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China's Nutrient Availability and Sources, 1950-91

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ABSTRACT

The rapid changes in China's economy and data availability have led to the need for a quantitative assessment of its food and nutrient situation. This paper first reports estimates of China's average per capita daily energy, protein, and fat availability through yearly food balance sheets for 1950-91. Then policy impacts on the nutrient changes are examined. Results suggest that China's nutritional status has improved significantly over the period, especially since the 1978 economic reforms. Government policy has been a key factor influencing the nutrient changes since 1950 and will continue to play an important role in China's nutritional improvement.

CHINA'S NUTRIENT AVAILABILITY AND SOURCES, 1950-91

With more than 1.1 billion people, China is the world's largest producer and consumer of many food products such as grain and pork. Any change in China's food production and consumption will have significant impacts not only on the welfare of its more than one-fifth of the world's population, but also on the international food market, because China has been an important food trader since the early 1960s.[1]

The critical importance of China's food situation and the country's relative success in providing basic needs for its large population have attracted wide interest and engendered many studies on China's food and nutritional issues.[2] But most studies are descriptive and yield substantially different results. For example, Imfeld claimed that China had eliminated hunger by the mid-1970s,[3] whereas Smil and Lardy concluded that by the late 1970s the Chinese population's average diet was still no better than that of either the mid-1930s or the mid-1950s.[4] Piazza's quantitative estimates of China's average per capita daily nutrient availability for 1950-82, derived through yearly food balance sheets (FBS), are superior to the previous attempts because of significant improvement of the data in the early 1980s.[5] But even his results underestimate the average nutrient availability in lean years and overestimate it in bumper harvest years as a result of excluding food-stock changes in the FBS. FAO's periodical series of three-year-average FBS for China and many other countries leave much to be desired. Their lack of documentation of sources and their methods of estimation lead to suspect assumptions.[6]

China's economic reforms, beginning in 1978, have brought about the most rapid economic growth and nutritional improvement period in China's history.[7] From 1978 to 1991, China's real

GNP grew by an average of almost 9 percent a year, and the average consumption of many preferred food commodities, like red meats and eggs, more than doubled.[8] Although China's economic reforms and their world impact have been identified in many studies,[9] the changes in China's nutrient situation are less well understood. The objectives of this study are to assess the changes in China's average nutrient availability and sources since 1950 by including recent data and adjustments for grain stocks and to examine the role of government policy on the nutrient changes. The following sections describe methods and data sources, present the results of China's yearly FBS, examine the policy impacts, and derive policy implications.

Methods and Data Sources

Besides anthropometric measurements, like average height and weight by sex and age, FBS and food intake surveys are two major methods by which to assess the nutritional status of a referenced population. Because detailed survey data of food intakes are not available in China, this study uses FBS to estimate China's average per capita daily nutrient availability and sources since 1950.

FBS estimate the quantities of food commodities available for direct human consumption as the differences between their domestic supply and the sum of all nonhuman food end uses. The former is the domestic production net of international trade and stock change, and the latter includes seed, feed, nonfood industrial input, waste during transportation and storage, and losses in processing. The estimates of food commodities available for direct human consumption are then converted into average per capita daily nutrient availability according to the nutrient content of each food commodity and the mid-year population.[10] Three major nutrients considered in this study are energy, protein, and fat.

In addition to average per capita daily nutrient availability, FBS also provide information about nutrient sources and food consumption patterns because the average per capita food and nutrient availability is calculated by food commodities and the shares of each commodity can be easily

derived. Use of FBS is the most useful way to make a preliminary assessment of a referenced population's nutritional status in many cases, especially in developing countries where survey data are extremely limited. FAO first published FBS for 41 countries in 1949 and has continued a periodical series of three-year average FBS for most countries.[11]

The most recently released data on China's food production and international trade are the basis of this study. Most time-series data for 1950-91 are from various issues of *China's Statistical Yearbook*, *China's Agricultural Yearbook*, and a few other official publications.[12] Others are estimated from reliable information or adopted from previous studies. Most coefficients used to compile China's yearly FBS are from Piazza's publications.[13]

Average Per Capita Nutrient Availability and Sources

To date, Piazza has provided the best estimates of China's food and nutrient availability.[14] A major improvement over Piazza's estimates, this study includes the changes in state-held grain stocks in China's yearly FBS and extends the period of estimation from 1982 to 1991. This section first briefly discusses our estimation of yearly changes in China's state-held grain stocks and yearly feed grain uses, which highly affect the results of FBS but are not directly available, and then summarizes the results of China's yearly FBS from 1950 to 1991. We also compare our estimates of China's average per capita daily nutrient availability with Piazza's results.[15]

Estimation of State-Held Grain Stocks and Feed Grain Uses

A rationed food supply system for China's urban residents since the early 1950s has caused the Chinese government to purchase a large proportion of the nation's food products and to keep a significant level of stocks to stabilize state supply.[16] Crook reported that China's grain stocks fluctuated dramatically during 1960-1987, ranging from 9.6 to 111.2 million metric tons (mmt).[17] Carter and Zhong estimated China's year-end state-held grain stocks for 1950-86 based on the official

data of state purchases, sales, imports, and exports.[18] By using a similar method, we estimate the yearly changes of China's state-held grain stocks as the differences between state purchases and sales, excluding international trade because net import is listed as a separate column in the FBS. The estimated yearly changes of grain stocks are then shared by rice, wheat, corn, and soybeans according to their percentages of the total grain output.[19] Although there are also farmer-held food stocks in China, no reliable information is available on either their year-end volumes or changes over time. Carter and Zhong believe that the farmer-held food stocks are not very large because "the pricing system in China discourages private storage."[20] The stock changes of other food commodities, such as animal products, fruits, and vegetables, are assumed to be insignificant given China's limited storage and processing facilities for these products.

In addition to direct human consumption, feed grain is a major use of grains in China. Piazza (1983) assumed that feed grain uses were proportional to the output of major grains and tubers, 1 percent of rice, 3 percent of wheat, and 28 percent of corn, other grains (sorghum, oats, barley, and millet), and tubers.[21] In his later study Piazza (1986) estimated the yearly feed grain demand as a linear function of the total output of red meats and the year-end population of hogs and large animals (cattle, horses, donkeys, and mules).[22] The differences between feed grain demand and crop by-products used as feed were then shared equally by corn, other grains, and tubers.[23] We follow this method with two modifications. First, the output of poultry and other meats is added into the feed grain demand function. Second, the estimated feed grain demand net of crop by-products is shared equally by corn, other grains, and tubers for 1950 to 1979, but differently for years after 1979. Between 1980 and 1991, corn's percentage share of net feed grain demand increased by 3 percentage points per year from 36 to 69, while the percentage share of other grains decreased by 2 percentage points per year from 32 to 10 and tubers' percentage share decreased by 1 percentage point per year from 32 to 21. These modifications are due to rapid growth in the production of poultry and other

meats,[24] and because feed grain demand and corn output have increased gradually since 1979, while the outputs of other grains and tubers have fluctuated at low levels. All the coefficients used to estimate feed grain demand and crop by-products come directly from Piazza's research publications.[25]

Results of China's Yearly FBS

By following Piazza's procedures, we compiled the time-series data of China's food production, stock change, international trade, and nonhuman food end uses from 1950 to 1991 into yearly FBS, including 18 major food commodities. The disappearance rates and nutrient content of these commodities, presented in Table 1, are adopted from Piazza.[26] The national food balance sheet of 1991 is presented in Table 2, and the results for all years from 1950 to 1991 are summarized in Table 3. The average per capita daily nutrient availability and the percentage shares of nutrients from animal products are also illustrated in Figures 1 through 4. The mid-year population used to calculate the average per capita food and nutrient availability is estimated as the simple average of year-end figures. Detailed procedures for compiling FBS are available in Piazza.

To examine the effects of grain stocks, we compiled China's yearly FBS excluding stock changes for the same period. The results plotted in Figure 1 and Figure 2 suggest that excluding grain stock changes in the FBS tends to underestimate the average per capita daily nutrient availability in lean years and overestimate it in bumper harvest years. Furthermore, the estimates of energy and protein with stock adjustments are significantly lower than the estimates without stock adjustments in the period 1950-55. This is because China's food grain stocks were built up during this period and then dropped to nearly zero in 1961. Since grains have supplied a relatively small proportion of fat in China, the effect of grain stock changes on the estimate of fat availability is insignificant (see Figure 2).

The quantitative results clearly indicate that China's average per capita daily availability of energy, protein, and fat has improved significantly since 1950. But the improvement has not been

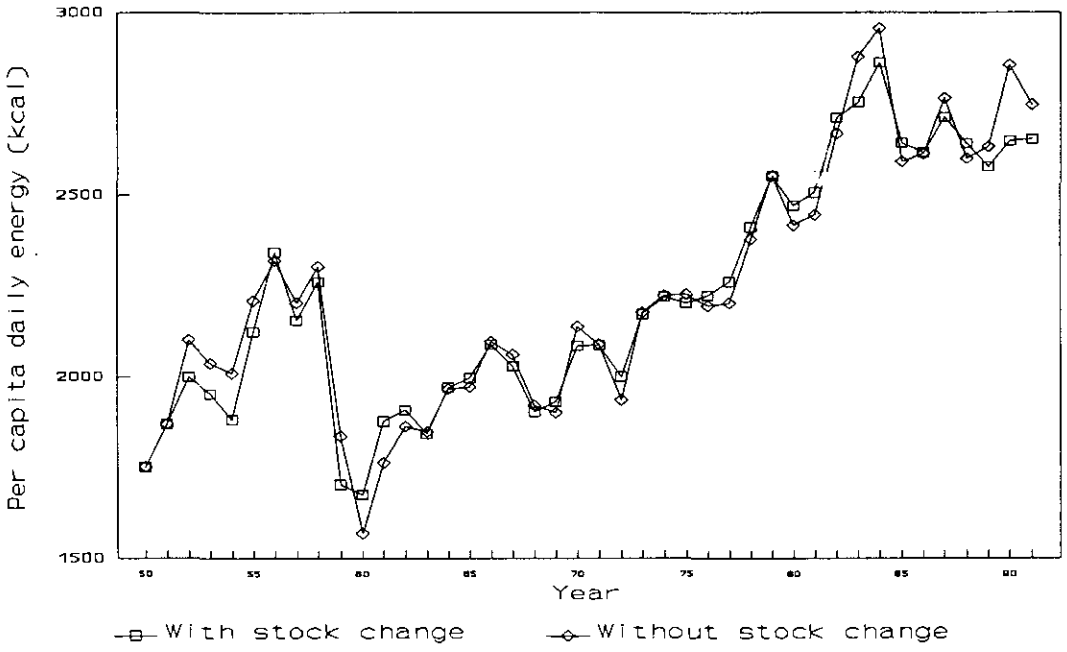

Figure 1. China's average per capita daily energy availability

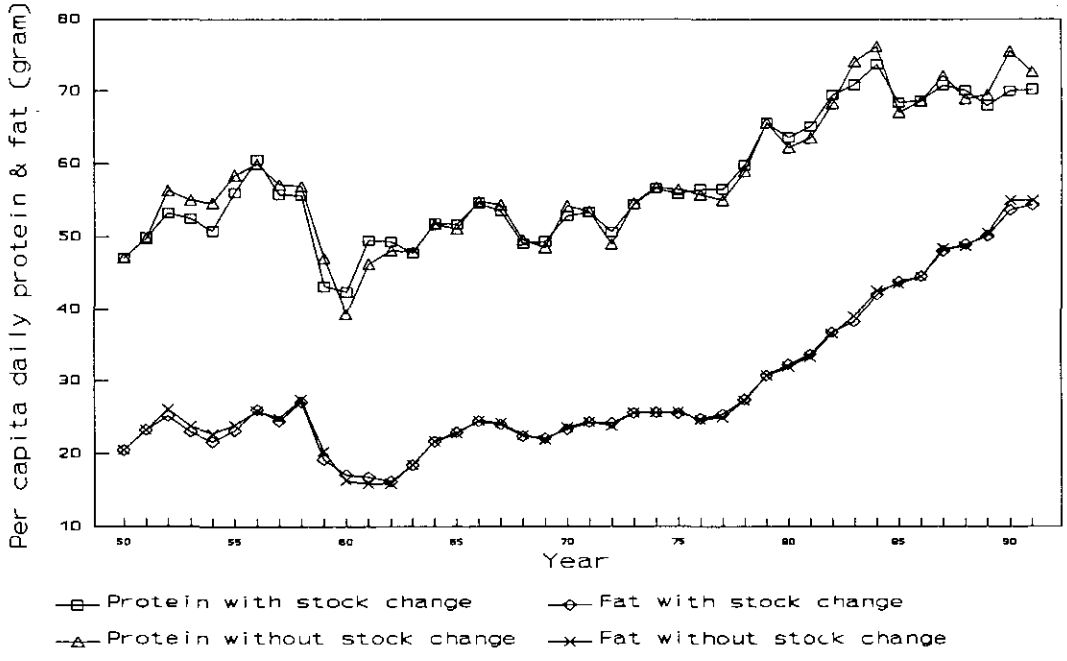

Figure 2. China's average per capita daily protein and fat availability

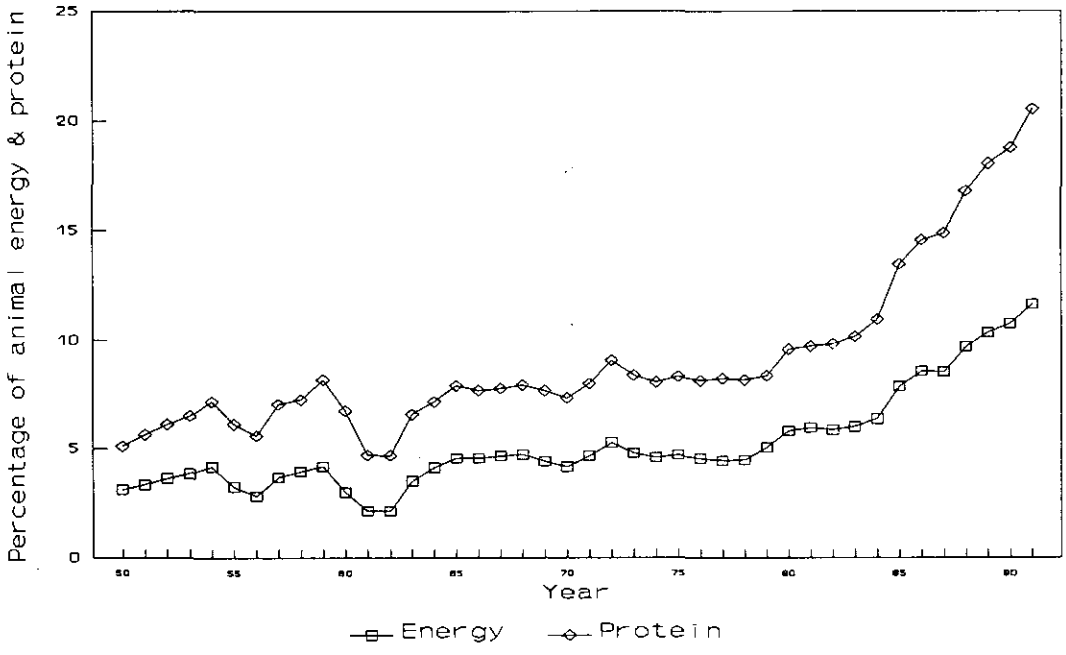

Figure 3. Percentage of animal energy and protein

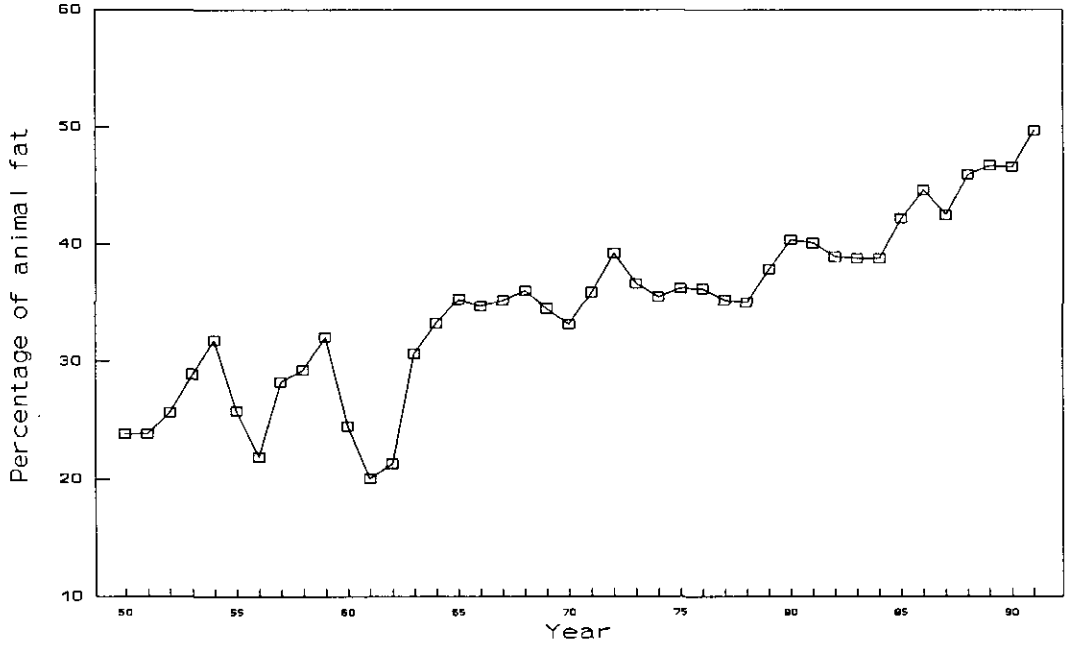

Figure 4. Percentage of animal fat

steady over time. Beginning with a low level in 1950, the average nutrient availability increased rapidly from 1950 to 1956, then fluctuated in the next four years and dropped to the lowest level in 1960. The average per capita nutrient availability increased significantly after the food crisis, around 1960, but did not recover the 1956 level until 1978. China has experienced rapid economic growth and significant nutritional improvement since the 1978 economic reforms. After the rapid increases of average per capita daily nutrient availability from 1978 to 1984, fat availability has increased continuously, while energy and protein availability have fluctuated close to 1982 and 1983 levels, but remained less than the 1984 availability (see Table 3 and Figures 1 and 2).

In addition to the absolute nutrient levels, nutrient sources are important indicators of a population's nutritional status.[27] An average low-income country has a diet typified by a high percentage of nutrients from crop sources, whereas a typical developed country has a mixed diet with a relatively high percentage of nutrients from animal sources. This study divides the food commodities into crop and animal products (see Table 2). Each food group's shares of the total per capita daily nutrient availability are presented in Table 3 and in Figures 3 and 4. The shares of energy and protein from crop products were remarkably high and stable from 1950 to 1978, ranging from 94.70 percent to 97.82 percent for energy, and from 90.94 percent to 95.30 percent for protein. Because of the rapid increases in per capita consumption of animal products, the percentage shares of energy and protein from animal products more than doubled from 1979 to 1991. Animal energy increased from 5.07 percent in 1979 to 11.61 percent in 1991, while animal protein increased from 8.37 percent to 20.53 percent in the same period. The share of animal fat has increased continuously since 1950, from 23.80 percent in 1950 to 40.39 percent in 1980, and reached 49.64 percent in 1991. These significant changes in nutrient sources since 1978 indicate China's ongoing transition in food consumption patterns to a more mixed diet.

Previous Estimations

There are a number of estimates of China's average per capita daily nutrient availability and sources in the food and nutrition literature. A summary table of these studies for years from 1929 to 1982 can be found in Piazza's book.[28] Piazza's quantitative estimates for 1950-82 are superior to the previous attempts because of significant improvement in the data in the early 1980s. Although the results of this study are in fairly close agreement with Piazza's estimates for most years between 1950 and 1982, our estimates of average per capita daily nutrient availability tend to be lower in bumper harvest years like 1952 and higher in lean years, such as the food crisis period around 1960. On the other hand, our estimates of shares of animal nutrients are higher in bumper harvest years but lower in lean years. These are as expected because of Piazza's exclusion of food stock changes in the yearly FBS.

Policies Affecting China's Nutritional Improvement

Changes in China's food production and average nutrient availability since 1950 correlate with major policy changes. The land reform around 1950 and the 1978 economic reforms resulted in rapid food production growth and nutritional improvement, but the commune system was most responsible for the food crisis in the early 1960s and the poor agricultural performance in most of the 1960s and 1970s.

By redistributing farmland from landlords to landless peasants, the nationwide land reform of 1949 to 1952 completely changed China's unequal land and income distribution system and therefore greatly stimulated peasants' production incentives.[29] The yearly FBS indicate rapid increases in food production and average per capita nutrient availability in the early 1950s. Rural collectivization, from household production units to small aid teams and then to agricultural cooperatives in the mid-1950s, significantly affected land improvement and irrigation projects. But the central government overrated

the positive impacts of collectivization and inappropriately merged the agricultural cooperatives into large communes nationwide in 1958.

Bad weather and the inappropriate institutional change precipitated the nationwide food crisis from 1958 to 1961. The crisis caused widespread malnutrition and 16 to 30 million deaths.[30] Under the commune system, both production and distribution of almost all agricultural products were governed by rigid plans through the bureaucratic communist party channels. Food self-sufficiency was a high priority of the central and local government, and peasants were allowed to produce only grains and a few other products to be used as industrial inputs according to state plans. Each production team had to deliver a certain amount of its products to the state at state-set low prices. The distribution of food and income within each production team was mainly based on household size and working hours rather than productivity. Weakened incentives and inefficient management slowed production growth and nutritional improvement for about 20 years, until the commune system was dismantled by the economic reform around 1980.[31]

China began its rural reform in 1978 by replacing the communes with the household responsibility system, under which farmland and production responsibilities were contracted to individual households. Although land was still owned by the collectives and peasants had to sell a certain amount of their products to the state at state-set prices, peasants now had much more flexibility in making their production and marketing plans. Their products can be sold in the free market after the contract is fulfilled. When the land contract was extended from 1 to 3 years to 15 to 25 years in the late 1980s, the positive impacts of the new system were more fully evident.[32] In addition to the new system, the procurement price of farm products increased by an average of about 38 percent between 1978 and 1984, while the price of major manufactured inputs, like chemical fertilizers, was almost unchanged.

The favorable prices for grain contributed significantly to the rapid growth of grain output, from 304.7 mmt in 1978 to 407.3 mmt in 1984.[33] But grain production stagnated in the next four years, at levels lower than those achieved in 1984, despite the fact that both direct and indirect demand for grains increased steadily due to income growth. Decreases in arable land (about 0.33 million hectares a year in the 1980s) and the price changes are identified as important sources of the stagnation of grain production. During 1984 to 1988, the state purchase price for grains was basically unchanged, but the price of manufactured inputs soared year by year.[34] Furthermore, the market price of some cash crops and animal products, which were not controlled by the state, increased significantly due to increased demand. Peasants shifted their production efforts from grains to more profitable activities.

Because of the stagnation of grain output and rapidly increasing demand, the Chinese government made grain production a top priority again in 1988 by implementing measures to promote grain production, including increased purchase prices and state investment in agriculture. Together with good weather, these measures have brought about significant growth of grain production since 1988, from 400.5 mmt in 1988 to the record high of 446.24 mmt in 1990, then 435.29 mmt in 1991. The growth of grain output and consumer income also stimulated the rapid growth in production of many other preferred food products (e.g., animal products). China's red meat output increased from 8.56 mmt in 1978 to 27.24 mmt in 1991, while egg production (measured in China in mmt) increased from 3.2 to 9.22 mmt in the same period.[35] The rapid increase of animal products has significantly improved China's average nutrient sources since 1978 (see Table 3 and Figures 3 and 4).

Food trade has been another factor influencing China's food situation since the early 1960s. As a net grain exporter with an average of 2.9 mmt per year in the 1950s, China first emerged as a net grain importer in 1961 and has since maintained a significant level of net grain imports, except in 1985 and 1986. From 1961 to 1990 China's average annual wheat imported was 6.97 mmt, averaging about 10 percent of the world's total traded volume.[36] Although the Chinese government's

delayed response to the food crisis that began in 1959 has been widely criticized,[37] the sharp increase of net grain imports in the early 1960s did significantly increase the average per capita food and nutrient availability. During 1966 to 1976, the net grain imports fluctuated around low levels, ranging from 0.02 to 3.68 mmt. China's net grain imports increased gradually from 0.6 mmt in 1976 to the record high of 14.87 mmt in 1982, then decreased in the next four years. China was a net grain exporter in 1985 and 1986. The net grain imports have increased again since 1987, but remained lower than those in 1982. The results of FBS suggest that the changes in net grain imports have significantly affected China's food and nutrient availability since the early 1960s. As China moves toward a market economy, its trade policy is likely to have much greater impacts not only on its food situation and nutritional improvement, but also on the international food market.[38]

Policy Implications

The quantitative results indicate that China's economic reforms, begun in 1978, have brought about significant improvement of the population's average diet. China's average per capita nutrient availability and sources achieved since the early 1980s compare favorably with those of a middle-income country. But China still faces the challenge of feeding its huge population and improving the population's nutritional status in accordance with economic growth. Despite the rapid growth of grain output from 304.77 mmt in 1978 to 435.29 mmt in 1991, grain supply is still the bottleneck of China's nutritional improvement in the 1990s because the growing population and ongoing transition in food consumption patterns to a mixed diet require much more direct and indirect grain consumption. Previous studies have forecast a grain shortage somewhere between 100 mmt and 160 mmt in the year 2000.[39] The results of this study suggest several policy implications regarding China's grain problem and prospects for nutritional improvement in the 1990s.

First, China's current food policies that tax grain producers and subsidize urban consumers have affected peasants' incentives for grain production and caused huge state expenditures. The state

expenditure for food subsidies has been about 15 percent of total government revenue in the late 1980s.[40] China's food rationing system was established in the early 1950s to ensure a low-cost food supply for industrial workers, state employees, and their families. The government has purchased large amounts of food products from peasants at state-set low prices and sold them to the urban residents at subsidized prices through food coupons. Although the number and volume of food products controlled by the state have decreased significantly since the economic reforms, urban consumption of grains and vegetable oils is still under state subsidy. China's urban household survey indicates that the average per capita annual grain consumption decreased from 137.17 kilograms (kg) in 1986 to 127.93 kg in 1991,[41] significantly less than the average state-subsidized supply.[42] Furthermore, about 10 percent of the grain consumed in cities was bought from free markets. The urban households' extra grain coupons have been sold illegally in free markets. This evidence suggests that reducing or even removing the grain subsidy, or using an income subsidy rather than a price subsidy, would improve the efficiency of food distribution and reduce state expenditures without significant impacts on the urban residents' living standard. The budgetary savings could be used to increase agricultural investment and promote food production.

Second, adjustment of China's current meat consumption patterns can be expected to improve the overall conversion rate from feed to food nutrients. China's yearly FBS indicate that food consumption has moved quickly to a mixed diet with more animal products since the early 1980s. Given China's low level of average meat consumption, this is a general trend rather than a temporary phenomenon. Because the conversion rate of feed to food nutrients is significantly different across animal products, the overall conversion rate and feed grain demand are determined directly by the structure of production and indirectly by consumption patterns. China's livestock production in 1991 was 77.99 percent pork, 8.63 percent beef and mutton, 12.56 percent poultry, and 0.82 percent other meats, which is significantly different from that recommended by feed experts. Chinese feed experts

report that the conversion rate of feed protein to food protein is 12.8 percent for pork, 52.4 percent for poultry, 37.0 percent for milk, and 25.9 percent for eggs.[43] Dividing the protein-to-meat ratio represented in Table 1 by the meat-to-feed grain ratio reported by Tuan,[44] suggests the number of grams (g) of protein produced from one kilogram of feed grain. The ratio is 18.5 g/kg for beef, 28.3 g/kg for pork, 48.8 g/kg for poultry, and 118.4 g/kg for fish. These figures clearly suggest that poultry, fish, and milk production use the least feed grain to produce protein. Any measure to guide China's consumption from meats with a high feed grain requirement to those with a low feed grain requirement could be extremely beneficial. Although pork has been the most important meat for Chinese consumers for thousands of years, price policy and nutritional education can be expected to influence food consumption patterns.

Third, one major theme of China's economic reforms is to expand foreign trade. Although China's international trade has increased dramatically from U.S. $20.64 billion in 1978 to U.S. $135.7 billion in 1991, many scholars indicate that the Chinese government has failed to make effective use of international grain markets to assist it in stabilizing domestic grain markets.[45] It has been well established that the lowest cost and most effective approach to national food security is through use of international markets combined with a modest domestic storage program for large countries.[46] But China's grain imports have been tightly controlled by the central government, and food security has been highly focused on domestic storage. Johnson estimates that the annual cost of holding 100 mmt of grains in China is about 10 billion yuan.[47] The huge cost of storing grain could be substantially reduced by utilizing international trade to even out the available domestic supply. China's rapidly growing exports of manufactured products and extremely limited per capita arable land indicate that importing more food grains and feed grains is not only financially feasible but also economically efficient for improving the nutritional status of China's population in the 1990s.

Summary

China's yearly FBS, compiled in this paper, do not indicate possible disparities in average nutrient availability and sources across regions or income groups. Food intake surveys and FBS for different regions or income groups are generally used to adjust the national FBS. But food survey data are not available in China, and compiling FBS for different population groups is not feasible because of data limitations. With its nonprivate land ownership and substantial government intervention in resource allocation and output distribution, China has been considered to be an egalitarian society by many observers.[48] But some studies have reported that the dismantling of the commune system in the late 1970s and early 1980s has significantly disrupted China's rural welfare and health care systems.[49] One major challenge for improving China's nutritional status in the 1990s is to guarantee basic food and health care for the poor in rural areas, especially in the remote and poor regions. Policies and state assistance to restore the rural welfare and health care systems are of great importance under the new economic system.

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22. The annual feed grain demand is estimated as the sum of: (1) 3 kg for every kg of red meat output; (2) 150 kg for every large animal of year-end inventory; and (3) 60 kg for every hog of year-end inventory. Alan Piazza (1986), pp 108-109, *op cit*, Ref 2.

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49. Alan Piazza, *op cit*, Ref 2.

Table 1. Disappearance rates and nutrient contents of major food commodities in China[a]

Commodity	Percentage disappearance as					Nutrient contents per kilogram of food commodity		
	Seed	Feed[b]	Nonfood industrial inputs	Waste in transport & storage	Losses in milling & processing	Energy	Protein	Fat
						kcal	gm	gm
Rice	2.4		0.2	3.0	33.0	3660.0	64.0	8.0
Wheat	10.0		0.1	3.0	13.0	3500.0	113.0	15.0
Corn	2.5		4.0	3.0	9.0	3620.0	90.0	34.0
Other grains	4.0		3.0	3.0	20.0	3478.0	129.0	18.0
Tubers	10.0		3.0	7.0		5140.0	60.0	13.0
Soybeans	12.0		45.0	3.0		4000.0	351.0	177.0
Peanuts	10.0		50.0	3.0		5480.0	234.0	453.0
Vegetable oils			7.0	3.0		8840.0	0.0	1000.0
Sugar				2.0		3510.0	0.0	0.0
Fruit				10.0		537.0	6.0	3.0
Vegetables				10.0		262.0	16.0	3.0
Red meats				5.0		3002.0	117.0	278.0
Poultry				5.0		1989.0	156.0	146.0
Other meats				5.0		1276.0	177.0	57.0
Aquatic products				5.0		630.0	103.0	21.0
Eggs				5.0		1450.0	115.0	102.0
Milk				5.0		634.0	32.0	36.0
Animal fats			10.0	3.0		9020.0	0.0	1000.0

Notes:

[a] Adopted from Alan Piazza (1983), p 94, and Alan Piazza (1986), pp 74-75, *op cit*, Ref 2.

[b] Total estimated feed grain demand net of crop by-products used as feed is shared by corn, other grains and tubers (see the text).

Table 2. China's national food balance sheet of 1991[a]

Food commodity	Domestic production	Stock changes (state-held)[b]	Net import	Domestic supply	Domestic uses: Food	Domestic uses: Nonfood end uses	Per capita food and nutrients[c]: Food	Energy	Protein	Fat
	mmt						kg/year	kcal/day	gm/day	
CROP PRODUCTS										
Rice[d]	183.81	6.54	-0.69	176.24	165.98	10.26	144.23	969.00	16.93	2.12
Wheat	95.95	3.41	12.37	104.91	91.95	12.96	79.90	666.36	21.52	2.85
Corn	98.77	3.52	0.01	95.26	33.49	61.77	29.10	262.73	6.53	2.48
Other grains	19.89		-7.98	11.91	1.85	10.06	1.61	12.28	0.46	0.06
Tubers	27.16			27.16	5.79	21.37	5.03	70.79	0.83	0.18
Soybeans	9.71	0.35	-1.11	8.25	2.96	5.29	2.57	28.16	2.47	1.24
Peanuts	6.30		-0.43	5.87	2.13	3.74	1.85	27.80	1.19	2.30
Vegetable oils	6.60		0.51	7.11	6.30	0.81	5.47	132.58		15.00
Sugar	6.40		0.67	7.07	6.93	0.14	6.02	57.87		
Fruit	21.76		-0.16	21.60	19.44	2.16	16.89	24.86	0.28	0.14
Vegetables	163.52			163.52	147.17	16.35	132.11	91.80	5.61	1.05
SUBTOTAL								2344.45	55.82	27.42
ANIMAL PRODUCTS										
Red meats	27.24		-0.38	26.86	25.52	1.34	22.18	182.38	7.11	16.89
Other meats	0.25		-0.02	0.23	0.23	0.00	0.20	0.71	0.10	0.03
Poultry	3.95		-0.05	3.90	3.71	0.19	3.22	17.57	1.38	1.29
Aquatic products	13.51		-0.38	13.13	12.48	0.65	10.85	18.71	3.06	0.62
Eggs	9.22			9.22	8.76	0.46	7.61	30.24	2.40	2.13
Milk	5.24			5.24	4.98	0.26	4.33	7.52	0.38	0.43
Animal fats	2.72			2.72	2.37	0.35	2.06	50.87		5.64
SUBTOTAL								307.99	14.42	27.03
TOTAL								2652.44	70.24	54.45

Notes:

[a] Compiled from the data discussed in the text and the coefficients represented in Table 1.

[b] Estimated from state purchases and sales (see the text).

[c] The estimated mid-year population of 1991 is 1150.78 million (the average of year-end population in 1990 and 1991).

[d] Net import is on a milled rice basis, other figures are on a paddy rice basis.

Table 3. China's average per capita daily nutrient availability and sources in the period 1950-91[a]

	Nutrient availability			Nutrient sources					
				Crop products			Animal products		
Year	Energy	Protein	Fat	Energy	Protein	Fat	Energy	Protein	Fat
	kcal	gm	gm	percent					
1950	1751.80	47.08	20.52	96.86	94.88	76.20	3.14	5.12	23.80
1951	1869.41	49.82	23.29	96.65	94.34	76.19	3.35	5.66	23.81
1952	1999.56	53.22	25.20	96.36	93.87	74.38	3.64	6.13	25.62
1953	1952.52	52.43	23.01	96.14	93.48	71.10	3.86	6.52	28.90
1954	1881.17	50.81	21.67	95.83	92.82	68.21	4.17	7.18	31.79
1955	2125.07	56.03	23.21	96.74	93.85	74.24	3.26	6.15	25.76
1956	2342.49	60.63	26.06	97.16	94.40	78.14	2.84	5.60	21.86
1957	2156.57	55.83	24.48	96.30	92.93	71.80	3.70	7.07	28.20
1958	2261.92	55.73	27.13	96.05	92.74	70.75	3.95	7.26	29.25
1959	1702.96	43.17	19.22	95.81	91.81	67.93	4.19	8.19	32.07
1960	1675.62	42.38	17.14	96.98	93.25	75.54	3.02	6.75	24.46
1961	1877.31	49.58	16.80	97.82	95.29	79.95	2.18	4.71	20.05
1962	1908.18	49.38	16.23	97.82	95.30	78.68	2.18	4.70	21.32
1963	1842.90	47.80	18.48	96.46	93.40	69.32	3.54	6.60	30.68
1964	1970.81	51.89	21.72	95.85	92.82	66.69	4.15	7.18	33.31
1965	1997.49	51.76	23.02	95.43	92.09	64.71	4.57	7.91	35.29
1966	2089.90	54.70	24.51	95.44	92.30	65.27	4.56	7.70	34.73
1967	2029.59	53.58	24.08	95.32	92.22	64.77	4.68	7.78	35.23
1968	1902.96	49.13	22.46	95.26	92.06	63.97	4.74	7.94	36.03
1969	1930.96	49.41	22.15	95.56	92.32	65.47	4.44	7.68	34.53
1970	2086.50	52.88	23.34	95.83	92.66	66.80	4.17	7.34	33.20
1971	2087.62	53.40	24.34	95.32	92.00	64.09	4.68	8.00	35.91
1972	2000.28	50.68	24.22	94.70	90.94	60.76	5.30	9.06	39.24
1973	2173.38	54.48	25.60	95.19	91.62	63.38	4.81	8.38	36.62
1974	2221.16	56.71	25.62	95.40	91.93	64.52	4.60	8.07	35.48
1975	2204.06	55.85	25.54	95.29	91.67	63.77	4.71	8.33	36.23
1976	2224.74	56.61	24.86	95.44	91.86	63.78	4.56	8.14	36.22
1977	2262.81	56.60	25.39	95.53	91.77	64.77	4.47	8.23	35.23
1978	2411.87	59.90	27.48	95.51	91.83	64.92	4.49	8.17	35.08
1979	2551.12	65.70	30.74	94.93	91.63	62.10	5.07	8.37	37.90
1980	2470.12	63.72	32.33	94.15	90.44	59.61	5.85	9.56	40.39
1981	2505.65	65.18	33.74	94.02	90.31	59.92	5.98	9.69	40.08
1982	2711.26	69.51	36.86	94.11	90.20	61.06	5.89	9.80	38.94
1983	2753.57	70.89	38.30	93.97	89.85	61.18	6.03	10.15	38.82
1984	2862.66	73.73	42.04	93.61	89.09	61.19	6.39	10.91	38.81
1985	2641.88	68.48	43.90	92.14	86.56	57.85	7.86	13.44	42.15
1986	2615.77	68.68	44.62	91.44	85.44	55.40	8.56	14.56	44.60
1987	2712.82	70.81	48.09	91.48	85.12	57.52	8.52	14.88	42.48
1988	2640.51	70.09	49.05	90.32	83.20	54.09	9.68	16.80	45.91
1989	2577.28	68.04	50.21	89.67	81.93	53.30	10.33	18.07	46.70
1990	2646.88	70.07	53.74	89.26	81.22	53.44	10.74	18.78	46.56
1991	2652.44	70.24	54.45	88.39	79.47	50.36	11.61	20.53	49.64

Note:

[a] Estimated from the time series data discussed in the text and the coefficients presented in Table 1.