle								
	Total	Under 2 years	Over 2 years	Total	Female		Male		Dairy steers	Horses	Goats	Sheep
					Under 2 years	Over 2 years	Under 2 years	Over 2 years				
1,000 head												
1960 <sup>1</sup>	824	304	520	2,340	400	1,284	NA	655	NA	673	561	788
1961	885	321	564	2,313	311	1,349	NA	653	NA	618	520	677
1962	1,002	365	637	2,332	332	1,354	NA	646	NA	547	499	504
1963	1,145	416	729	2,337	359	1,309	NA	668	NA	471	464	389
1964	1,238	443	795	2,208	350	1,200	NA	658	NA	396	401	274
1965	1,289	430	859	1,886	395	919	NA	572	NA	322	325	207
1966	1,310	425	885	1,577	377	733	NA	466	NA	268	280	146
1967	1,376	462	914	1,551	362	700	NA	459	NA	240	246	113
1968	1,489	521	968	1,666	365	715	NA	585	NA	216	223	83
1969	1,663	565	1,098	1,795	390	749	NA	656	NA	190	198	64
1970	1,804	606	1,198	1,789	371	794	NA	624	NA	137	171	22
1971	1,856	611	1,245	1,759	375	714	368	116	186	124	160	26
1972	1,919	584	1,235	1,749	361	613	364	115	295	97	130	21
1973	1,780	567	1,213	1,818	343	577	335	93	444	79	137	17
1974	1,752	537	1,215	1,398	338	595	338	104	524	66	124	16
1975	1,787	552	1,235	1,857	340	609	332	101	476	43	111	12
1976	1,811	536	1,275	1,912	344	645	353	84	485	36	94	10
1977	1,888	564	1,324	1,987	351	642	366	96	531	31	82	11
1978	1,979	602	1,377	2,030	346	632	369	118	566	25	79	11
1979	2,067	620	1,447	2,083	340	623	374	116	629	22	71	12
1980 <sup>2</sup>	2,136	NA	NA	2,227	NA	619	NA	NA	749	NA	NA	NA
1981	2,104	NA	NA	2,281	NA	620	NA	NA	NA	24	NA	16

NA = Not available.

<sup>1</sup>Inventories as of February of each year.<sup>2</sup>Regular survey was not taken in 1980.Source: Ministry of Agriculture, Forestry, and Fisheries, *Statistical Yearbook*, various issues.

# Japan's Feed-Livestock Economy

Appendix table 10—Japan: Formula feed production by livestock category

Year	Chick	Layer	Broiler	Swine	Beef	Dairy	Other	Total
1,000 metric tons								
1960	NA	1,734	586	NA	5	309	248	2,892
1961	627	2,360	140	465	11	403	90	4,096
1962	687	2,831	186	628	16	520	122	4,990
1963	869	3,365	296	875	36	640	120	6,201
1964	953	4,095	383	1,137	55	711	142	7,498
1965	793	4,064	456	1,773	78	803	183	8,150
1966	949	4,443	705	2,552	125	925	200	9,898
1967	898	4,713	795	2,423	234	1,067	193	10,324
1968	1,002	4,997	993	2,433	448	1,301	183	11,356
1969	1,076	5,464	1,401	3,100	600	1,521	199	13,362
1970	1,064	5,880	1,506	3,932	876	1,741	77	15,076
1971	934	5,894	1,745	4,032	1,203	1,812	74	15,693
1972	933	6,185	2,045	4,699	1,453	1,945	85	17,345
1973	854	6,063	2,196	5,155	1,835	1,907	74	18,084
1974	769	5,693	2,170	4,860	1,665	1,732	69	17,019
1975	829	5,694	2,315	4,538	1,544	1,833	65	16,818
1976	856	5,948	2,579	5,197	2,004	1,960	74	18,618
1977	875	6,130	2,925	5,597	2,154	2,115	81	19,878
1978	893	6,246	3,107	6,262	2,197	2,268	95	21,067
1979	905	6,324	3,302	6,911	2,536	2,350	109	22,438
1980	944	6,403	3,345	6,399	2,724	2,323	116	22,252
1981	980	6,492	3,358	6,257	2,652	2,295	117	22,159

NA = Not available.

Source: Japan Feed Association, *Shiryo Geppo* (Feed Monthly), various issues.

Appendix table 11—Japan: Barley marketed as a single ingredient

Japan fiscal year	Barley
1,000 metric tons	
1970	647
1971	703
1972	765
1973	836
1974	897
1975	947
1976	1,054
1977	1,098
1978	1,097
1979	1,200
1980	1,285
1981	1,316

Source: Japan Feed Association, *Shiryo Geppo* (Feed Monthly), various issues.



Appendix table 12—Japan: Production of major livestock products

Year	Eggs, in shell	Chicken	Pork, carcass	Milk	Beef and veal, carcass
1,000 metric tons					
1960	547	NA	147	1,887	142
1961	728	NA	206	2,114	143
1962	780	NA	324	2,437	146
1963	851	NA	320	2,761	197
1964	982	176	342	3,020	237
1965	984	204	407	3,221	216
1966	1,063	240	565	3,409	154
1967	1,328	292	603	3,566	159
1968	1,415	328	590	4,016	176
1969	1,607	400	590	4,509	236
1970	1,734	490	734	4,761	278
1971	1,801	540	843	4,822	296
1972	1,794	622	885	4,939	317
1973	1,800	685	971	4,908	246
1974	1,799	725	1,098	4,868	321
1975	1,788	740	1,040	4,961	353
1976	1,859	824	1,056	5,262	298
1977	1,883	903	1,169	5,735	381
1978	1,965	1,005	1,284	6,111	403
1979	1,991	1,092	1,430	6,463	402
1980	1,999	1,128	1,476	6,502	418
1981	1,990	1,100	1,396	6,620	471

NA = Not available.

Source: Government of Japan, Ministry of Agriculture, Forestry, and Fisheries, *The Meat Statistics of Japan*, and *Statistical Yearbook*, various issues.

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