

3

COMPONENTS OF DEMAND

The Chinese revealed in the spring of 1979 that foodgrain consumption per capita in 1977 was no higher than it was in 1957.¹¹ But approximately 300 to 350 million more Chinese were averaging consumption at that level in 1977 than 20 years earlier, and a smaller proportion of production was devoted to direct human consumption (livestock feed accounted for much of the difference).¹² Then, too, 1977 was the second year of grain production stagnation, resulting in part from extremely dry weather, while 1957 and 1958 were at the apex of 1950s growth, not again surpassed until the mid-1960s.

The principal point to keep in mind in comparing past and present Chinese consumption levels is that the average level in the 1930s was already very high by international standards and the 1978-79 average level ranks China among the highest in the world. There remains excess direct demand for grain in China, not because average per capita consumption is low, but because sizable segments of the population have been consuming well below the average and because even average supply of nongrain foodstuffs is low. Purchasing more foodgrains is the cheapest means for individuals to augment consumption and producing more foodgrains is the least land-consumptive means for economic planners to supply the extra demand for calories.

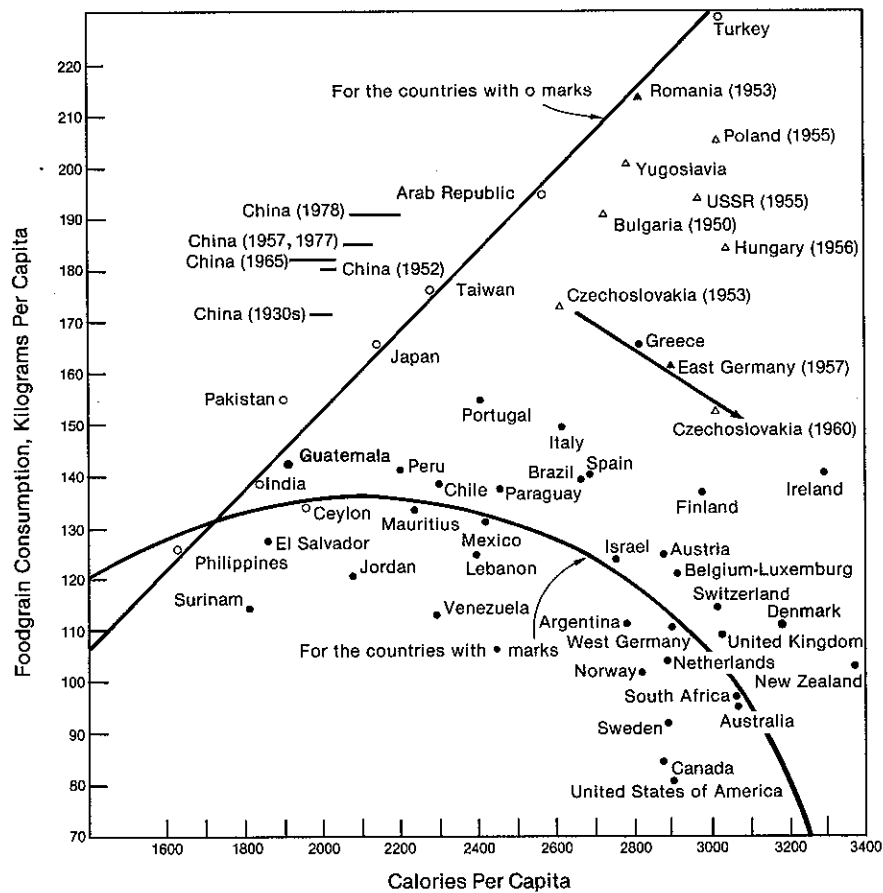
Figure 1, most of which is borrowed from a 1977 article by Ishikawa, is an international cross-section of average annual foodgrain consumption per capita plotted against average daily caloric consumption per capita from all food sources. Nations represented by triangles are Eastern European socialist countries. Those represented by circles along the rising trend line are Asian, and dots, along the falling trend line, represent all others. Among a variety of interesting observations drawn by Ishikawa, the figure makes clear that China's total caloric consumption is modest (about average among developing countries) but that its foodgrain consumption per capita ranks high. This observation suggests that improvements in the nonfoodgrain diet might be a much higher Chinese priority than further incre-

ments of foodgrains for direct consumption. But this ignores the tendency of socialist planners to prolong concentration on foodgrain output expansion, and high average foodgrain consumption levels in Asian countries generally, as well as the issue of distribution around the quoted mean levels.

Raising The Consumption Level of the Lowest 20 to 40 Percent of the Population

The redistributive nature of government policy and egalitarian nature of Chinese society can be easily exaggerated. The development process is normally associated with a widening of rural income differentials, and redistributive efforts have had to contend with this effect as well as the original maldistribution. Over and above the minimum guarantees of foodgrains, cloth, oils, shelter, basic medical treatment, rudimentary education, and so forth, the socialist principle of "each according to his work" has, in many respects, clearly triumphed over the communist principle of "each according to his need," and recent policy changes have effected an even greater compensation emphasis upon results achieved over effort expended in rural areas.¹³ The land reform in the early 1950s, though clearly redistributive, by no means eradicated rural income differentials (see Table 2), and it appears quite possible that the subsequent collectivization movement and other redistributive activities were even less effective in reducing the remaining differences, except to the extent that they provided greater security against drastic temporary and trend degeneration of welfare.¹⁴ Although China's rural income distribution is one of the most egalitarian in the world today, average per capita incomes vary considerably among administrative and productive units. In 1977, for example, average foodgrain distribution in Jiangsu was 44 percent greater

Figure 1—International cross-section relationship between per capita grain consumption per year, and per capita calorie intake per day of all food



Note: The figures for per capita foodgrain consumption are calculated as the sum of the weight of processed foodgrains consumed directly by humans and one fourth of the weight of tubers. To conform with other international data, the entries for China omit soybean consumption, which is normally included in the Chinese definition of foodgrains.

Sources: Shigeru Ishikawa, "China's Food and Agriculture: A Turning Point," *Food Policy* 2 (May 1977): 93. The idea for the graph and all entries except those for China are from Ishikawa. He used data for socialist countries for the dates indicated; where the date is not given, figures are from Food and Agriculture Organization of the U.N., 1965 *FAO Production Yearbook*, vol. 19 (Rome: FAO, 1966). For China the data was derived as follows: the figures for the 1930s, 1952, and 1957 are recomputations of data appearing, for the most part, in Thomas B. Wines, "Agricultural Statistics in the People's Republic of China," in *Quantitative Measures of China's Economic Output*, ed. Alexander Eckstein (Ann Arbor: University of Michigan Press, forthcoming), Table II-9. For the 1950s following Wines' suggestion, the "low" figure for rice and the "high" figures for other grains were used, omitting soybeans. Population figures are, for the 1950s, from T'ao-chung Liu and Kung-chia Yeh, *The Economy of the Chinese Mainland: National Income and Economic Development, 1933-59* (Princeton: Princeton University Press, 1965), p. 178; the figures for other years are May 1979 midyear estimates by John Aird appearing in U.S. Central Intelligence Agency, National Foreign Assessment Center, "China: A Statistical Compendium," ER79-10374, Washington, D.C., July 1979, p. 5. Estimates of foodgrain percentage in total calorie consumption range from 85 percent (soybeans excluded) to 90 percent (soybeans included) (see Stone, "A Review of Chinese Agricultural Statistics," *International Food Policy Research Institute*, Washington, D.C., June 13, 1979, Table 5). These figures determine the range of the estimates. The 1977 foodgrain output figures by crop are from Table 11 (tubers converted to one-fourth of their natural weight; soybeans excluded). Net foodgrain imports are from Stone, "A Review of Statistics," Table 6. The figures for processing loss by crop and calories per plot (0.05 tons) are from Wines, "Agricultural Statistics." The midyear population was estimated by Aird, in CIA, "China: A Statistical Compendium." The percentage used for direct human consumption was 79 percent (Stone, "A Review of Statistics," Table 4). The foodgrain percentage in total calories assumed the same range as above. There is no strong statistical basis for the assumption, but scattered reports of low output levels of nongrain foods suggest that this percentage has not fallen significantly.

The total output for 1965 is from Table 1. The sources of disaggregated figures are as follows: wheat, Wines, *Agricultural Statistics*, Table II-15; soybeans, the sown acreage from Wines, "Agricultural Statistics," Table II-14, and the yield from Stone, "A Review of Statistics," Table 8; coarse grains and tubers (assumed to be the same as in 1957), Nai-Ruenn Chen, *Chinese Economic Statistics: A Handbook for Mainland China* (Chicago: Aldine, 1967), pp. 338-39; rice is a residual when tubers are converted to one-fifth of their natural weight. The percentage of foodgrains consumed directly is 82 percent (Stone, "A Review of Statistics," Table 4), all other figures are from same sources as for 1977.

The total output for 1978 is from Table 1 except that net foodgrain trade figures from Stone, "A Review of Statistics," Table 6 have been added. potatoes have been converted to one-fourth of their natural weight, and soybeans have been omitted. Output figures from 1977 were adopted for potatoes and soybeans; otherwise, wheat, coarse grains, and rice were estimated to increase in equal proportions to account for 1977-78 difference in domestic output. The midyear population is from Aird, in CIA, "China: A Statistical Compendium." All other parameters used are the same as for 1977 above, except that the percentage of foodgrains consumed directly is assumed to have fallen from 79 percent to 75 percent and the proportion of foodgrain calories in total calorie consumption is assumed to have fallen from 85 percent to 83 percent (if soybeans are excluded from foodgrains) and from 90 percent to 89 percent (if they are included). The justification for these hypothesized declines may be found in the text and in Stone, "A Review of Statistics," Tables 4 and 5. If the 1977 proportions are assumed, the 1978 coordinate would be set above 200 kilograms and slightly to the left of the indicated 1978 coordinate (though still to the right of 1977). Since soybean consumption per capita has probably declined by at least 30 percent since 1957, the higher end of the total calorie consumption ranges for 1977 and 1978 (based on the "without soybean" calculation) are suggested.

Table 2—Changes in the distribution of per capita income produced, 1930s to 1952

Percentile	Share of Farm Income			Share of Total Income		
	1930s	1952	Change in Share	1930s	1952	Change in Share
	(percent)			(percent)		
Top 10	26.0	21.6	-4.4	24.4	21.6	-2.8
Top 20	42.7	35.1	-7.6	42.0	35.0	-7.0
2nd 20	23.8	21.3	-2.5	23.9	21.3	-2.6
3rd 20	16.3	17.5	+1.2	14.9	17.4	+2.5
4th 20	11.4	14.8	+3.4	13.2	15.0	+1.8
Bottom 20	5.8	11.3	+5.5	6.0	11.3	+5.3
Bottom 20	1.8	5.1	+3.3	2.5	5.1	+2.6
Average per capita income (catties of grain) ^a	972	920	...	1,084	1,082	...

Sources: Table 6 and Robert C. Roll, "Incentives and Motivation in China: The 'Reality' of Rural Inequality," a paper presented at the annual meeting of the American Economic Association, Dallas, Tx., December 28, 1975, pp. 27, 49.

The distribution of incomes for the 1930s is derived from the sample survey data presented in John Lossing Buck, *Land Utilization in China*, 3 vols. (Nanking: University of Nanking Press and Chicago: University of Chicago Press, 1937), Statistics, in Roll, "Incentives and Motivation," Chapter 3.

^a One catty equals 0.5 kilograms.

than that of Ningxia, while average distributed income per capita (excluding private plot and sideline income) in Shandong was over 77 percent higher than that of Ningxia (see Table 3). Turning to variations within provinces, in 1978 Zhejiang's 10 high-yield counties averaged 161 yuan of distributed income per capita, 57 percent above the provincial average of 102 yuan, whereas the four poorest counties averaged 40 yuan per capita.¹⁵ Among communes, average per capita income levels may still vary on the order of 1:10, and differences within communes and even brigades remain substantial.¹⁶ In 1979 Shanghai's 10 richest brigades averaged 325 yuan per capita, whereas the 10 poorest averaged 190 yuan per capita.¹⁷ Thus, the available information on distribution would indicate that for the poorest members of the poorest communes, the margin of consumption of calories (and even of rationed foodgrains)¹⁸ above a modest subsistence level may be very slight, despite average rates of foodgrain consumption ranking among the world's highest.

A formal foodgrain rationing system in both rural and urban areas was instituted in the mid-1950s. By 1956-57 the average urban ration had been raised from 125.8 to 134 kilograms of grain per capita (processed). These rations represented minimum guarantees; average consumption levels were

purported to be significantly higher.¹⁹ Although harvest fluctuations remain a problem in broad regions throughout China, resultant extreme losses in income documented by Buck²⁰ for earlier years are far less of a threat. Moreover, a variety of redistributive policies and activities of the Chinese government assist backward provinces and localities in maintaining subsistence and ensure all areas against extreme harvest loss.²¹

But there are indications that the rationing mechanism may break down in some of the areas most in need. Refugee-based research reveals cases of malnutrition in localities of several regions of China,²² and Chinese press statements have indicated that 200 million peasants each consumed less than 150 kilograms of grain in 1978.²³ If this figure refers to unprocessed grain, then the processed figure would be around 124 kilograms,²⁴ well below the 1957 average urban ration. This suggests that some of the targeted increase in production might be devoted to raising the consumption standards of the bottom quintile of the population.

Although it is difficult to estimate how much positive distributional impact on China's lower income and consumption strata will result from the broad spectrum of recent policy changes to be discussed later in the paper, some direct measures have

Table 3—Average rural provincial foodgrain and income distribution

Province	Average Foodgrain Distribution Per Capita					Average Cash Distribution Per Capita from Collective Income		
	1976	1977	1978	1979	1957	1977	1978	1979
	(kilograms)					(yuan)		
Anhui							66.7	70.2
Beijing								8.7 greater than 1978
Gansu								20.8 greater than 1978
Guangdong			32 greater than 1977					
Heilongjiang						84.0	110.0	
Henan								7.8 greater than 1978
Hunan								13.5 percent greater than 1978
Jiangsu		219.5	249.5			67.0	85.0	
Jiangxi				300.0			73.0	89.0
Jilin		209.0	249.5			81.0	107.0	
Liaoning		205.5	220.0			77.0	87.6	
Ningxia		152.2	187.2			63.5	80.2	
Qinghai			25 greater than 1977					
Shandong			24 greater than 1977					
Sichuan	184.4	217.5	246.6	250.0		112.6 10 greater than 1976	112.4 8 greater than 1977	
Xinjiang		169.3	184.8	193.3		73.6	85.6	102.6
Xizang			37 greater than 1977			104.0	130.0	
Zhejiang			42.5 greater than 1977	285.0	57.5	84.5	102.5	120.0
Average			9 percent greater than 1977				13.7 percent greater than 1977 ^a	

Sources: Average foodgrain distribution per capita: Stone, *A Review of Chinese Agricultural Statistics, 1949-79*, Research Report 16 (Washington, D.C.: International Food Policy Research Institute, forthcoming), Table 4A.

Average income distribution per capita:

Anhui: FBIS, *PRC*, April 22, 1980, p. O4; and January 18, 1980, p. O4.

Beijing: FBIS, *PRC*, February 14, 1980, p. L1.

Heilongjiang: FBIS, *PRC*, July 3, 1979, p. S3.

Henan: FBIS, *PRC*, April 3, 1980, p. P1.

Hunan: FBIS, *PRC*, March 25, 1980, p. P6.

Jiangsu: FBIS, *PRC*, May 25, 1980, p. O3; May 30, 1980, p. O4.

Jiangxi: FBIS, *PRC*, April 24, 1980, p. O8.

Jilin: FBIS, *PRC*, May 1, 1979, p. S3; May 9, 1979, p. S4; "Rural Economy Looking Up," *Beijing Review*, May 11, 1979, p. 5.

Liaoning: FBIS, *PRC*, June 5, 1979, p. L9; June 8, 1979, p. S4.

Ningxia: FBIS, *PRC*, May 16, 1979, p. T1 (where the 1978 increase over 1977 was given as 26.3 percent); elsewhere it was given as 16.7 yuan.

Shandong: "up 9.8 yuan in 1978" FBIS, *PRC*, April 25, 1979, p. O5; "up 8.7 percent" FBIS, *PRC*, June 25, 1979, p. L18.

Sichuan: FBIS, *PRC*, April 4, 1979, p. Q1; May 14, 1979, p. Q4.

Xinjiang: FBIS, *PRC*, May 11, 1979, p. T1; April 10, 1980, p. T2.

Xizang: FBIS, *PRC*, June 25, 1979, p. Q2.

Zhejiang: "Average rural per capita income in the highest yield counties in 1978 was 161 yuan...57 percent greater than the provincial average" (FBIS, *PRC*, April 17, 1979, p. O4). Also see, FBIS, *PRC*, February 13, 1980, p. O4.

All provinces: FBIS, *PRC*, June 14, 1979, p. L9; Minister of Finance Zhang Jingfu "Report on the Final State Accounts of 1978 and the Draft State Budget for 1979" (delivered at the 2nd Session of the 5th National People's Congress on June 21, 1979), *Xinhua* [New China] news bulletin, June 29, 1979; FBIS, *PRC*, July 3, 1979, pp. L6-L7.

Note: Income and foodgrain distribution is shown, but not private plot and sideline income.

^a 1979 per capita income distribution from the collectives increased more than 10 yuan over 1978 and 20 yuan over 1977, suggesting that the national average was less than 73 yuan in 1977 and less than 93 yuan in 1979.

been taken that should raise consumption standards of the poor localities over 1979 levels. Already in 1978 large increases in collective income and foodgrain distribution were registered in a majority of Chinese provinces. Except in two cases, all provinces, municipalities, and autonomous regions increased per capita collective distribution. The average provincial increase across China was 9 percent for foodgrains and 14 percent for per capita distribution of collective income (see Table 3). In 1979 the state reduced (compulsory) rural grain purchases by 2.5 million metric tons. From 1979 onward, wet rice areas with foodgrain rations of less than 200 kilograms (probably unprocessed) and nonstaple foodgrain areas with rations under 150 kilograms have been exempt from state purchases. Newly reclaimed land will be exempt from state purchases for the first five years of production.²⁵

Agricultural taxes, which averaged a little over 5 percent of agricultural crop output in 1974²⁶ and 3.35 percent of gross industrial and agricultural output value of rural areas in 1977, were further reduced or eliminated for poor communes. Rural processing enterprises operated by the people's communes are now tax exempt until the annual profit reaches 3,000 yuan (as opposed to 600 yuan before), while all new rural industrial enterprises (exclusive of tobacco factories, distilleries, wineries, and cotton mills) in financial difficulties can operate tax-free for two to three years. In frontier counties and national autonomous areas, the tax exemption is for five years. The Ministry of Finance estimates that these tax reductions alone will add 1 billion yuan to rural incomes.²⁷ The incidence of the tax reductions falls primarily on low-income areas.

There remains an estimated 25.4 billion yuan flowing to China's countryside in 1979 from the state²⁸ to be set against remaining direct and indirect rural taxes. Although social relief funds and aid to communes and brigades are included in this sum, the extent to which low-income groups will benefit from the programs financed thereby remains unclear.

If we made the very conservative assumption that income distribution in 1978 was no more egalitarian than it was at the end of the land reform in 1952 and that foodgrain distribution was identically correlated with income distribution, then the bottom income

quintile of the Chinese population consumed an average of 113.6 kilograms of processed grain per capita in 1978 and the fourth quintile averaged 150.7 kilograms per capita.²⁹ Bringing the bottom quintile's consumption up to the estimated 1978 average level of 201 kilograms per capita would then require about 21.3 million metric tons (unprocessed grain); the fourth quintile's requirement would be about 12.2 million metric tons for a total of 33.5 million metric tons.³⁰ All things considered, however, it seems highly unlikely that the 1978 income distribution is as skewed as it was in 1952, whereas it is very likely indeed that the distribution of foodgrain consumption is significantly less skewed than is income, even considering flaws in the rationing system and upward leaks in the official distribution ceilings.³¹

Furthermore, ignoring the above-mentioned biases, if the 150-kilogram figure quoted by the Chinese press is in terms of processed grain, then the incremental foodgrain requirement to bring the consumption of the bottom two quintiles up to the average is more likely to be in the neighborhood of 20 million metric tons (unprocessed). Moreover, it is not at all clear that the Chinese government has the intention of increasing consumption levels of poor localities to anywhere near the current national average through unilateral state programs within the 1979-85 planning period. Under our more pessimistic assumptions about the 1978 mean level of per capita consumption of the bottom quintile of the population (113.6 kilograms per year), raising the average to 150 kilograms (123.75 kilograms processed) would require a little less than 2.5 million metric tons, which would be covered by the 1979-85 reduction in compulsory grain deliveries. In the eyes of the government, this sum would be enough to alleviate the most drastic insufficiencies among the Chinese population.³²

If the sole beneficiaries of the one billion yuan to be transferred to rural areas through tax reductions were lower-income groups and this sum completely devoted to increased grain consumption (which may be perilously close to the truth), an estimate of 4.3-5.8 million metric tons of additional grain³³ would be available to the bottom quintiles for a total of 7-8 million metric tons.

The remaining 25.4 billion yuan flowing to rural areas in 1979 is an estimated gross sum, not an increase over 1978. Aid to rural

communes actually declined (from 7.695 billion yuan to 7.05 billion yuan) from 1978 to 1979.³⁴ Funds for capital construction, rural enterprises, and social relief rose from 4.8 billion yuan to 7.8 billion yuan, but of the increment, the extra share devoted to social relief was probably not large.³⁵ Loans to communes and brigades from rural banks and credit cooperatives rose from 10.03 billion yuan to 13.03 billion yuan, but the lion's share (11.6 billion yuan) was devoted to agricultural development and commune-run industries, and certainly not to consumption loans.³⁶ By far the largest increase in the rural package derives from an estimated 8 billion yuan for increases in state purchase prices for agricultural products.³⁷ But, as will be discussed in subsequent sections, the primary incidence of this increase will more likely be in high-income and fast-growing rural areas.

In summary, although the lowest two quintiles of the Chinese population may require 20-33 million metric tons per year of additional foodgrains to achieve the 1978 national average for per capita consumption, direct financial arrangements may make possible increases of around 7-8 million metric tons if the 1979 policy changes extend through 1985. Further improvement for those poor areas appears to be dependent on production increases and population control, both of which may continue to be difficult tasks despite policy changes which facilitate the former, especially in well-organized and wealthier areas.

Maintaining Per Capita Consumption Levels

The next question to be addressed is that of how much foodgrain will be required to maintain the status quo: that is, to feed the 1985 population at the sufficiency level achieved for the 1978 population. The important thing to note is that incremental demand in this regard will not be generated so much from numerical growth in population as from chronological growth. In estimating how much additional grain must be supplied to satisfy all of China's citizens in 1985 to an extent equal to that enjoyed in 1978, one must first recognize that an identical per capita ration will not be sufficient owing to

the changing age distribution of the Chinese population. Although there appears to be no one inside or outside China who has a highly detailed and accurate knowledge of the Chinese population, John Aird, of the Foreign Demographic Analysis Division of the U.S. Department of Commerce, appears to produce the most comprehensive and authoritative materials readily available on the subject. If his figures³⁸ are even generally correct, something on the order of 40 percent of China's population in 1978 were children under 15 years of age. The results of a recent sample survey conducted by Song Jian and three other Chinese scientists seem to confirm Aird's data, suggesting a figure of 38.6 percent. This means that the numerical mean ration based upon the entire population (approximately 201 kilograms per year processed, aside from stock contributions) is substantially below the average adult ration (which may be as high as 269 or more kilograms).³⁹ Thus, even if birth and death rates were zero over 1979-85, a sizable amount of grain would be required to supply the new adults with adult rations, and adolescents with increases commensurate with their quantitatively greater nutritional requirements in 1985.

Appendix 1 attempts to incorporate this phenomenon into a rough estimate of incremental foodgrain requirements for supplying the 1985 population with rations equal to those available to members of a similar age group in 1978. In the absence of relevant Chinese data, people 15 years old and older have been assigned 100 percent of an adult ration indiscriminate of age and sex. The weighting then proceeds: 14 years (90 percent), 13 (80 percent), 12 (70 percent), 11 (60 percent), 10 (50 percent), 9 (45 percent), 8 (40 percent), 7 (35 percent), 0-6 (an average of 15 percent) of an adult's ration.

There is no doubt that these weights are highly arbitrary, but it is quite likely that they represent some improvement over the assumption that all newborn children are immediately adult consumers and that changes in the age distribution of the population have no impact on the degree of adequacy of foodgrain supplies. Since there is no data available for age distribution of deaths, all deaths (1979-85) are assumed to be of adults, which gives a systematic downward bias to the estimates; but child deaths have been greatly reduced in China in the past 30 years, so the size of the error, in view of the relatively low hypothesized

death rates, may not be too large. Furthermore, the bias should be partially counterbalanced by the absence of an estimate for the reduction in consumption requirements for aged Chinese over the 1979-85 period.

The results of this exercise show that a large quantity of grain—about 42-46 million metric tons per year—will be required by 1985 over and above the 1978 level just to hold the line on consumption per person relative to age. China's fulfillment or failure to fulfill 1980 and 1985 target rates of natural increase is fairly immaterial to the estimates. As Appendix 1, Table 12 shows, the Official A estimates use the official 1978 vital rates (including the lower of the two given death rates) and assume a 1 percent rate of natural increase during 1980-85. The Official B estimates use the official 1978 rates (including the higher of the two death rates) and assume rates of natural increase of 1 percent in 1980 declining to 0.7 percent in 1985. Aird's estimates, based on his projected rates, are actually the lowest owing to his higher hypothesized death rates. The three estimates are all relatively close since they all depend heavily on Aird's population estimates for 1963-78, which have been selected as those most likely to be accurate among series readily available. Even official population estimates are now drawing very close to Aird's.⁴⁰

Grain Stockpiling Food Processing Brewing, and Other Industrial Uses

China's national grain stockpile, which was probably quite depleted by the early 1960s, was as high as 40 million metric tons in the early 1970s and is apt to be no lower in 1979 despite two recent years of output stagnation. It has therefore been accumulating at an average rate of 1-2 percent of yearly output. A 1.5 percent figure would allow China by 1985 to surpass its long-range stockpiling target formulated in the early 1970s; a lower figure is more likely in view of greater administrative emphasis since 1978 on leaving more grain in rural areas.⁴¹ But even the 1.5 percent figure would only take 6 million metric tons from a hypothetical 400-million-metric-ton 1985 production figure and less than 1.5 million metric tons of the 95-million-metric-ton increment.

These figures probably do not include local and provincial stocks, of which very little quantitatively is known. Although visitors' reports confirm the existence of stocks at several local levels, the slight information available indicates that they may not be comparable in the aggregate to the national stockpiles.⁴²

Ishikawa has estimated that the proportion of grain used in industry and for food processing and brewing in 1952, 1956/57, and 1965 were 2 percent, 3 percent, and 2 percent, respectively.⁴³ His foodgrain balance calculations in a recent article suggest that the proportion may only have risen to 3 percent again by 1974.⁴⁴ If this is so, then it seems likely to have declined again in 1976/77 when foodgrain production per capita dipped back toward the levels of the 1950s and 1960s, exacerbated by larger feedstock requirements.⁴⁵ The proportion should have recovered to 3 percent in 1978, and with prospective grain production increases running well ahead of population growth, it can be expected to rise slowly over the 1980s. A proportion of more than 6 percent (6 million metric tons) for the hypothesized increment of 95 million metric tons (not the average for 400 million metric tons) would not be surprising in view of a renewed flurry of activity⁴⁶ in such industries and more favorable tax and financing schemes available from 1979.⁴⁷ This would bring the average proportion for the entire 400 million metric tons toward 4 percent by 1985.

If 7-8 million metric tons for immediate increased direct consumption levels of the lowest quintiles, 1-2 million metric tons for stocking, 6 million metric tons for industrial use, food processing, and brewing, and 42-46 million metric tons for population growth are added, it would still leave 33-39 million metric tons of the targeted increase unaccounted for.

Past and Future Trends For Live-stock Feed

A large portion of the remainder, particularly in view of the relatively low probability of actual target fulfillment by 1985, is likely to be devoted to improvements in diet quality (as opposed to quantity). Aside from illustrations of China's unusually high foodgrain consumption per capita figure, Figure

1 also indicates the relatively modest position with respect to nongrain caloric intake per capita. For nonrationed items such as fruit and animal products,⁴⁸ the skewness of distribution far exceeds that of foodgrains. With average consumption at very modest levels, and greater skewness, it is clear that the bottom brackets enjoy very little of these commodities.⁴⁹

The most important food in this respect is undoubtedly pork. The Chinese have focused on increasing the pig population because of its fecundity and early maturity, its omnivorous and hence less immediately competitive consumption habits, its importance in traditional Chinese diets, and its efficiency as a fertilizer producer. The hog population has quintupled since 1949⁵⁰ despite major setbacks due to pricing inconsistencies and excessive compulsory grain deliveries in the mid-1950s (and very possibly the mid-1970s),⁵¹ as well as an intermediate decline due to the agricultural failures of 1959-61.

The average annual peasant consumption of pork in 1952, 1955, and 1956 was 4.95 kilograms, 3.3 kilograms, and 3.85 kilograms, respectively, with worker and employee consumption in 1955 at 5.90 kilograms.⁵² Chinese figures place 1977 consumption of all meats (dominated by pork) at 7.5 kilograms per year,⁵³ somewhat lower than recent Western estimates,⁵⁴ and there are current plans to further increase these levels to deal with active unsatisfied demand. Although rural private and collective pigs are fed a substantial amount of nonfeedgrain, low-opportunity-cost materials, Western analysts suggest that further increases in hog stocks will require a commitment to increase the percentage of feedgrain consumption.⁵⁵

In any event, the planned improvement in diet quality⁵⁶ will be a more land-consumptive means of furnishing calories. Ishikawa estimates the cultivated land requirements for supplying meat and vegetable oils at, respectively, 3.3 and 10 times that of furnishing foodgrains directly.⁵⁷ Public pledges by party and government officials and reports of pent-up demand for meats and oils are entirely consistent with China's high relative proportion of foodgrains in total calories consumed (see Figure 1), rising disposable income per capita in both rural and urban areas,⁵⁸ recent policy changes that immediately raise rural and urban money income,⁵⁹ and high-income elasticities

of demand for such products relative to foodgrains.⁶⁰

The proportion of foodgrain production used for livestock feed in the 1930s has been estimated at about 12.5 percent⁶¹ and was roughly the same in the 1950s. About one-fifth of this was fed to hogs.⁶² The share for all animals may have been as high as 14 percent in 1965⁶³ and 14-17 percent in 1974,⁶⁴ if fine-feed (concentrate) consumption rates per head of livestock were allowed to drift up with increases in per capita grain supplies for nonseed purposes as hypothesized by Ishikawa. A rough calculation on 1978 livestock figures⁶⁵ indicates that if rates of concentrate use per head of livestock and the ratio of whole grain to millings were kept at the low 1957 levels, only about 10.7 percent of total 1977 foodgrain production (or 9.9 percent of 1978 production) was consumed by pigs and large animals, although almost 40 percent of the total was hog feed.⁶⁶

These last figures may be a closer approximation of current reality since even model pig-raising units in the late 1970s were feeding their animals an average of only 10.8 percent more grain per head than in 1957.⁶⁷ Even if the latter were representative of pig raising generally, it would require less than an additional 1 percent (for a total of 11 percent) of total grain supplies.

But current policy is moving away from grain-saving techniques.⁶⁸ If the entire nutritional requirements of the 1978 Chinese hog stock were supplied by grains and millings, it would necessitate the allocation of an additional 30 million metric tons. This, of course, will not occur, but present policies could bring about a 15 percent increase in the long-term hog population growth rate through 1985 (from 3.5 percent to 4 percent). Some of the increment over the old rate could result from planned and current development of suburban pig farms requiring high rates of concentrate use. But development of these farms would have to occur at several times the current rate to utilize as much as a million tons of foodgrain by 1985.

Assuming essentially no growth in absolute quantities consumed by the stagnant large animal population,⁶⁹ adding 95 million pigs to the 1978 stocks would mean an extra 4 million metric tons of feedgrains. This includes the high concentrate diets of hogs reared on present and planned suburban pig farms, but not any further upward drift in the fine-feed consumption rates of private

and collective sideline pigs. If concentrate consumption by all pigs were allowed to drift up by a second 11 percent over 1957 levels (to the average level of state procured pigs in the first six months of 1979), an extra 2 million metric tons would be needed.

The target adopted by the Central Committee in December 1978 called for a 30 percent increase in cattle, sheep, and pigs and for the annual quantity of meat products to double by 1985.⁷⁰ This would mean an additional 90 million hogs, 51 million sheep, and 3 million cattle above December 1978 stocks, and an extra 7.5 million metric tons of meat products.⁷¹ Assuming the higher of our previous fine-grain consumption rates for hogs, the 1957 rate for large animals, and the 1957 ratio of grain to millings in concentrate synthesis for all stock (45:55), then the targeted increments would call for 3.8 million tons and 1.2 million tons of additional unprocessed grain for pigs and cattle, respectively. It should be noted that to say that cattle herds will increase by 30 percent does not imply a 30 percent increase in China's 84 million other large animals (including horses, donkeys, mules, camels, yaks, and breeds of oxen excluded from cattle statistics).⁷²

Large Animals

In 1957 water buffalo accounted for 13.127 million (15.7 percent) of China's 83.457 million large animals, whereas all varieties of oxen numbered 50.485 million (60.5 percent).⁷³ By 1978 large animals had only reached 93.89 million with "cattle" accounting for about 10 million (10.7 percent) of the total.⁷⁴ Cattle here include water buffalo (about 20 percent of the total) and dairy cattle, but possibly only the common (yellow) ox from among a number of varieties,⁷⁵ or only those raised specifically for beef as opposed to those used as draft animals. If it includes all oxen, then numbers of other draft animals believed to be in decline must have increased over the 1957-78 period, while cattle numbers alone dropped drastically. This contradicts both Western analysts and the implications of official reports. Even if the 10 million figure does not include most oxen, it is clear that most of those that are included, as well as the stocks of water buffalo, have declined since 1957. This conclusion seems to be borne out

by scattered reports from both agricultural and herding provinces.⁷⁶

The government has aggressive plans to increase China's inadequate herd of 500,000 dairy cattle and is developing long-range schemes to utilize the northern grasslands for beef cattle.⁷⁷ But the plans are still too small in scale and the transformation of the grasslands too distant to reach the required numbers by 1985, let alone the figure for meat increase. In the collective economy of major growing areas, cattle raising cannot be expected to compete economically with pig raising, and calving rates are too low to generate the required increases.

The most auspicious opportunity is probably presented by major herding provinces such as Qinghai, which accommodated 16 million cattle in 1956,⁷⁸ as opposed to 5 million in 1979.⁷⁹ Restoration of reclaimed farmland to pasture and elimination of government limitations on private stock, as well as technical progress in breeding and varietal improvement, should facilitate the process of recovery and expansion, provided the decimation through soil erosion of former pasture is not critically extensive.

The additional yield of meat from an extra 3 million head is likely to be only about 40,000-140,000 kilograms⁸⁰ due to the unavoidable low slaughter rate of large animals. It is not impossible that the stock increment (1979-85) will exceed the given figure,⁸¹ but the additional feedgrain required is not apt to surpass the estimated 1.2 million metric tons since the largest stock increases are likely to occur in pastoral provinces such as Qinghai and Xinjiang, where cattle will feed primarily on grasses.

As for other large animals (except perhaps camels, yaks, and highland horses), it is reasonable to assume that stock increases in herding provinces and middle-income localities better able to afford draft animals will be largely offset by continued stock declines in the poorest agricultural localities (owing to more direct competition with humans and with the more economical meat-and-fertilizer-producing hogs) as well as in richer areas where more extensive and effective mechanization will continue to displace draft animals.

Sheep and Goats

Sheep and goat numbers have already

responded well to pastoral policy reform and will be quite capable of reaching and even surpassing their target. Following 15 years of growth at slightly over 2 percent per year (1962-77), herds expanded 5.3 percent between December 1977 and December 1978, 7.3 percent between July 1978 and July 1979, and 4.1 percent between December 1978 and December 1979.

Less than 4 percent per year (1978-85) would be required to increase numbers by 30 percent over the December 1978 stock of 170 million.⁸² But at current slaughter rates (about 40 percent), the targeted increment of 51 million head would only provide 300-500 thousand tons of lamb and mutton.⁸³ The herd growth rate may indeed be higher than the hypothesized 4 percent per year. A high rate is indicated not only by the 1978-79 performance, but by a new slaughtering regimen which should take the maximum number of animals in the fourth quarter for more efficient fodder utilization and maximum herd growth.⁸⁴ But even considering the auspicious signs, the meat contribution of the increment to the sheep and goat population is not likely to be more than a million tons.

Fortunately, although both the late 1950s and mid-1970s were periods in which pastoral lands were viewed as prime targets for expansion of grain acreage,⁸⁵ the current period rejects such a view. Herders have been released from grain production duties to a considerable extent, and herding is no longer regarded as a retardant of progress in grain production.⁸⁶ Because the vast majority of China's sheep and goats are raised in predominantly herding areas where the animals graze for most of the year and winter for two to three months on cut grasses,⁸⁷ no estimate has been made to account for extra feedgrain consumption of these animals.

Poultry

No mention of poultry has been attempted thus far. Unfortunately, national statistics on absolute poultry numbers are unavailable, probably even to Chinese officials. Therefore, increments to feedgrain demand from this source have been ignored. By means of justifying the omission, an "order of magnitude" estimate of poultry numbers in 1979 has been made on the basis of the quantity

of chicken eggs purchased by the state during the first half of the year.⁸⁸ Although the results of this exercise must be regarded as an extremely loose approximation, they suggest that poultry numbers (including chickens, ducks, and geese) may have been on the general order of a billion birds at midyear 1979, about three times the estimated figure for 1956,⁸⁹ implying a growth rate of about 4.7 percent per year.

If this rate were extrapolated or even doubled through 1985, additional grain demand generated by the increment over 1978 stocks would be well within the most optimistic standard of error for our estimate of aggregate incremental demand for foodgrains between 1979 and 1985. This is especially true because the amount of grain the average Chinese bird is allowed to consume has been kept low. New suburban facilities for poultry and egg production accommodate about 200,000 birds, while new commune-level facilities average about 7,000 birds.⁹⁰ Development of the former, although contributing to increased feedgrain demand, is still in the initial stages (the first large center was opened in 1978),⁹¹ whereas commune facilities are of a size that allows substantial substitution of low-opportunity-cost materials for feedgrains.

Hogs: Greater Numbers Versus Heavier Stocks

Unless poultry is counted as meat, the bulk of the targeted meat product increase of 7.5 million metric tons must come from hogs. But how much meat can be expected from an increment of 90 million hogs? Using parameters from the mid-1950s, the quantity of pork available from the increment would be 2.3-3.1 million metric tons,⁹² which together with increased mutton and beef could reach the neighborhood of 4 million metric tons of extra meat. Increased consumption of large species principally identified as draft animals has not been included (the most important omission is probably that of yaks). Inclusion of dead draft animals and yaks raised for meat might add an absolute maximum of about 2 million metric tons to 1978 total meat consumption figures,⁹³ but surely a much smaller figure (at least an order of magnitude lower) is appropriate for the probable 1985 increment over that level.

If fulfillment of the target for increased meat is seriously intended (which cannot be taken for granted), the solution to the problem may lie in attempting to drive the hog stock growth rate beyond 4 percent per year; attempting to increase the average weight of hogs; or a combination of both approaches. Boosting the rate of stock increase has the disadvantages of requiring lower slaughter rates early in the period and requiring large and sudden, rather than gradual, increases in grain-consuming stock held over the winter—just at a time when it appears the leadership has finally come to believe that it is quite important to bring about some clear and immediate improvements in popular living standards, especially in rural areas.

Increasing the average weight per pig, however, would seem to require even more fine feed for each additional kilogram of pork. If the remaining 3.5 million metric tons of targeted meat production were to be attained entirely from increased hog numbers, the 1985 stocks would have to be some 76 percent above the year-end 1978 level. A further increment of 5.5 million metric tons of unprocessed grain plus additional millings would also be required.⁹⁴ If the same result were to be achieved by increasing the weight of the planned 1985 stock of 392 million hogs (1978 stocks plus 30 percent), the required weight increase might be over 22 kilograms (for a total of about 90 kilograms per hog at slaughter time if the 1957 average was relevant for 1978).⁹⁵ According to previously well-accepted parameters in the 1930s, this would necessitate the allocation of an additional 18.2 million metric tons of feedgrains.⁹⁶

Chinese officials until recently have evidently maintained a policy of pushing low concentrate use in feed schedules to an uneconomical extent.⁹⁷ The result of a typical 1974 official study⁹⁸ implied that as much as 20-23 million metric tons would be needed to add an average of 22.4 kilograms to the weight of 329 million hogs (making sure that it would appear quite foolhardy not to slaughter after a relatively brief and concentrate-scarce period for fattening weaned shoats). But calculations based upon a recomputation by Wiens of a 1957 Chinese study (the original results of which may have been altered to conform with official concentrate conservation policy)⁹⁹ indicate that the feedgrain requirement for an extra 22.4 kilograms per hog would be, on the contrary, in the range of 11-15 million

metric tons, depending upon the quantity and mix of supplementary feed used. This range is even below the figure of 18.2 million metric tons derived by assuming 4 kilograms of concentrate (grain and millings) per kilogram of incremental hog weight, widely used as the rule of thumb in China in the 1930s.

Requirements and Availability of Millings

All estimates made so far have been based on a 1957 grain proportion of 44.7 percent of total concentrate weight. Most of the remaining weight has typically been supplied by millings. The larger estimate (5 million metric tons of grain for increased numbers and 18.2 million metric tons for increased weight) would also require 28.7 million metric tons of additional millings or other fine feed. At the 1977 average processing loss of 17.5 percent,¹⁰⁰ no more than 19.6 million metric tons of millings could be provided from the targeted increment of 95 million metric tons of unprocessed grain. In 1978 a maximum of 36.7 million metric tons (or about 66.7 percent) of millings out of a potential 55.3 million metric tons available in 1978 were used for animal feed (excluding poultry). Thus under the more pessimistic assumptions, if about 88 percent of all millings available in 1985 can be allocated to livestock feed, relatively tractable quantities of other concentrates will be required. If not, the slack will have to be made up by more rapid growth of the availability of other fine feeds (such as wine dregs or oil cakes from soybean, cotton, rape, sesame, or peanuts, after the oil has been extracted), or from additional grain.

The Outlook for Grain Demand From Livestock in 1985

On balance, then, where does all this conditional figure manipulation lead us? It would be absurd to pretend to give a definitive answer. But there are a few things that can be said without sinking into complete ambiguity in view of the rough picture of Chinese planning, popular responses, and current conditions available in January 1980. At least 5 million metric tons of extra unprocessed grain must be supplied to

livestock by 1985 in order to satisfy the basic stock expansion plans formulated in 1978; it seems quite likely that these plans can in fact be fulfilled. If the target for domestic supply of meat products is also to be achieved, somewhere between 6 and 19 million metric tons of additional grain must be supplied (primarily to hogs, although additional demand for poultry feed could probably also be included).

The actual figure within the range of 6-19 million metric tons depends on whether the means of increasing the meat supply focuses more on increasing weight per hog or on increasing the numbers of stock. This in turn depends primarily upon: the amount of grain available and its redistribution (the more available and less redistributed, the more grain-intensive will be the means of meat increase); the availability of nongrain feedstuffs; and the extent to which the state believes that peasants can or should be persuaded to forgo higher current incomes and standards of living now to increase national income later.

If current signs are any indication, the supply of nongrain feedstuffs is a bit of an obstacle to continued hog stock increase by means of the methods officially recommended over the last two and a half decades (although temporary removal of this constraint is not out of the question).¹⁰¹ Feedgrains will be increasingly available and will be left in the hands of those that produced it to a greater extent than before. The state, at least for the time being, appears to feel, more than in the past, that the most effective means of rural enrichment and the solution to the agricultural problem lie in allowing peasants to enrich themselves within permissible latitudes of action. The bonds restraining peasant economic activities have not been and will not be eliminated. But the range of permissible activity has unquestionably been widened.

All this would suggest that a more grain-intensive means of supplying additional pork products will be followed above and beyond what can be gained from a moderate upturn in the growth rate of hog numbers.

What little can be ascertained from the record of the first year or so of policy changes suggests that this prediction may be correct. The July 1979 official stock figure is about 4 percent above that of July 1978, a tidy but unextravagant increase over the long-term rate of 3.5 percent. But the December-to-December increase was only

2.7 percent.¹⁰² Meanwhile, it has been reported that in the first four months of 1979 the average weight of marketed pigs rose by 8 kilograms in Shanghai municipality and by 4 kilograms in Guizhou province. The national average increase for pigs sold to the state over the first half of 1979 has been given as 5.3 kilograms (from 76.5 to 81.8 kilograms) over the corresponding 1978 period.¹⁰³ Pigs sold to the state may indeed be heavier than those appearing in rural fairs and retained for home consumption. But the average for the first six months of 1979 marks a 13.8 kilogram increase over the average 1957 level for state-marketed hogs.

The appearance of the average-weight-increase statistical category itself is indicative of an official attitude encouraging weight increase as opposed to previous government efforts to promote concentrate conservation and early slaughter. Furthermore, the purchase price of pigs (by kilogram) as well as of beef and sheep has been raised.¹⁰⁴ It also appears that hogs brought for state sale have, if anything, exceeded government expectations and occasionally, facilities for storage.¹⁰⁵ Still, it is not at all clear that the meat-products target will be fulfilled. Even if it is, the additional supply will derive from increases of stocks as well as of weight. And the percentage of meat per kilogram of live weight should increase with the latter. Therefore, if forced to quote a number, 10 million metric tons for additional feedgrain by 1985 seems a reasonable estimate, with a probable maximum of 15 million metric tons. The millings complement of even the latter figure could be supplied out of the 95 million metric tons of hypothesized incremental grain production.

Increased Direct Consumption Among the Top Three Quintiles

Current rural policies notwithstanding, however, it is not completely clear whether Chinese authorities will allow livestock to consume as much as 15 million metric tons of grain so soon. One very important issue has so far been avoided: aside from feeding the 1985 population at the 1978 level, aside from raising the standard of the bottom 20 percent or even 40 percent of the population, aside from increased supplies for livestock and stockpiles, how much additional food-

grain can the average Chinese absorb? How much would he choose to consume? To what extent is this level actually dependent upon any realistic supply of nonfoodgrain items to the average Chinese citizen by 1985? These are questions about which we are not only uninformed but profoundly ignorant.

It might be suspected from Figure 1 that the middle-income Chinese would now want more nongrain foods rather than additional foodgrains. It has also been noted that he probably wants, first and foremost, more calories, and that the cheapest way for him to acquire them and the most economical and secure way for the state to supply them is to encourage more foodgrain production and consumption. But how long is this process likely to continue?

One Chinese agricultural economist¹⁰⁶ suggests that foodgrain output can be expected to grow 3 percent per year (0.5-1.0 percent below our forecast) but not much more over the 1979-85 period, and livestock feed will comprise only 10 percent of total additions to supply (slightly below our basic estimate). A growth rate of 3 percent per year in foodgrain production (1980-85) with 10 percent of the increment supplied to hogs and cattle would allow 7.14 million metric tons of additional livestock feed over that available in 1978. After 5 million metric tons are deducted to feed the planned additions to livestock at the 1978 feeding rate, the remaining grain would only cover a weight increase of 3 or 4 kilograms for each hog slaughtered. If the 400-million-metric-ton target were reached, 10 percent of the increment going to feeds would mean 9.5 million metric tons and would allow 7 kilograms of extra weight per hog.¹⁰⁷

If our ranges for other uses are correct (for stocking, industrial use, and so forth, and population growth) this would leave a mean value of 34 million metric tons for improved direct consumption in the event of 1985 foodgrain production target fulfillment. This is probably more than enough to raise the average consumption of the bottom two quintiles to 201 kilograms per year of processed grain or 269 kilograms per adult equivalent, should the recent and future policy changes result in such a distributional pattern. But as has been noted above, only about 7 or 8 million metric tons of additional deliveries to the lower-income peasants seems assured. How then are the remaining 27 million metric tons likely to be divided

among the categories of increased direct consumption and increased indirect consumption?

Despite the expectation, through international comparison, that further increases in income among middle- and upper-income peasants might lead to a modest interest in increased grain consumption, it is possible that this notion is seriously in error. Recent nutritional studies note rising foodgrain requirements of consumers who have consistently derived high percentages of caloric intake from foodgrains.¹⁰⁸ Refugee studies have also turned up evidence of high foodgrain demand in particular localities,¹⁰⁹ although such demand must be taken in the context of particularly low caloric availability from nongrain sources compared with that of the average Chinese peasant. Ultimately it may turn out that the elasticity of demand for foodgrains among even the top three quintiles of Chinese consumers is much greater than expected from examination of world-wide data.

In 1978 grain distribution per capita was 249.5 kilograms (probably of unprocessed grain) in Jiangsu and Jilin, two of China's relatively more affluent provinces within their respective regions. In 1979 Sichuan's per capita distribution was 250 kilograms while Zhejiang's was reported as 285 kilograms. Although official figures are not available for all provinces, those included are clearly in the upper range of foodgrain distribution.¹¹⁰ Jilin's value of animal products, however, is only 11 percent of the total provincial gross value of agricultural output (GVAO)¹¹¹—even less than the low national average of 13.7 percent¹¹²—and Sichuan's animal stocks have only just started to grow again after recovering from a severe decline in grain distribution (reaching a low of 184.4 kilograms per capita in 1976).¹¹³ Liaoning, which distributed 220 kilograms per capita in 1978,¹¹⁴ registered a value increase of 35 percent in pork supplies between January and July 1979 relative to the same period in 1978.¹¹⁵ But the March 1979 rise in purchase price of pigs alone,¹¹⁶ which may have been included in the pork value calculations, could cover most of the increase. Although too fragmentary to constitute proof, these data indicate no discernible decline in the rate of direct consumption increase, at least until the approximate level of the national average is reached (201 kilograms of processed grain; about 244 kilograms of unprocessed grain).

In 1954, when children comprised about 40 percent of the population (as they did in 1978),¹¹⁷ a survey was conducted covering over 16,000 peasant households in 25 provinces.¹¹⁸ "Poor" peasant families with an average income of 116.7 yuan per family member consumed a mean of 176.5 kilograms of processed foodgrains per capita (or about 1.5 kilograms per yuan of income). "Middle" peasants with an average income of 154.9 yuan per family member consumed 189 kilograms each (0.32 kilograms per yuan of income over that of a poor family member). Curiously, the marginal propensity to consume foodgrains did not drop off significantly among "rich" peasants: at 216.2 yuan per family member, they consumed 206.5 kilograms per family member, 0.29 kilograms per yuan of incremental income over that of "middle" peasant family members (see Table 4). When converted to monetary terms, the marginal propensity to consume yuan of foodgrains per extra yuan of income merely dropped from 6.1 percent to 5.3 percent. If anything the figures may overestimate the decline since richer peasants may consume foodgrains of higher quality and price. One may assume that a rich peasant in 1954 was able to consume substantially more nongrain foodstuffs than was a poor peasant.

Unfortunately a full range of variations of the marginal propensity to consume was not obtainable since the peasant categories were defined along class rather than economic lines and therefore mask much more substantial regional variation in income¹¹⁹ (and probably consumption). Nevertheless, even on the basis of this abbreviated information, it should be observed that the figure of 206.5 kilograms of processed grain would be about 5 kilograms per capita above the 1978 national average; below Zhejiang's 1979 average distribution (when converted to processed terms); but about equal to the 1978 figures for even the more relatively well-off provinces, such as Jilin and Jiangsu. All this suggests that even the middle quintile is likely to have unsatisfied demand for foodgrains. How far such demand may extend into the top 40 percent of peasant incomes and among urban dwellers is unknown, as is the point at which Chinese consumers are likely to begin eating less rather than more grain with increased incomes.

There is some indication, however, that a major point of inflection may finally be within sight. Zhejiang province has his-

torically allocated about 2 percent of total grain production to hogs.¹²⁰ In 1979, however, when distribution per capita reached 285 kilograms per capita (223 kilograms processed¹²¹ or about 22 kilograms above the national mean), and grain production increased by 1 million, hog numbers rose to 15 million—7 million above the previous record. This would indicate that about 20 percent of incremental grain production was allocated to hogs alone.¹²²

To summarize the breakdown of estimates for grain demand increases, about 43 million metric tons will be required to maintain 1978 standards of direct consumption for the older and numerically larger population. About 2 million metric tons will probably be reserved for national, provincial, and local stocks and 6 million metric tons for industrial use, processed food, brewing, and so forth; 5 million metric tons will be required as a minimum grain provision for planned increases in livestock, and 7 million metric tons will be transferred more or less directly to lower-income groups. These components sum to 63 million metric tons, which would be covered by an annual growth in foodgrain supply of 2.7 percent—a reasonably safe goal given the period under question. The remaining 32 million metric tons supplied if the 1985 target is reached will be divided principally among increased livestock feed (at least an additional 5-10 million metric tons would be required to approximate the 1985 target for provision of meat products) and increased direct consumption among all categories. Considered thus far, however, have been demand increases over and above the level supplied in 1978, which included 6.4 million metric tons of net foodgrain imports.

International Foodgrain Trade

In the immediate future, trade will almost surely play an augmented role (although still a relatively subsidiary one) in helping China meet its foodgrain demands. The importation of wheat in exchange for rice began, on a major scale, in 1961, following the agricultural failures of the period, although large rice exports began in the mid-1950s.¹²³ This kind of trade can be expected to expand. In spite of recent progress in wheat yields, China's production matrix and

Table 4—Average income and foodgrain consumption per person, and the average and marginal propensity to consume foodgrains in 1954

Category of Household	Percent of All Peasant Households	Average Income Per Household (yuan)	Average Number Per Household	Average Income Per Person (yuan)	Foodgrain Consumption Per Person		Average Propensity to Consume Foodgrains (kg/yuan)	Marginal Propensity to Consume Foodgrains (kg/yuan)	(yuan/yuan)
					Amount (kilograms)	Cost (yuan)			
Poor peasant	29.0	488.7	4.2	116.36	176.5	31.59	1.52	0.27	...
Middle peasant	62.2	774.4	5.0	154.88	189.0	33.83	1.22	0.22	0.061
Rich peasant	2.1	1,297.0	6.0	217.17	206.5	36.96	0.95	0.17	0.053
Former landlords	2.5	497.2	4.2	118.38	180.5	32.31	1.52	0.27	...
Members of Agricultural Cooperatives	4.2	704.6	5.1	138.16	195.5	34.99	1.42	0.25	...

Sources: The average income per household and the average number of persons per household are from a sample survey of 16,000 peasant households in 25 provinces. A summary of results appears in People's Republic of China, State Statistical Bureau, "A Brief Summary of Data on the Income and Expenditure of Peasant Households in 1954," *Tongji gongzuo* [Statistical Work], May 29, 1957, pp. 31-3; translated in Nai-Ruenn Chen, *Chinese Economic Statistics: A Handbook for Mainland China* (Chicago: Aldine, 1967), pp. 430-1. Chen gives the year of reference as 1955; it is actually 1954.

Foodgrain consumption per person: The amounts were calculated from information given in the State Statistical Bureau sample survey in Chen, *Chinese Economic Statistics*. They appear in jin in this source and have been converted at the rate of 2 jin per kilogram.

The cost of foodgrain consumption per person was calculated at the rate of 0.179 yuan per kilogram. The relevant price for peasants is not the retail price but the opportunity cost of eating the grains they produce—the average rural purchase price. The price used is derived from a 1950 average foodgrain price of 0.111 yuan per kilogram and an index number of 130.3 for 1954 derived as a weighted average of the average wheat and unhulled rice indexes for 1954 (1950=100). The weights are derived from the relationship between the wheat, rice, and average foodgrain price indexes for 1952. This yields a price figure for unprocessed grain of 0.145 yuan per kilogram. But since consumption was given in processed units, 0.145 yuan has been divided by an average processing loss figure (0.809) to obtain a suitable price for the processed grain (0.179 yuan). This average grain price was used for all average propensity calculations. The price data are from Stone, *A Review of Chinese Agricultural Statistics, 1949-79*, Research Report 16 (Washington, D.C.: International Food Policy Research Institute, forthcoming).

Average propensity to consume foodgrains: This is calculated from the average cost of foodgrain consumption per person, the average foodgrain consumption per person, and the average income per person.

Marginal propensity to consume foodgrains: This is calculated from the average income per person and the foodgrain consumption per person. The price used to compute the yuan of extra foodgrain consumption per extra yuan of income is an estimate of the over-quota purchase price, which ran generally 20-30 percent above the compulsory procurement price of the 1950s. The compulsory procurement price was used for 25-34 percent of all grain production between 1953 and 1956; the over-quota purchase price is relevant for the remainder. On the basis of this information, the within-quota price was estimated at 0.122 yuan per kilogram. The over-quota price was 0.153 yuan per kilogram of unprocessed grain or 0.189 yuan per kilogram of processed grain. The marginal values for middle peasants were computed using poor peasant income and consumption as a base. The marginal values for rich peasants were computed using middle peasant income and consumption as a base.

dietary habits still make it a rice-surplus, wheat-deficit economy, and the probable pattern of yield increase over the immediate future may well accentuate this characteristic. The world foodgrain price structure also argues in favor of this kind of trade, and recent econometric work indicates that the world rice price is a strong determinant of China's level of rice exports.¹²⁴ A more detailed explanation shows that wheat and coarse-grain imports are related to the two previous years' production of these crops and the previous year's trade balance (which, among other things, is influenced by the relative prices of wheat imports and rice exports). Rice exports are, of course, also related to per capita rice production and foreign exchange requirements.¹²⁵ Imports of wheat are loosely related to the procurement of grain in the North China Plain surrounding the major urban centers of Beijing and Tianjin where much of the imported grain has been consumed.¹²⁶

Even the recent grain import contract commitments (11-13 million metric tons per year through 1981)¹²⁷ cannot be seen as altering significantly the per capita consumption of foodgrains in China as a whole. Nor does it appear that land being shifted out of foodgrain production is large relative to reclamation plans, much less total cultivated acreage.¹²⁸ The imports can clearly be seen as part of a coordinated program of investment in peasant incentives: allowing more grain to be left in rural areas, particularly in North China where output is erratic owing to drought, while easing bottlenecks in transport facilities; increasing urban foodgrain stocks (especially in Beijing, Tianjin, and other waterports); and supplying the new suburban hog and poultry farms.

In this last connection, feedgrains and feedgrain products may represent a growing trade opportunity. China has recently built a farm for raising up to 10,000 hogs and another for raising 200,000 laying hens;¹²⁹ Chinese leaders are reportedly considering the installation of seven new large-scale integrated hog-raising and processing plant facilities, with an annual capacity of 90,000 hogs, primarily to serve northeastern industrial centers. Large-scale poultry operations have also been discussed.¹³⁰ This stock will be fed a substantially higher proportion of fine feed than the average levels throughout China, and authorities may very well not require contiguous rural areas to cover the additional demand, pre-

sending an opportunity for trade. But it should not be overlooked that state purchases in most provinces appear to be rising. Moreover, the vast majority of Chinese livestock will remain on private plots and in small unconcentrated collective units throughout China and will continue to subsist on substantially nonfeedgrain materials.

China was once one of the world's leading producers of soybeans with a large export market, but production may have actually declined somewhat since the late 1950s.¹³¹ Soybean acreage was probably squeezed out in the early and mid-1960s by other, higher-yielding food crops and in the 1970s was primarily intercropped and planted at the edges of fields, though total output may well have recovered to around the 1957 level. Soybeans were previously counted on a weight-equivalent basis with cereals for purposes of quota fulfillment. The ratio has recently been changed to 2:1 in favor of soybeans¹³² but is probably still low in view of their protein content, low per hectare yield, and value on the world market. Some provinces have already taken additional measures.¹³³ Despite a renewed government interest in soybean production, current diet-improvement policies may lead Chinese authorities to import soybean products¹³⁴ over and above increases in domestic output. This would be due to the value of soybeans as a protein source, their prominent role in traditional Chinese diets, the aforementioned feedgrain requirements, and both the pent-up demand for vegetable oils and high costs in cultivated land for producing them domestically.

The new import contract commitments are at levels two to three times the 1961-77 average.¹³⁵ These commitments seem to have been made principally because rural policy, urban consumption, and stockpiling plans could not be left to the vagaries of weather during the critical period of transition to new leadership. Per capita consumption, both urban and rural, is increasing at a reasonable rate, however, and it is unlikely that imports above the annual level of those committed to will be necessary.

While it is quite possible that around 10 million metric tons or a bit more will continue to be imported through 1985 (reduced within-quota procurements are guaranteed "from 1979 onward"),¹³⁶ it would not be too surprising if the level were cut back somewhat after 1981 if the initiative to further develop marketable grain bases progresses

well. It should be noted that despite the reduction in within-quota purchases, total state procurements in 1979 rose substantially over 1978.¹³⁷ In view of the probable extension of current grain purchase prices, the trend is likely to continue, provided grain production expands as required within agriculture as a whole. This issue is the subject of the remaining sections, but it should be noted that it appears improbable that China would radically increase net foodgrain exports within the 1980-85 period except to partially defray grain import costs. Even in the unlikely event that 400 million metric tons of

domestic production is reached by 1985, the possibility of a massive increase in grain exports is quite remote: increased consumption is too important a plank in the administration's current rural and urban platform; and unsatisfied demand for grain, both direct and indirect, is too apparent. On the other hand, the Chinese have lived with unsatisfied demand since well before the establishment of the People's Republic of China. Therefore, although state policy must now address that demand, it need not be eliminated at once: evidence of clear, steady progress is probably sufficient.

FOOTNOTES

¹¹ See Stone, "A Review of Statistics," Table 4, discussion.

¹² Ibid., Tables 1 and 4. The Chinese put the population increase figure at 300 million. "Decisions of the CCP Central Committee on Some Problems in Accelerating Agricultural Development" (adopted by the 3rd Plenary Session of the 11th Chinese Communist Party [CCP] Central Committee on December 22, 1978), printed in *Zhanwang* (Hong Kong) June 16, 1979, pp. 21-4; July 1, 1979, pp. 23-5; and in FBIS, *PRC*, August, 31, 1979, pp. L22-L37. John Aird's "best" estimates indicate that the increase was 345 million (Stone, "A Review of Statistics," Table 1).

¹³ See for example, "Discussion of the CCP Central Committee," FBIS, *PRC*, August 31, 1979, p. L26. The recommended bases of distribution of commune members' food rations are 30-40 percent of work points and 60-70 percent of basic food rations, but commune members may use any method approved by the majority. This limits differences in food rations within communes, but not among communes. National upper limits on foodgrain distribution were abolished in 1979. The impact of the new rural incentive program upon income distribution will be discussed later in the paper.

¹⁴ Dwight Perkins, "Radical Land Reform—The Experience of China," a paper presented at the Symposium on Institutional Innovation and Reform: The Ladejinsky Legacy, Kyoto, October 1977.

¹⁵ FBIS, *PRC*, April 30, 1979, p.05.

¹⁶ C. Robert Roll, "Incentives and Motivation in China: The 'Reality' of Rural Inequality," a paper presented at the annual meeting of the American Economic Association, Dallas, Tx., December 28, 1975, p. 35, indicates that about 75 percent of the differences in crop income in the 1950s were caused by differences between regions. The remainder were attributed to differences within regions. Roll concludes, however, that the dispersion of rural income in China is one of the lowest in the world today. The 1:10 figure indicates that per capita income is 10 times larger in the richest 10 percent of all communes than in the poorest 10 percent of communes.

¹⁷ "Investigation Report by the Shanghai Municipal Agricultural Office," FBIS, *PRC*, August 16, 1979, p. O6.

¹⁸ Other rationed commodities include cloth, oil, sugar, and occasionally pork.

¹⁹ Stone, "A Review of Statistics," Table 4, discussion.

²⁰ Especially those resulting in famine. See Buck, *Chinese Farm Economy*; and John Lossing Buck, *Land Utilization in China*, 3 vols. (Nanking: University of Nanking Press and Chicago: University of Chicago Press, 1937). The latter presents compilations of county records demonstrating that the surveyed localities suffered an average of from 2.5 (in the rice region) to 3.6 (in the wheat region) extreme famines between 1850 and 1932, which resulted not merely in malnutrition, but in migration, starvation, and cannibalism.

A summary of harvest losses not resulting in famine is given in Bruce Stone, "Agricultural Purchase Price Policy in the People's Republic of China," a paper presented at the International Food Policy Research Institute, Washington, D.C., January 10, 16, 1979. Stone uses Buck's figures to calculate step probability density functions to delineate the risk of varying degrees of harvest loss in the wheat and rice regions between 1904 and 1929.

Buck's figures include data for 64 localities in the wheat region over a 25-year period. They had a double-cropping index of 127 (Buck, *Land Utilization*, Study, p. 274). Their average yield, $E(X)$, was equal to 76 percent of normal yield (Buck, *Land Utilization*, Statistics, p. 208). Normal yield, yield when no major natural calamities occur, is

equal to 1.31578 E(X). In the table below, 1-[X/1.31578 E(X)] is the percent of the normal harvest lost because of a natural calamity; j is a reference number given to each of the percentages in the table. The probability of sustaining a harvest loss of the percentage indicated by 1-[X/1.31578 E(X)] is indicated by p. The percentage harvest loss itself is indicated by x. It is shown in the table as the probable number of harvests with the harvest loss indicated. It was calculated by dividing the number of entries with crop losses of Z percent by the number of localities, then multiplying by the number of years multiplied by the double-cropping index.

j	1	2	3	4	5	6	7
1-[X/1.31578 E(X)]	80-100 (avg. 88.5)	70	60	50	40	30	20-0 (avg. 5.9)
p	1.0	1.8	4.5	8.8	17.0	16.6	50.3

Similarly, Buck's figures include data for 96 localities in the rice region over a 25-year period. Their double-cropping index was 166. E(X) was equal to 79 percent of normal yield, which equalled 1.26582 E(X).

j	1	2	3	4	5	6	7	8
1-[X/1.26582 E(X)]	85-100 (avg. 93.4)	80	70	60	50	40	30	20-0 (avg. 8.5)
p	1.1	3.3	3.6	3.1	6.7	3.9	6.2	72.1

The average percentage loss (x_n) in the wheat region when j equals 7 and in the rice region when j equals 8 was computed as follows:

$$x_n = \bar{x} - \sum_{j=1}^{n-1} p_j x_j / p_n$$

where \bar{x} = E(X)/ normal harvest = average harvest loss;
 p_j = the probabilities or frequencies associated with x_j ;
 x_j = the percentages of normal harvests lost;
 $\sum_{j=1}^n p_j x_j$ = \bar{x} ; and
 p_n = $1 - \sum_{j=1}^{n-1} p_j$

Finally, the figures included in these tables exclude less frequent calamities that result in famines. These would add an extra 3.4 percent for the wheat region and 1.8 percent for the rice region to the tails of the distributions.

²¹ Nicholas Lardy, *Economic Growth and Distribution in China* (Cambridge: Cambridge University Press, 1978).

²² Miriam and Ivan London, "Hunger in China: The 'Norm of Truth'," *World View*, 22 (March 1979): 14-6; "Hunger in China: The Failure of a System?" a paper prepared for the Workshop on Agriculture and Rural Development in the People's Republic of China, Cornell University, Ithaca, N.Y. May 17-19, 1979.

²³ Stone, "A Review of Statistics."

²⁴ The composite grain processing reduction factor 0.825 is taken from Stone, "A Review of Statistics," Table 4.

²⁵ "Decisions of the CCP Central Committee," FBIS, *PRC*, August 31, 1979, p. L27.

²⁶ *Peking Review*, January 3, 1975, pp. 10-1.

²⁷ "Tax Reduction in Rural Areas," *Beijing Review*, March 16, 1979, p. 12; see also Xinhua, news bulletin, December 27, 1979; FBIS, *PRC*, December 27, 1979, p. 13.

²⁸ Zhang Jingfu, "Report on the Final State Accounts of 1978 and the Draft State Budget for 1979," (delivered at the 2nd Session of the 5th National People's Congress on June 21, 1979), appearing in Xinhua, news bulletin, June 29, 1979; FBIS, *PRC*, July 3, 1979, pp. L6-L17. The relevant section here is on p. L13. In this report the total estimated sum was 24.4 billion yuan; the estimated component for financial transfer to rural areas owing to tax reductions and the rise in agricultural purchase prices was 7 billion yuan. The final estimate for the latter, however, was 9 million yuan (Xinhua, news bulletin, December 27, 1979; FBIS, *PRC*, January 3, 1980, p. L18). The 25 billion yuan appearing in the text is derived by adding 2 billion yuan to the original 24 billion yuan estimate, then deducting the 1 billion yuan for tax reduction already discussed.

²⁹ These figures were calculated using an average consumption per capita figure of 201 kilograms per year (207 kilograms available for consumption after deductions for feed, seed, industrial and food processing, brewing, net international trade, and processing loss have been made, minus 2 percent of the original production figure [304.75 million metric tons] for national, provincial, and local stockpiling; this is Stone's (best) estimate in Stone, "A Review of Statistics," Table 4), Aird's midyear 1978 population figure of 1,002.437 million, and Roll's 1952 income share percentages (see Tables 2 and 4).

³⁰ Stone's estimate is 201 kilograms per capita (Stone, "A Review of Statistics"); population is Aird's midyear 1978 figure from Table 5; the composite processing reduction coefficient used is 0.825 (Stone, "A Review of Statistics"), derived from Wien's processing loss figures for individual crops and Stone's estimated 1977 crop distribution (see Table 8 in this paper).

³¹ Stone, "A Review of Statistics," notes to Table 4. See Table 3 below.

³² *Cheng Ming* referred to the condition of the 200 million peasants consuming below the 150 kilogram mark as a "state of semi-starvation" (FBIS, *PRC*, May 10, 1979, p. US). Although 1978 figures for steel were mentioned in the article, it is not clear whether the foodgrain reference is for 1977 or 1978. In "Decisions of the CCP Central Committee," FBIS, *PRC*, p. L22, it was stated that in 1977 "somewhat more than 100 million peasants had inadequate foodgrain supplies." Despite population and livestock increases, per capita direct consumption should have been significantly higher in 1978 than in 1977.

³³ Since the reform includes reductions of rural taxes other than the agricultural tax, the appropriate price for such a calculation is not immediately clear. The 1979 average compulsory purchase price of rice was about 0.230 yuan per kilogram. In 1978 it was 0.192 yuan per kilogram. See Stone, "A Review of Statistics," Table 20B; and Zhang Jingfu, "Report," FBIS, *PRC*, p. L10. The average compulsory purchase price is the lowest relevant price because agricultural tax reductions of grain retained in rural areas would be evaluated at this rate. For the highest price relevant to the purchased grain, the retail price of 0.32 yuan per kilogram may be used. This is the mean of 1975 national average prices of Grade B rice (286 yuan per kilogram) and medium grade wheat flour (0.360 yuan per kilogram) from Peng Kuang-hsi, *Why China Has No Inflation* (Peking: Foreign Languages Press, 1976), p. 7. One billion yuan at the average retail price would purchase about 3.1 million metric tons of processed grain (5.75 million tons in unprocessed equivalent). At the within-quota price the sum would purchase 4.34 million metric tons of unprocessed grain.

³⁴ Zhang Jingfu, "Report," FBIS, *PRC*, July 3, 1979, p. L8, L13. The 1977 figure was 5.069 billion yuan.

³⁵ The 1979 figure is from Zhang Jingfu, "Report," FBIS, *PRC*, p. L13. The total sum for capital construction (39.5 billion yuan) plus those parts of regular reserve funds and other standby financial resources earmarked for capital construction in local budgets came to 45.192 billion yuan in 1978, a large increase over 30.088 billion yuan in 1977 (p. L8). Agriculture's share in 1978 was 10.7 percent (Xinhua, news bulletin, December 27, 1979; FBIS, *PRC*, January 3, 1980, p. L18), or 4.836 billion yuan.

³⁶ "Rural Bank Loans and Savings Increase," *Beijing Review*, November 16, 1978, pp. 6-7. If loans emanating directly from the newly established Agricultural Bank of China are included, the totals are, for 1978, 13.178 billion yuan; for 1979, 17 billion yuan; and for 1980, 20 billion yuan (Xinhua, news bulletin, January 23, 1980; FBIS, *PRC*, January 23, 1980, p. L3).

³⁷ Purchase price increases and tax reductions accounted for 9 billion yuan in 1979 (as opposed to 7 billion yuan estimated a year earlier—see footnote 28). Of this sum, an estimated billion yuan were from tax reductions (see footnote 27).

³⁸ Calculated from Aird's May 1979 midyear China population series in U.S. Central Intelligence Agency, National Foreign Assessment Center, "China: A Statistical Compendium," ER79-10374 Washington, D.C., July 1979, p. 5. The 40 percent figure assumes that child deaths were zero over the 15-year period 1964-78. The Chinese sample survey was quoted in Xinhua, news bulletin, February 13, 1980; FBIS, *PRC*, February 15, 1980, pp. L11-L13.

³⁹ Stone's 1978 estimate is 201 kilograms per year (see footnote 29). The 269 kilogram figure is derived in Appendix 2 of this paper.

⁴⁰ See footnotes 10 and 38. New official targets for the rate of natural increase were published in February 1980: less than 1 percent for 1980, 0.8 percent for 1981, and 0.5 percent for 1985. (*Renmin Ribao* [People's Daily], February 11, 1980, p. 1; FBIS, *PRC*, February 15, 1980, p. L15).

⁴¹ Stone, "A Review of Statistics," Tables 4 and 4A. The early 1970s figure and long-range target were given by Vice Premier Li Hsien-nien, cited in Ishikawa, "China's Food and Agriculture," p. 90. The report of a 1975 study mission to China put the figure at 40-60 metric tons. Food and Agriculture Organization of the United Nations, Study Mission, "Learning From China: A Report on Agriculture and the Chinese People's Communes," FAO, Regional Office for Asia and the Far East, Bangkok, 1977, p. 19.

⁴² In 1978 when the province's output rose 27 percent over 1977, a dry year, Jilin's grain reserve increased 13.5 percent to 295,425 tons. FBIS, *PRC*, May 1, 1979, p. S1. Jilin is a major grain-producing province in the Northeast with average per capita consumption greater than the national mean in 1979 (202 kilograms per capita of processed grain).

⁴³ Shigeru Ishikawa, "Factors Affecting China's Agriculture in the Coming Decade," Institute of Asian Economic Affairs, Tokyo, 1967, Table 3 and Appendix 1. (Mimeographed.)

⁴⁴ Shigeru Ishikawa, "China's Food and Agriculture," p. 91.

⁴⁵ Stone, "A Review of Statistics," Tables 1-4; see also U.S. Central Intelligence Agency, "A Preliminary Reconciliation of Official and CIA National Product Data," ERM79-10690, Washington, D.C., December 1979, p. 4.

⁴⁶ Ma Hung-yun and Liu Yun-ch'ien, "Train More Experts of Economic Management of Agriculture," *Kwang-ming Jih-pao*, November 18, 1978; translated in U.S. Joint Publications Research Service, *PRC Agriculture* 23 (JPRS 072,921), pp. 14-6; "Proposal for Changing Dietary Habits," *Peking Review*, December 1, 1978, pp. 18-9; Benedict Stavis, "Turning Point in China's Agricultural Policy," Working Paper No. 1, Rural Development Series, Michigan State University, East Lansing, Mich., May 1979, p. 43.

⁴⁷ See above.

⁴⁸ Pork is strictly rationed in many urban areas.

⁴⁹ An exception to this observation appears to be vegetable consumption in areas where urban supply is relatively high (0.5 kilograms per capita per day, gross weight) and fairly well insulated against seasonal fluctuations (varying less than 20 percent in either direction of the yearly average), though there appears to be considerable pent-up demand for the gradually progressing program of varietal increase. See Thomas B. Wiens, "The Economics of

Municipal Vegetable Supply in the People's Republic of China," a paper prepared for the Vegetable Farming Systems Delegation, National Academy of Sciences, Washington, D.C., December 1977. (Mimeographed.) Lower-income people would probably enjoy fewer vegetables in those rural areas with short natural growing systems and incomes too low to afford vinyl technology. Although in the 1950s the average consumption of vegetables by peasants was greater than in the cities, current urban consumption per capita is 125 percent above consumption in 1955 (this calculation is based on official data found in Nai-Ruenn Chen, *Chinese Economic Statistics: A Handbook for Mainland China* [Chicago: Aldine, 1967], p. 438). It should again be noted that average statistics conceal large variations at the extremes of the distribution. In the major municipal area of Tianjin, vegetable consumption per capita averages 1 jin 1 tael in the busy season and 1.7 tael in the slack season (about an eighth of busy season consumption). The facilities for busy season storage still do not even out the seasonal variation, so rotting is extensive. Tianjin also has a varietal problem: a surfeit of leafy vegetables and a lack of yellow vegetables. One of the apparent causes is inflexible management of prices by officials who do not take the problem of rotting into consideration and insulate the producers from corrective market signals. Neither free nor market administrative adjustments have solved this problem (*Tianjin Ribao* [Tianjin Daily] in FBIS, PRC, May 4, 1979, p. R3).

⁵⁰ Stone, "A Review of Statistics," Table 3. The use of 1949 as a base year is less misleading in this instance as hog numbers, unlike many other farm output indicators, were already above their prewar levels (see Ta-chung Liu and Kung-chia Yeh, *The Economy of the Chinese Mainland: National Income and Economic Development, 1933-59* [Princeton: Princeton University Press, 1965], p. 135). The numbers of other livestock, especially large animals, have grown less rapidly.

⁵¹ At the end of 1975 or midyear 1976, the hog stock was as low as 180 million head, although in 1974 stocks were probably between 260 and 290 million (Stone, "A Review of Statistics," Table 3). This sudden decline has yet to be clearly explained.

⁵² Chen, *Chinese Statistics*, p. 438.

⁵³ "Decisions of the CCP Central Committee," FBIS, PRC, August 31, 1979, p. L29, gives the total quantity of meat products as 15 billion jin (7.5 million metric tons). It is possible that the figure refers to 1978.

⁵⁴ A figure of 9.6 kilograms per capita can be calculated from Henry J. Groen and James A. Kilpatrick, "Chinese Agricultural Production," in U.S. Congress, Joint Economic Committee, *Chinese Economy Post-Mao*, vol. 1 (Washington, D.C.: U.S. Government Printing Office, 1978), p. 645.

⁵⁵ Conversation with C. Peter Timmer, Harvard University, Cambridge, Mass., October 1978; C. Peter Timmer, Walter P. Falcon, and Gerald C. Nelson, "A Perspective on Food Policy in China," October 1978 (mimeographed); and Thomas B. Wiens, "Animal Husbandry in the People's Republic of China," August 1978. (Mimeographed). This is in part because of the increasing scarcity of even nonfeedgrain materials (conversation with Timmer, 1978; and Wiens, "Animal Husbandry," p. 46), but also owing to a renewed emphasis of central policy on large collective pig farms for increasing urban supply rather than on collective sideline and private pig raising (Timmer, Falcon, and Nelson, "A Perspective on Policy"; and Wiens, "Animal Husbandry").

⁵⁶ Refer to Zhou Enlai's statement in 1971 to a Japanese delegation, reported in *Nogyo to Keizai* [Agriculture and Economy] 38 (March 1972), p. 20, cited in Ishikawa, "China's Food and Agriculture," p. 94. Also see more recent statements by Chairman Hua Guofeng.

⁵⁷ Shigeru Ishikawa, "Factors Affecting China's Agriculture in the Coming Decade," pp. 23-8; and Ishikawa, "China's Food and Agriculture," p. 94.

⁵⁸ According to Christopher Howe, "Labor Organization and Incentives in Industry," in *Authority, Participation, and Cultural Change*, ed. Stuart Schram (Cambridge: Cambridge University Press, 1974), pp. 237-8, real urban wages grew about 6 percent per year from 1952-57, then essentially stagnated until 1971 and 1972, when wages were raised an average of 10 percent. A survey of 152 families of "typical" workers, salaried employees, and intellectuals in 10 districts of Shanghai (cited in Shigeru Ishikawa, "Prospects in the 1980s," p. 19), showed that per capita monthly earnings rose from an average of 26.78 yuan in 1966 to 33.43 yuan in 1973. But it appears that the increase was not so much the result of higher wages for an employed family member as of an increase in the number of members employed per family. Another article, "From the Household's Receipt and Expenditure Accounting Book of a Worker," *Jinmin Chugoku* [People's China], January 1974, pp. 24-7; cited in Ishikawa, "Prospects in the 1980s," Table 7, examining the accounts of a "typical" Shanghai worker, shows a similar effect. Ishikawa notes that the wage cited was approximately equivalent to the 1957 average wage from the other study. Lardy, *Economic Growth*, p. 175, shows that real wages of all workers rose 31 percent between 1952 and 1957, then declined to below the 1956 level by 1971. Despite the 1972 wage increases, real industrial wages were at the 1956 level in 1975.

In 1977, 46 percent of workers and government employees received a wage increase ("Increasing Wages," *Beijing Review*, November 19, 1979, p. 4). This actually amounted to a 10 percent raise for 60 percent of the industrial work force (*Beijing Review*, June 29, 1979, p. 11, and July 6, 1979, p. 40; FBIS, PRC, June 25, 1979, pp. L8, L9, and June 27, 1979, p. L17). In 1978 an additional 2 percent received an increase ("Increasing Wages"). But the amount of these raises did not counterbalance the March 1979 price rises when real earnings of staff and workers declined to below the 1965 level (*Cheng Ming*, FBIS, PRC, May 10, 1979, p. U4). To redress this situation, the average wages of 40 percent of workers and government employees were raised in November 1979 ("Increasing Wages") but retail prices of nonstaple food were also raised the same month by healthy margins ("Nonstaple Food Prices Raised," *Beijing Review*, November 19, 1979). To compensate for the rising prices (estimated to increase state revenue by 5 billion yuan) the government granted 5 yuan per month to each of 100 million workers and civil servants (including apprentices and retired), which transferred an estimated 6 billion yuan from the state back to consumers ("Nonstaple Food Prices Raised"). In summary it appears that inflation has just about cancelled nominal wage increases since the late 1950s, with real urban earnings in 1980 remaining very close to the 1957 level. Urban employment among legal residents has been reduced, however, lowering the dependency ratio per employed family member and bringing about

increases in per capita earnings. These should result in rising demand for nongrain foods.

The increases of peasant incomes are complex and are discussed in the text. But keep in mind that average peasant incomes in the late 1970s were rising and reached their highest levels in the history of the People's Republic, and some localities have consistently done well since 1949. See also Peter Schran, "China's Price Stability: Its Meaning and Distributive Consequences," 1976 (mimeographed); Alexander Eckstein, "The Chinese Development Model," in U.S. Congress, Joint Economic Committee, *Chinese Economy Post-Mao*, vol. 1 (Washington, D.C.: U.S. Government Printing Office, 1978), pp. 80-114; *Beijing Review*, June 29, 1979, p. 11, and July 6, 1979, p. 40. FBIS, *PRC*, June 25, 1979, pp. L8-L9, June 27, 1979, p. L17, and December 27, 1979, p. L3.

⁵⁹ See footnote 58, Table 3, and the discussion of prices in the text.

⁶⁰ Some cited elasticities for other Asian countries, excluding the Middle East and Japan, are, for foodgrains: cereals, 0.5; starchy roots, 0.16; pulses and nuts, 0.3. For other food products they are: sugar, 1.3; vegetables and fruit, 0.9; fats and oils, 1.2; dairy products, 1.8; meat, 1.5; eggs, 2.0; and fish, 1.1 (1962 FAO figures cited in John W. Mellor, *The Economics of Agricultural Development* (Ithaca, N.Y.: Cornell University Press, 1966), p. 66.

⁶¹ Japanese material cited in Wiens, "Animal Husbandry."

⁶² Using Chinese data, Wiens gets 10-12 percent for 1954-57 (excluding millings and ignoring any fine feed devoted to sheep, goats, and poultry) and a high in 1957 of 21 percent (including millings in all nonseed grain use). See Wiens, "Animal Husbandry." Ishikawa derives figures for 1952 (12 percent) and 1956-57 (14 percent) from hypothesized stable correlations, based on Japanese experience, between per capita supply of foodgrains and per capita supply for all nonseed purposes. They are not strictly comparable with any of Wiens' figures. See Ishikawa, "Factors Affecting China's Agriculture," Table 3 and Appendix 1.

⁶³ Ishikawa, "Factors Affecting China's Agriculture."

⁶⁴ Ishikawa, "China's Food and Agriculture," p. 91.

⁶⁵ Based on methods and parameters quoted in Wiens, "Animal Husbandry," pp. 39-41. The concentrate required per fattened pig is 74 kilograms, only 44.7 percent of which is trade grain (which has been processed to 86 percent of its original weight). The remainder is millings.

⁶⁶ This is because the growth of the number of large animals (50 percent between 1949 and 1977; 15 percent between 1957 and 1977) was slow in relation to the growth in the number of hogs (400 percent between 1949 and 1977; about 100 percent between 1957 and 1977). See Stone, "A Review of Statistics," Table 3.

⁶⁷ Based on Chinese material quoted in Wiens, "Animal Husbandry," pp. 39 and 44.

⁶⁸ Ibid., pp. 44-7. This trend is partially confirmed by 1979 Chinese press reports that the average weight of hogs marketed in Shanghai has increased 8 kilograms over their weight in 1978 (FBIS, *PRC*, May 16, 1979, p. O6). In Guizhou the figure was 4 kilograms (FBIS, *PRC*, June 4, 1979, p. O3), while the national average of state-procured hogs seems to have risen from 76.5 kilograms in the first half of 1978 to 81.8 kilograms in the first half of 1979 (Xinhua, news bulletin, September 18, 1979, p. 12). The total number purchased (58.79 million), however, represents less than a fourth of the number likely to have been slaughtered in 1979.

⁶⁹ See Stone, "A Review of Statistics," Table 3, discussion.

⁷⁰ "Decision of the CCP Central Committee," FBIS, *PRC*, August 31, 1979, p. L29.

⁷¹ Calculation based on "Decision of the CCP Central Committee," FBIS, *PRC*, August 31, 1979, and official figures in Stone, "A Review of Statistics," Table 3.

⁷² For pigs, 82 kilograms of fine feed per fattened hog (footnote 68); all other parameters are cited in footnote 65; for cattle, 383 kilograms per large animal (a 1957 estimate from Wiens, "Animal Husbandry," pp. 40-1). The large animal stock estimate is a 1978 year-end figure minus 10 million "cattle" (from Stone, "A Review of Statistics," Table 3).

⁷³ Chen, *Chinese Statistics*, p. 340.

⁷⁴ State Statistical Bureau figures from sources listed in Stone, "A Review of Statistics," Table 3.

⁷⁵ Wiens suggests that water buffalo are included and that the remainder are mostly common (yellow) oxen (Wiens, "Animal Husbandry," p. 14); his information ostensibly comes from People's Republic of China, Ministry of Agriculture and Forestry, Animal Husbandry Bureau, *Ta-li-fa-chan Han-chu Shih-yeh* [Greatly Develop the Pig-Raising Profession] (Peking: Ministry of Agriculture and Forestry, 1974), and Chen, *Chinese Statistics*.

⁷⁶ According to *Nanfang Ribao*, FBIS, *PRC*, March 20, 1979, p. P3, cattle breeding in Guangdong declined over the 1970s; absolute numbers were about 4.34 million head in 1957 (Chen, *Chinese Statistics*, p. 359). A similar history has been noted for Anhui (FBIS, *PRC*, May 9, 1979, p. O1) and Xinjiang (March 13, 1979, p. M1), which maintained 22.23 million head of livestock in 1958 (Chen, *Chinese Statistics*, p. 349). According to "Expansion of Animal Husbandry" *Beijing Review*, January 28, 1980, p. 7, the number of cattle and horses began to rise in 1979 after declining steadily for several years.

⁷⁷ Stone, "A Review of Statistics," Table 3, discussion.

⁷⁸ Chen, *Chinese Statistics*, p. 348.

⁷⁹ FBIS, *PRC*, March 8, 1979, p. M2.

⁸⁰ The estimate is based on a slaughter rate of 12 percent (Liu and Yeh, *The Economy of the Chinese Mainland*, p. 311). Average live weight of an adult male animal varies among major breeds of oxen and water buffalo from 424 kilograms to 574 kilograms, or, omitting the heaviest and lightest breeds, 480-525 kilograms (Chinese sources in Wiens, "Animal Husbandry," p. 17). The estimate uses 500 kilograms. The 40,000-140,000 ton range then covers any realistic

parameter for meat yield per slaughtered animal and a reasonable margin of error. This estimate, however, should be supplemented by an equivalent figure for highland yak meat which has not been included. Yaks have a slaughter rate of about 20 percent, see Republic of China, Ministry of Agriculture and Forestry, *Nung-lin Tung-chi Shou-tse* [Handbook of Agriculture and Forestry Statistics] (Nanking: Republic of China, 1948), p. 59; Chang Chung-wang and Hwang Wei-yi, *Tsu-kuo Ti Hsu-mo Yu Hsu-chan Tzu-yuan* [Animal Husbandry and Animal Products of our Fatherland] (Shanghai: Yung-Hsiang Book Co., 1953), p. 207; and Liu and Yeh, *The Economy of the Chinese Mainland*, p. 310. Qinghai grazed 4.6 million yaks in 1978, more than any other province. Yaks subsist on grasses growing on land generally unfit for grain cultivation. They have also been crossbred with oxen to produce an animal yielding more meat earlier and able to graze during the summer in high mountain areas (FBIS, *PRC*, June 28, 1979, pp. L14-L15). These animals may require feeding during some months of the year, but are probably included with oxen in cattle statistics.

If the figure of 10 million cattle in 1978 is correct, a higher slaughter rate is indicated, since over 1.3 million head were sold to the state in addition to the numbers slaughtered at home (calculated from "Expansion of Animal Husbandry," *Beijing Review*, January 28, 1980, p. 7). Most likely, the 10 million figure is an underestimate, but the difference should be covered by the wide range in meat yield allowed for when 'most probable' figures are used.

Camels number about 0.6 million (including 0.38 million in Nei Menggu). They are used for both draft and slaughter, supplying about 350 kilograms of meat per animal ("More Camels," *Beijing Review*, February 1980, p. 29). Slaughter rates are apt to be low—5 or at most 10 percent—suggesting meat yield of 10,000-20,000 tons per year.

⁸¹ Xinjiang, which supported 22.23 million head of all kinds of livestock in 1958 but experienced stagnation and decline from at least 1967 to 1977 (see footnote 79), increased its livestock numbers by 575,000 head in 1978 (FBIS, *PRC*, March 13, 1979, p. M1). Cattle in Heilongjiang increased from 1.5 million head in 1977 to 1.6 million head in 1978 (FBIS, *PRC*, May 23, 1974, p. S3).

⁸² The figures in this sentence and the preceding paragraph have been taken or are calculated from official figures in Stone, "A Review of Statistics," Table 3.

⁸³ Calculated from above figures and statistics from Jen Chi-chou et al., "Pastoral Production Process and the Seasonal Animal Husbandry," *Chung-kuo Nung-yeh K'o-hsueh* [Chinese Agricultural Science], no. 2, 1978, p. 91; cited in Wiens, "Animal Husbandry," p. 51. Furthermore, although an estimated 40 percent or so were slaughtered, only about 15 percent were sold to the state in 1979 (calculated from the above figures and 10.7 million sold to the state in 1979, "Expansion of Animal Husbandry," *Beijing Review*, January 24, 1980, p. 7).

⁸⁴ Jen Chi-chou et al., *Chung-kuo Nung-yeh K'o-hsueh*, p. 87; Wiens, "Animal Husbandry," p. 50.

⁸⁵ Wiens "Animal Husbandry," p. 35; Stone, "A Review of Statistics," Table 3, discussion.

⁸⁶ Stone, "A Review of Statistics," Table 3, discussion.

⁸⁷ See the discussion of Xinjiang fine wool sheep in the Gansu highlands, in Jen Chi-chou et al., *Chung-kuo Nung-yeh K'o-hsueh*, pp. 87-91; Wiens, "Animal Husbandry," p. 48.

⁸⁸ Xinhua, news bulletin, September 19, 1979, p. 12.

⁸⁹ It is possible to calculate the poultry population only by making a large number of gross assumptions. The quantity of chicken eggs bought by the state during the first half of 1979 was 579,700 tons (579 million kilograms, Xinhua, news bulletin, September 19, 1979, p. 12) or 11.6 billion eggs at 20 eggs per kilogram. Yearly production may then be about twice that level, or 23.2 billion eggs. If we estimate 90 eggs per laying hen per year (Chinese sources in Liu and Yeh, *The Economy of the Chinese Mainland*, p. 313), then the total number of hens may be 257.6 million and the number of birds no greater than 515.3 million. Even if ducks and geese made up 18.4 percent of total fowl as in 1933 (Buck, *Land Utilization in China*, Study, p. 122), then total poultry would be about 631.5 million. This figure was based on the number of chicken eggs bought by the state and ignores eggs sold at rural fairs and retained for personal consumption. If it is assumed that state procurement is primarily for urban consumption, and if 1956 estimates constructed for the ratio of egg consumption per capita among urban and rural dwellers are adopted, then it may be concluded that although the rural population outnumbered urban dwellers 8:1 in 1978, total eggs consumed may have amounted to only about 1.7 times the procured level. This suggests that poultry stocks in 1978 were more than 1 billion birds or about 3 times the 1956 level. The estimate was made using Shanghai worker annual egg consumption per capita for 1956 (Chen, *Chinese Statistics*, p. 440), rural, urban, total and Shanghai year-end population figures for 1956 and 1957 (Chen, *Chinese Statistics*, p. 124, 127, and 129), estimates for the total number of poultry in 1953 and for the value of poultry in 1956 relative to 1933 (Liu and Yeh, *The Economy of the Chinese Mainland*, p. 250), estimates for the 1978 urban population (Stone, "A Review of Statistics," Table 1, official series) and for the total population (Stone, "A Review of Statistics," Table 1, Aird's best series), and other data cited above.

If the total 1979 state procurement figure of 825 million kilograms (Xinhua, news bulletin) was used in the above calculation, the procedure should yield an estimate of 0.8 billion birds. Wiens' estimate (Wiens, "Animal Husbandry," p. 3) based on constant ratios of poultry per capita, poultry per ton of grain produced, and poultry per pig, suggests figures of 0.85 billion for 1957 and 1.4 billion for 1978, but Wiens claims no great accuracy for these figures.

Moreover, laying rates of famous breeds such as the Peking duck (180 eggs per year) and the sparrow duck (200-250 eggs per year) are much higher than Liu and Yeh's 90 egg per year figure (W.R. Cockrill, "Report of a Visit to China, April/May 1974," Food and Agriculture Organization of the United Nations, Rome, 1974 [mimeographed]; see Wiens, "Animal Husbandry," p. 21). But these figures cannot be generalized.

From the above evidence, it can only be suggested that poultry numbers in 1979 are at least 800 million. But they could be twice that.

⁹⁰ Vice-Minister of Agriculture Hou Cheng as related by Darwin Stolte, president of the U.S. Feedgrains Council, in an interview on March 30, 1979.

⁹¹ "Mechanized Pig and Chicken Farms," *Peking Review*, October 20, 1978, p. 30.

⁹² The slaughter rate used for this estimate was 80 percent (Chang and Hwang, *Tsu-Kuo Ti*). The percentage also appears to be used to derive the "number of hogs in the fattening process" from the "number of live hogs on July 1" (or vice versa) for the years 1953 to 1957 in *Chung-yang Ho-tso Tung-hsun* [Central Cooperative Bulletin] March 11, 1959, p. 31; Chen, *Chinese Statistics*, p. 404). The figure used for average live weight at slaughter was 68 kilograms, a mid-1957 average of hogs at sale (Liu Jui-lung, "Summary Report of the National Keypoint Pig-Raising Counties Discussion Meeting," *Chung-kuo Nung-pao* [Chinese Agricultural Journal], No. 11, 1957, p. 1; Wiens, "Animal Husbandry," pp. 43-4). The national average weight of state procured pigs during the first half of 1978 was 76.5 kilograms, and 81.8 kilograms in the first six months of 1979 (see footnote 68), but the average weight of pigs consumed was probably well below these figures. Wiens estimates the 1957 weight of pigs consumed by peasants to be close to 50 kilograms, despite the average sale weight of 68 kilograms. Therefore 68 kilograms may be a reasonable average to assume for 1978 hogs. If all hogs reach the 1978 state procurement average and the higher pork percentage per kilogram of live weight (see below) were used, additional meat supply would be almost 3.1 million metric tons for 90 million hogs. The range of the estimate in the text was derived from two differing percentage estimates of average weight per pig above and of meat yield per kilogram of live weight: 46.7 percent and 55.6 percent. Both percentages were based on average per capita pork consumption figures for 1955 appearing earlier in the paper (footnote 52), official 1955 yearly average population figures for rural and urban areas (Chen, *Chinese Statistics*, p. 127) and the "number of hogs in the fattening process" in 1955. The lower estimate assumes that in the official calculation the average weight of all slaughtered pigs was 68 kilograms. The higher estimate assumes that only "pigs purchased by the state" (*Chung-yang Ho-tso Tung-hsun*, March 11, 1959, p. 31) averaged 68 kilograms and that in the official calculations pigs sold in rural fairs and slaughtered for home peasant consumption averaged 50 kilograms (as assumed by Wiens, "Animal Husbandry," p. 44). The higher percentage is favored owing to the increase in average hog weight.

⁹³ Of a large animal stock of 94 million in 1978, 10 million cattle were considered above. Yak numbers are estimated at 10 million (a guess based on 4.6 million in Qinghai in 1978 and the historical stock relationship of that province to other highland provinces and autonomous regions). The yak slaughter rate adopted is 20 percent (Republic of China, *Nung-lin Tung-chi*; Chang and Hwang, *Tsu-kuo Ti*). The average weight per yak: 370 kilograms (Wiens, "Animal Husbandry," p. 17). Average kilograms of meat per kilogram of live weight: 0.5 (assumed to be the same as hogs). These figures suggest that the contribution of yak meat in 1978 was around 0.37 million metric tons. For the remaining 74 million large animals, it is assumed that the death rate is 10 percent (Liu and Yeh, *The Economy of the Chinese Mainland*, p. 341); the meat yield ratio is 0.5, and the average weight per animal is 350-500 kilograms. The 500 kilogram figure is assumed to be about the average for the various breeds of oxen in case most are not included in the cattle figures. The 350 kilograms figure is the modal breed average for Chinese horses (Wiens, "Animal Husbandry,"). These figures suggest a meat yield of 1.40-1.85 million metric tons, for a total (including yaks) of 1.8-2.2 million metric tons.

⁹⁴ 301.29 million in 1978 (Stone, "A Review of Statistics,"), 30 percent (90.387 million) computed previously, and 128.7 million additional. The last figure was derived by working backwards from 3.5 million metric tons of pork using the parameters cited in footnote 92.

⁹⁵ Stone, "A Review of Statistics," except that total stock (391.677 million), slaughter rate (80 percent) kilograms of meat per kilogram of live weight (0.5) and 3.5 million metric tons of meat required were used to derive the weight increment necessary (22.37 kilograms).

⁹⁶ All parameters in footnote 65, with the addition of the typical Chinese parameter of 4 kilograms of concentrate per kilogram of incremental live weight needed. This figure was so well accepted in the 1950s that the relationship between the price of meat and the price of grain was based on this requirement. See Chang Tsung-hui, *Chung-kuo Yang-chu-fa* [Chinese Methods of Pig Raising] (Nanking, 1957); Wiens, "Animal Husbandry," p. 39.

⁹⁷ Wiens, "Animal Husbandry," pp. 38-47.

⁹⁸ Based on a study in Wu Yun-feng, ed., *Chien-ming Hsu-mu Shou-tse* [Simplified Animal Husbandry Handbook], pp. 73-4; Wiens, "Animal Husbandry," p. 43. Two methods are presented: one "for areas with adequate concentrate supplies" and the other (clearly the one intended to appear more efficient) "for areas deficient in concentrate supplies." For each method, daily concentrate feed for various growth stages up to 90 kilograms live weight have been calculated using material appearing in the cited table and the remaining parameters from footnote 65. Statistics for the concentrate-saving method do not even reach 90 kilograms, so the feeding regimen suggested for the first method has been added for an extra 26 days of weight gain after 75 kilograms have theoretically been reached under the second feed schedule. Aside from earlier slaughter (240 versus 260 days from weaning) the principal differences noticeable in the second (recommended) regimen are that prescribed concentrate and fodder are substantially lower for the middle growth period (between the dates at which the hog reaches 30 kilograms and 50 kilograms live weight; this period then, is 100 rather than about 70 days), partially compensated for by a high rate of forage feed (such as squashes and melons, the leaves of vegetables such as cabbage or beans and various trees) during the middle period and a lower rate in the final stage. Once the requirements for fattening 392 million hogs to 90 kilograms was calculated (38-41 million metric tons of unprocessed grain), 18 million metric tons were deducted as an estimate of requirements for 392 million hogs at 68 kilograms per hog (from footnotes 65 and 67—82 kilograms of concentrate per hog).

⁹⁹ Hsiung Te-hsiao, "How to Raise Pigs and Utilize Feed Economically and Effectively," *Nung-yeh K'o-hsueh Tung-hsun* [Agricultural Science Bulletin], no. 8, 1957, p. 422; Wiens, "Animal Husbandry," p. 45. Wiens found that Hsiung's computation contained many mathematical errors, some of which he suspects were deliberate in view of remarks Hsiung made to him. Other parameters required for the computation are found in footnote 65.

¹⁰⁰ The 44.7 percent figure is from footnote 65; the sources of computation for the milling rate are described in footnote 30.

¹⁰¹ See footnote 55. A variety of means are being explored to improve the situation in provinces with large and growing stocks of hogs. In Zhejiang, crop stalks totalling 15.4 billion jin (7.7 million metric tons or about 70 percent of the total available) were burned as fuel annually in the mid-1970s. In recent years marsh gas digestors have become the main energy source for 31 communes and about 500 brigades, freeing a considerable volume of stalks to be used as a supplement to livestock roughage and as organic fertilizer. By mid-1979 Zhejiang had built 271,000 such fuel units. (FBIS, *PRC*, June 20, 1979, p. 07). For other methods of stretching the nutritional value of concentrate, see Scientific Cooperative Group, *Jen-kung Liu-wei Fa-hsiao Ts'u-liao* [Artificial Stomach Fermented Feed] (Peking: Scientific Cooperative Group, 1976); Kwangtung College of Agriculture and Forestry, Department of Animal Husbandry and Veterinary Medicine, "Isolation Selection of Cellulose Molds and Breeding of Induced Mutants," *Kuang-tung Nung-yeh K'o-hsueh* [Kwangtung Agricultural Science] no. 2, 1974, p. 24; both cited in Wiens, "Animal Husbandry," pp. 46-7. There are 1979 claims that the mixture of grain and nongrain feeds currently promoted by the government results in faster growth—an increase in weight of at least 30 percent is promised over an equivalent growing period. The exact proportions of this mixture are unknown, but it is likely to gain prevalence over 1980-85 and almost certainly incorporates higher percentages of fine feed. Zhao Zhiyang, "Study New Conditions and Implement the Principle of Readjustment in an All-Round Way," *Hongqi* [Red Flag], January 1980, pp. 15-20.

¹⁰² Based on Stone, "A Review of Statistics," Table 3.

¹⁰³ See footnote 68.

¹⁰⁴ In March 1979 the purchase price of pigs was raised 26 percent. The national purchase prices of cattle and sheep for slaughter were raised by 20-50 percent. ("Higher Purchasing Prices Bring Good Results," *Beijing Review*, November 19, 1979). In Heilongjiang, prices rose 25 percent for pigs, 35 percent for cattle, and 33 percent for sheep (FBIS, *PRC*, April 24, 1979, p. 56). It appears that even before the increase relative feedgrain and hog purchase prices did not fully reflect the government policy of fine feed conservation. In actuality it was profitable to continue feeding more concentrate than was recommended. Also, see Zhao Zhiyang, "Study New Conditions."

¹⁰⁵ The state purchase of pigs over the first half of 1979 was 58.79 million head or 19.2 percent above the equivalent in 1978 (Xinhua, news bulletin, September 18, 1979, p. 12). The Hunan Provincial Commercial Department found it necessary to reduce the sale price of pork in urban areas (January 25–February 5, 1980) to prevent rotting, as the department's refrigeration warehouses could not store any more pigs (FBIS, *PRC*, January 29, 1980, p. P3). The problem was also experienced in April just after an April 1 price increase (FBIS, *PRC*, April 21, 1979, p. P4). At that time the doubling of pork supplies within a few days was ascribed to panic sale by peasants who believed the rise to be temporary. But the problem seems to be persistent.

¹⁰⁶ Wu Chuan-chun, Institute of Geography, Academia Sinica, Beijing, conversation, January 25, 1980.

¹⁰⁷ Figures for this calculation include a 1979 preliminary grain production estimate of 315 million metric tons (footnote 3), hog slaughter rate of 80 percent (footnote 92), the 5-million-metric-ton estimate for a 30 percent increase in hog and cattle stock (footnote 71), 86 percent milling factor for trade grain, 44.7 percent grain weight in total concentrate (footnote 65) and the rule of thumb from the 1930s of 4 kilograms of concentrate required to increase hog weight by 1 kilogram, which is probably high. The preliminary 1979 grain figure was used since it was the latest available at the time the 3 percent growth rate was quoted by Dr. Wu.

¹⁰⁸ It was first suggested that this idea be applied to Chinese grain sufficiency in Kenneth Walker, "Grain Self-Sufficiency in North China, 1952-75," *China Quarterly*, September 1977, pp. 581-2.

¹⁰⁹ London, "Hunger in China: Failure."

¹¹⁰ All figures from Chinese sources in Stone, "A Review of Statistics," Table 4A. Also see Table 3 of this paper.

¹¹¹ FBIS, *PRC*, September 26, 1979, p. S2.

¹¹² FBIS, *PRC*, September 12, 1979, p. L14.

¹¹³ Stone, "A Review of Statistics," Table 4A.

¹¹⁴ Ibid.

¹¹⁵ FBIS, *PRC*, September 20, 1979, p. S4; Xinhua, news bulletin, August 3, 1979 p. 5 gave the figure as 1/5.

¹¹⁶ See footnote 104.

¹¹⁷ The 40 percent figure for 1955 is based on computations using age-specific and total population figures for 1958 prepared by John Aird in May 1979 and found in CIA, "China: A Statistical Compendium," pp. 4-5; the 40 percent figure for 1978 was also based on Aird's population and birth rate estimates from the same publication and found in Appendix 2.

¹¹⁸ A State Statistical Bureau study cited in Chen, *Chinese Economic Statistics*, pp. 430-1.

¹¹⁹ The identification of the class position of each peasant was made according to People's Republic of China, Political Council, "Decision of the Political Council of the Central People's Government on the Classification of Rural Classes," *Collected Materials on Land Laws in the People's Republic of China*, ed. Peking Politics and Law College (Peking: Law Publishing Co., 1957), pp. 34-56; Shigeru Ishikawa, "Agrarian Reform and its Productivity Effect: Implications of the Chinese Pattern," in *The Structure and Development in Asian Economies*, Center Paper No. 10 (Tokyo: Japan Economic Research Center, 1968) p. 320. "Rich peasant" is defined as a peasant who is engaged in farm operation relying mainly on the exploitation of hired laborers. "Middle peasant" is a peasant who relies mostly on his own labor in farm operation, regardless whether he owns land or leases it. "Poor peasant" is a peasant who is exploited by others either through the payment of land rent or through the receipt of undervalued wages of labor.

A much wider range of income variation is exhibited in Table 2 and for example in Li Ch'eng-jui, *Chung-hua Jen-min Kung-ho-kuo Nung-yeh-shui Shih-kao* [A Draft History of the Agricultural Tax in the People's Republic of China]

(Peking: Finance Publishing House, 1959), pp. 133-8; Roll, "Incentives and Motivation," Table 1, p. 11. Here average income varies widely between regions but no foodgrain consumption figures are presented.

¹²⁰ Zhejiang's hogs numbered 5.68 million in 1957 (Chen, *Chinese Statistics*, p. 354). Marketed hogs were fed an average of 74 kilograms of fine feed nationally in 1957, 44.7 percent of which was grain (see footnote 66), or 2.4 percent of the total provincial grain production of 7.793 million metric tons (Chen, *Chinese Statistics*). Most hogs were retained for home slaughter or breeding and probably consumed less grain per head.

¹²¹ The processing loss figure (0.216) used for Zhejiang in this estimate was higher than the 1977 national average computed elsewhere (0.175, or 82.5 percent retained), owing to the higher proportion of rice in the province's grain output composition. The figure included is an average of 2 estimates: 77.4 percent based on 1957 crop composition from Chen, *Chinese Statistics*, and Wiens' figures for processing loss by crop (Stone, "A Review of Statistics," Table 4, notes); and 79.4 percent for 1979, estimated by assuming 6.55 million metric tons for early rice (FBIS, *PRC*, August 20, 1979, p. O5) represents total provincial rice production (biasing the estimate upwards) and assumes that nonrice production consisted entirely of wheat (biasing downward).

¹²² The parameters are from footnotes 66 and 68; grain and hog figures are from "Changes in Zhejiang Countryside," *Beijing Review*, February 18, 1980, pp. 4-5. Output rose at an average annual rate of 13 percent in 1978 and 1979 (total 3 million metric tons, see Xinhua, news bulletin, December 18, 1979; FBIS, *PRC*, December 20, 1979, p. O12).

¹²³ See Stone, "A Review of Statistics," Table 6.

¹²⁴ From unpublished findings by Ammar Siamwalla, International Food Policy Research Institute, Washington, D.C.

¹²⁵ Frederic Surls, "China's Grain Trade," U.S. Joint Economic Committee, *Chinese Economy Post-Mao*, vol. 1 (Washington, D.C.: U.S. Government Printing Office, 1978), pp. 663-6; Stavis, "A Turning Point in Policy," pp. 6-7.

¹²⁶ Stavis, "A Turning Point in Policy," pp. 6-7.

¹²⁷ Stone, "A Review of Statistics," Table 6.

¹²⁸ Ibid, Table 9A.

¹²⁹ "Mechanized Pig and Chicken Farms," *Peking Review*, October 20, 1978, p. 30.

¹³⁰ George Gunset, "China's Grain Push Could Alter Markets," *Chicago Tribune*, February 7, 1979.

¹³¹ Production in 1957 was 10.045 million metric tons (official sources in Chen, *Chinese Statistics*, pp. 338-9). U.S. Department of Agriculture (USDA) figures show production rising from 6.2 million metric tons in 1969 to 10 million metric tons in 1973 and oscillating between 9 and 10 million metric tons thereafter (figures cited in Gunset, "China's Grain Push"). Wiens, however, gets an estimate of 7 million metric tons for 1977 (an unpublished estimate of Wiens, based on official sources). Recently a highly reliable official source is reported to have agreed that the current USDA estimate of around 10 million metric tons is "about right." The difference between the USDA and Wiens estimates (both of which are derived from official sources) may be "soybeans not consumed directly as foodgrain," which at least recently may have been excluded from official foodgrain statistics (Stone, "A Review of Statistics," Table 2, discussion).

¹³² FBIS, *PRC*, February 23, 1978, p. E17.

¹³³ Hunnan province, for example, has a subsidy program encouraging production of all bast fiber and oil crops, (FBIS, *PRC*, March 3, 1980, p. P3).

¹³⁴ Stone, "A Review of Statistics" Table 6 gives 1977 soybean imports as 360,000 metric tons.

¹³⁵ Stone, "A Review of Statistics," Table 6.

¹³⁶ "Decisions of the CCP Central Committee," FBIS, *PRC*, August 31, 1979, p. L27.

¹³⁷ The state purchase period of a given year runs from April 1st of that year to March 31st of the succeeding year. By December 20, 1979 the state had purchased 50.144 million metric tons of grain, exceeding the 1979 plan by 2.04 percent and surpassing grain collected in 1978 by that date by 4.5 million metric tons (Xinhua, news bulletin, December 25, 1979; FBIS, *PRC*, January 4, 1980, p. L9). Jiangsu and Shandong had already registered increases over 1978 by December 5, 1979 (FBIS, *PRC*, December 20, 1979, p. O13). State purchases across China in calendar year 1979 exceeded those of 1978 by 5.15 million metric tons (Xinhua, news bulletin, February 27, 1980; FBIS, *PRC*, February 28, 1980, p. L5).