

Recent Developments in the Livestock Sector
in China
and
Changes in Livestock/Feed Relationship

KE Bingsheng
Director, Research Center for Rural Economy
Chinese Ministry of Agriculture
Beijing, PRC

June 2001

Agricultural and Natural Resource Economics Discussion Paper 01/2001

School of Natural and Rural Systems Management
University of Queensland
St. Lucia 4072
Australia

© June 2001

Recent Developments in the Livestock Sector in China and Changes in Livestock/Feed Relationship

by

KE Bingsheng

Director, Research Center for Rural Economy

Chinese Ministry of Agriculture

Beijing, PRC

.....
This important longish paper was originally prepared in early 1997 as a briefing document for the Food and Agriculture (FAO). It was not published at that time. It is being included in the Discussion Papers Series since it contains a great deal of useful detailed information not generally available in English. To assist readers, both a detailed Table of Contents and a List of Tables follow. (Editors)
.....

1.	Introduction	2
2.	Significance of Livestock Sector	2
3.	Recent Policy Development	3
3.1	<i>Production Policy</i>	3
3.2	<i>Consumption Policy</i>	5
3.3	<i>International Trade Policy</i>	5
4.	Discussion Over Production and Consumption Statistics	6
4.1	<i>Production Statistics</i>	6
4.2	<i>Consumption Statistics</i>	7
4.3	<i>Resulting Imbalance – Discussion</i>	8
5.	Livestock Products Production (Based on Official Statistics)	9
5.1	<i>Recent Trend in Production</i>	9
5.2	<i>Product Price Development</i>	22
5.3	<i>Feed Prices and Feed Industry</i>	23
5.4	<i>Technical Progress and Other Factors</i>	25
6.	Demand for Livestock Products	26
6.1	<i>Recent Trend</i>	26
6.2	<i>Urban and Rural Disparities and Income Effects</i>	28
6.3	<i>Price and Consumers Preference</i>	32
6.4	<i>Geographical pattern of consumption</i>	34
7.	International Trade	36
8.	Feed/livestock Relationship	38
8.1	<i>Pig Sector</i>	39
8.2	<i>Cattle Sector</i>	40
8.3	<i>Mutton Sector</i>	40
8.4	<i>Poultry Sector</i>	40
8.5	<i>Discussions on Overall Feed Requirement</i>	41
9.	Feed Usage	41
10.	Outlook of Future Feed Concentrates (Grain) Supply	42
11.	Conclusions	44
	References	46
	List of Tables	47

Recent Developments in the Livestock Sector in China and Changes in Livestock/Feed Relationship

1. Introduction

This study is prepared for the Food and Agriculture Organization in early 1997. The main objectives are to assess the changes in the livestock sector and to draw the implications they would have on food demand. Given the importance of China for the world agricultural economy, it was felt that these changes might have a large impact not only for China but also for the rest of the world. Much of the information contained in this study has been collected through field visits to farms, officials from ministries, especially the Ministry of Agriculture, and from the State Statistic Bureau, the government body officially responsible for statistics in China. The consistency of the information was checked through discussions with professors at the China Agricultural University. Major contributions were made to the study by FAO staff from the Animal Production and Health Division and from the Commodities and Trade Division who visited China in March 1997. The author also relied extensively on a model developed by the FAO Animal and Health Division (LPT2) and on the study China's Livestock and Related Agriculture (Simpson, *et al.*, 1994) in sections dealing with technical aspects of the livestock sector.

2. Significance of Livestock Sector

Livestock plays a very important role in China due to its multi-functions. For many part of China (other than the pastoral regions and suburbs of big cities), large animals are important primarily not for their meat and milk products, but for the draught force they provide for crop production and local transportation.

Swine raising has been highly valued, especially in the 1960s and 1970s as a major source of fertilizer. In the period of grain surplus such as in mid-1980s and early 1990s, pig and poultry raising was encouraged and regarded as a mean to solve the grain surplus problems. However, the livestock sector as a major source for food has never been attached the same importance as the crop sector. The share of animal production value in the overall agriculture has increased over the past two decades, from 15% in 1978 up to nearly 30% in 1995(SSB, 1996).

Livestock production in China has been characterized by its small-scaled structure. China has not only the largest swine inventory and pork production, but also by far the largest number of swine holders in the world. It is estimated that over 80% of the rural households, or around 180 million farmers, have swine inventory. Pig inventory averages only 2-3 heads per household. Even in Sichuan province, the biggest swine production and surplus region in China, holders with over 10 heads pigs inventory have a share of only about 5% in the total pork production in mid-1980s (Ke, 1992). Changes have taken place in the past decade, but not very significantly. According to officials from MoA, the intensive pig raising in such definition has increased its share up to 15-20% currently.

The small-scaled production system is cost-efficient. A considerable part of nutrients need for

the livestock of the small farmers are provided by residues and by-products of crop production, which are otherwise of no value. For example, pig raising in the South is heavily dependent on green feeder and roughage including leaves and vines of sweet potato and rice bran (Xu *et al.*, 1994). This has not lowered the production cost, but also significantly reduced the feed grain/meat ratio, or the amount of feed grain for each kg of meat gain, to a level much lower compared with the industrialized production system. According to a survey on 6000 pig farms, the average feed grain/meat ratio is estimated at 1.8: 1 for pork in Sichuan province, the most important pig producer in China (Lu, 1997).

For many small farmers, livestock raising is an important source for cash income. Surveys organized by the Ministry of Agriculture indicated that, on the average of all kinds of farmers, pig sales alone accounted 6-12% of farmers' cash income (MoA, 1992). The central part of the country and the group with medium-level income has the highest shares. The pig's share in cash income for almost all groups has risen by 1-2 % over the observed period of 1986-1990 (Table A-1). In the major producing areas of pigs such as in Sichuan Province, pig sales consist up to 20% of farmers cash income, as estimated by local agricultural administrators and farmers interviewed by the author and CAU students.

For the major pig producing regions, often the poor and less developed inland areas, tax from pig marketing and slaughtering accounts for the major share of the township or even the county revenues.

In the process of transformation, the co-existence of traditional and modern production system is a new feature. In contrast to the vastly scattered traditional small holders, there is a growing number of large-scale pig and milk farms in the suburbs of large cities, mostly state farms. The production method and productivity of these large operations are comparable with that in the developed countries. The large-scale pig and milk farms in the proximity of large cities are assumed an important role to secure the provision of livestock products to the urban population and hence the social stability.

3. Recent Policy Development

Under the previous planning system, before the economic reform initiated at the end of 1970s, the livestock sector in China was under strict direct government control. This control encompassed all the phases of the economic process, from the very beginning of production, through distribution to consumption. This system has been greatly, if not completely, changed through the various reform stages initiated since 1978. Now, on the whole, a market system has been established, though there are still some government interventions. This holds true for all livestock categories and products. These policy changes, coupled with enormous changes in macro economic sectors, have had significant impacts on and have resulted in substantial changes in production, marketing and consumption of livestock products in China.

3.1 Production Policy

Livestock especially large animals such as horse, donkey, cattle and buffalo were considered to be production means during the pre-reform period, and were owned either by state farm or collectives. Individual farmers were not allowed to raise large animals. Exception existed only in the northwest and southwest nomadic regions, where each herdsman household was permitted to hold one or two milk cattle, or a couple of sheep or goat, to meet the consumption needs of the family. The same applied for pig and poultry raising in farming areas, mostly located in the eastern half of China.

Since the end of 1970s, the old system has been progressively reformed. Though farming as

well as grazing land remains public goods, its use right has been contracted to the individual farmers and herdsmen. Livestock herds in both pastoral areas and crop farming areas have been divided to individual herdsmen and farmers. The prevailing production system has turned from collective to rural household-based ones. Presently, except for a limited number of large-scale state pig and milk cattle farming enterprises in suburbs of large cities like Beijing and Shanghai, almost all livestock are owned by individual farmers.

In summary, the reform process of the livestock sector basically can be regarded as one of privatization. The individual farmers and herdsmen have become the decision-makers for their livestock production and marketing. This has greatly improved production incentives, resulting in a rapid expansion of livestock inventory and output. However, at the same time, over-grazing and other environmental problems have also been aggravated.

Due to low economic efficiency resulting from high production costs and management problems, large-scale state pig raising and milk cattle farms operate mostly at a loss. The major purpose of establishing state livestock farms closely located to large cities has been to secure animal products for the urban population to ensure social and political stability.

There were times when also individual farmers got direct support for pig raising and milk production, through the provision of subsidized feed. This practice has been canceled in the recent decade. The only form of direct assistance from local or central governments still provided are the granting of subsidized credit for investment, provision of technical assistance and improved bred to individual farmers and the setting of pilot farms, for example, in the northeastern region. Some kind of subsidy still exists for state pig sector in the suburbs of large cities. For example, currently in Beijing, state pig farms obtain 50 Yuan for every head of pigs they sell to the state slaughtering houses. It looks like a subsidy to state pig raising farms, but in reality it is a subsidy to the state pig marketing agencies. This is because the state pig marketing agencies pay a lower price compared with the market price, thus offsetting the potential benefit from the premium for the state pig farms. The 50 Yuan subsidy has enhanced the market position of the state marketing agencies in competing with private pig traders.

In parallel with the reform of production policy, marketing and price policies for livestock products have also undergone dramatic changes since 1980. The market liberalization process for livestock products was initiated much earlier than that for grain. By mid-1980s, the obligatory delivery scheme had been completely abolished. Not only have livestock raisers obtained the freedom in their marketing decision making, but also private intermediate traders have been allowed to enter the livestock market. The state monopoly marketing in livestock products has been abolished and a very competitive market has been formed.

Price control in various forms has been gradually lifted. Government subsidy to state-owned marketing agencies and shops have been substantially reduced. In small cities and towns and vast rural areas, the state marketing agencies get no more subsidies. Only in large cities do they still get direct subsidy, but at a much reduced level. Reasons for the maintenance of the subsidies include cost compensation for stock holding, price stabilization and support to retired state enterprise employees. The level of the subsidy is usually the result of the negotiation between the state marketing agency and the municipal government.

The current market structure of livestock products in China is characterized by a dual marketing system. On the one side there is a very large number of small private traders with very simple or even primitive slaughtering and marketing methods, while on the other, some large scale state marketing enterprise are equipped with much better or modern marketing facilities. The market share of state marketing agencies is directly related with the size of the city. The larger the city, the higher the share, but it does not exceed 50% even in metropolises like Beijing. It is estimated that, taking the nation as a whole, the private traders have a

dominant market share of over 80%. The hygienic control of the meat handled by the small private traders is becoming an increasing headache for local governments.

Producer price data on livestock products are rather incomplete in China. For poultry, there is no systematic data available. For beef cattle, sheep and goat, there are producer price data up to 1992. However, the prices were measured on the per head bases, not on weight. Only for hog there is consistent price data up to 1992. However, even for hog, the price data for different years are not completely comparable, for they were the mixed prices for state procurement and free market trade and for all qualities.

Since 1993, SSB only publishes aggregated price index, but no more disaggregated price data on livestock products. Surveys organized the Ministry of Agriculture provide only hog prices since 1993.

Based on the available prices, gross market margin for pigs is calculated, which has been rather stable, within the ranges of 50-60% of the producer price under the normal conditions (Table A-2). Exemptions only occurred for 1994 and 1995, when it rose up to 100%, reflecting a much higher consumer price rise than producer during the overall price soar in that time.

3.2 Consumption Policy

In the pre-reform period, before the end of 1970s, livestock products were provided at subsidized prices and rationed to urban consumers. The rural population was not covered by the ration scheme, i.e. rural population had to meet the consumption need by themselves. The availability of the livestock products in each city determined the level of the rationing. Both the quantity and quality of the rationed products were far from satisfactory. Meat purchasing was often a source for quarrel between customers and meat shop clerk, for the customers usually could only get the pieces of meat the clerk assigned to them, but not the ones they mostly wanted and preferred. Following the abolition of the rationing system by the mid-1980s, all the population have been given access to meat at the market retail prices.

3.3 International Trade Policy

International trade in livestock products is subject to a licensing system. Traditionally, export of livestock products has always been encouraged by government for the purpose of earning foreign hard currencies. Subsidy was also often needed and provided. Since the beginning of 1990s, export subsidy has been canceled.

Imports of breeding animals are exempted from tariffs. Imports of other livestock products are subject to high import tariffs, varying from 12% to 65% under preferential trade terms and 30% to 90% under normal trade terms. In addition to that, value-added taxes are collected, which range from 13-17%, as indicated in Table 3-1.

Table 3-1 Import Tariff for Livestock in China, %, Jan. 1997

	Preferential	Normal	Value-added tax
Breed Animal	0	0	13
Other cattle	12	30	13
Other swine	12	50	13
Other goat and sheep	12	50	13
Other poultry	12	50	13
Beef	50	70	17
Pork	45	70	17
Mutton	45	70	17
Poultry meat	45	70	17
Eggs	55	80	13
Butter an cheese	65	90	17

Source: Beijing Custom, Custom Declaration Manual, 1997.

As practiced in many other countries, there are also non-tariff barriers such as sanitary requirements and quarantine inspection requirement. For example, the Chinese customs, as many other countries, banned beef import from United Kingdom when the mad cattle disease caused great health concerns in 1996.

4. Discussion Over Production and Consumption Statistics

4.1 Production Statistics

In most developed countries, livestock statistics are based on the veterinary quarantine before slaughtering and are very reliable. In China, the veterinary quarantine control system is rather weak. Over 80% of the pigs in China are slaughtered and marketed by a great number of small traders, usually villagers. There are hardly any communal slaughtering facilities available, and these small traders use to slaughter one or two pigs in their backyard each time. They do not have much incentives to go through the quarantine process, which involves fees and transportation costs. In almost every province, pig slaughtering is subject to a slaughtering tax and various fees, which often accounts for up to 5% of the pig value. As a result, a large portion of the slaughtering evades the quarantine process and thus makes the quarantine statistics incomplete.

As an alternative, China has long adopted a reporting-based system to get livestock production statistics. It is a pyramid reporting system: village leaders make an accounting of livestock numbers and production in the village and report them to the township administration. Township administrators in turn compile the data from the villages and report them to the county authority. The county heads compile the data from the townships and report them to the province government. During the collective time before 1980s, this system was technically rather reliable, for the collectives had booking records. However, with the dismantling of collectives and the introduction of individual household-based production system, the reporting system lost its basic ground. Although village leaders still make reports, these reports do not result from book keeping records or surveys, and are rather estimated. In addition, there is a tendency to exaggerate the production figures for officers at various levels as production growth is often regarded as an important indicator for the performance of local government officers. In recognition of these bias, the central government and sometimes also provincial governments make downward adjustments to the compiled reporting-based figures according to experts' views, market balance situation, etc.

It is generally assumed that the real situation falls somewhere between the above-mentioned reporting-based statistical data and the figures derived from slaughter tax, with the former as

the upper limit and the latter as the lower limit. Example figures from survey by CAU students in a county in Guizhou province indicated that taxed slaughtered hogs was only 35-40% of that of official statistics for the recent years. The gap can not be completely attributed to tax evasion. At least part of the disparity is due to over-reporting. The problem of the over-report of meat production become more serious in the 1990s.

According to the official statistics obtained from the above-mentioned approach, livestock production in China has kept a very rapid growth rate over the past 15 years. The total meat production has more doubled in the period of 1980/90, and nearly doubled in the five years of 1990/95, as indicated in Table 4-1. The problem of over-report is clearly shown by the case for beef: it has increased by more than two folds just within five years of the 1990s! This over-reporting of meat production will be discussed in more details in comparison with consumption statistics later.

Table 4-1 Livestock Production and Growth in China, in million t

Year	Meat Total	Pork	Beef	Mutton	Poultry	Rabbits	Eggs	Milk
1980	13.08	11.34	0.27	0.44	1.00	0.03	2.57	1.37
1985	19.27	16.55	.047	0.59	1.60	0.06	5.35	2.89
1990	28.57	22.81	1.26	1.07	3.23	0.10	7.95	4.75
1995	52.60	36.48	4.15	2.02	9.35	0.27	16.77	6.73
1990/80	2.18	2.01	4.68	2.41	3.23	3.33	3.09	3.47
1995/90	1.84	1.60	3.29	1.89	2.89	2.68	2.11	1.42

Sources: SSB; SYC; MoA: 1996 Report

4.2 Consumption Statistics

As for consumption, the State Statistical Bureau implement annual sample rural and urban household surveys on income, expenditure and consumption. These surveys cover about 35 000 urban households and 67 000 rural households. Survey data are aggregated by these two consumer groups, for there are substantial differences in income and consumption patterns between the urban households and rural ones.

Officials from SSB believe with high confidence that the results of the surveys, both for the rural and urban households, are reliable, for the surveys have conducted through a very representative sampling and in a consistent way.

Based on the per capita consumption data from the household surveys and population statistics, total meat consumption for the whole country can be derived, as shown in Table A-3 for the representative years. Table A-4 contains the livestock consumption data derived from balance sheet. The major results and the differences are summarized in Table 4-2. The divergence is striking.

Table 4-2 Divergence in Livestock Consumption Data, in million t

	1980	1985	1990	1995
	Meat Total			
Data from Balance Sheet	12.58	18.75	27.95	51.87
Data from Household Surveys	10.53	15.35	18.20	19.59
Difference	2.05	3.40	9.75	32.28
in % of survey data	19	22	54	165
	Eggs			
Data from Balance Sheet	2.51	5.28	7.91	16.75
Data from Household Surveys	1.93	3.37	4.22	6.19
Difference	0.58	1.91	3.69	10.56
in % of survey data	30	57	94	171

Sources: SYC, and Custom Statistics of China.

4.3 Resulting Imbalance – Discussion

There are several explaining reasons for the divergence. First, eating-out is an important factor. Eating-out for urban residents is about one third of meat consumption in term of expenditure in the 1995 surveys. Take the national as a whole, the meat consumption in restaurants and canteens should not exceed 10% of the total meat consumption in quantitative term.

Secondly, the actual urban share of the population should be larger than the statistical figures. The so-called floating population, rural migrants working in the cities and town, is estimated as over 50 million in 1995 (CERC, 1997). Their meat consumption level should be close to that of representative urban households.

Thirdly, the difference in meat weight definition may be an important source for the imbalance. Meat production is in principle measured by carcass weight, while the consumption figures are the actually purchased weight, mostly without bones.

Fourthly, consumed by foreign tourists. Consumption of foreign visitors registered at 40-50 million a year, or less than 4% of the domestic population, should not be significant. Given an average stay period of four weeks a visit and a doubled daily meat consumption level compared with ordinary Chinese, the total meat consumption by foreigners is less than 1% of the total meat consumption in the country.

Finally, there might be bias in the sampling of the households. The sampled households may have a lower meat consumption level than the actual national average, if assumed that the numbers of households with high meat consumption levels have not been adequately included in the surveys. Such households include herdsman population, urban and rural consumers in less-fish consuming regions, and in the major meat production areas.

Put all the above-mentioned factors together, it is estimated that the actual meat consumption may be 40-50% higher than that derived from the household surveys. This estimation is largely consistent with the estimation made by SSB officials, in that they indicated that the actual consumption in 1995 was about 30 million tons.

This is also agreeable with the general opinion that until the second half of 1980s, the over-reporting of livestock production was not very significant. Since late 1980s, especially since the early 1990s, the over-reporting has become increasingly serious.

Table 4-3 Official Statistics of Cattle Inventory and Imbalance

million heads

Year	Inventory Year- Begin 年初存栏	Slaughtered Numbers 当年出栏	New Born 新生仔畜	Net Growth 当年净增数	Year-End Inventory		
					Derived 计算值	Statistics 统计值	Deviation 差距
	1	2	3	4=3-2	5=1+4	6	7=6-5
1987	91.67	7.40	14.91	7.51	99.17	94.65	-4.52
1988	94.65	8.58	15.85	7.27	101.92	97.95	-3.97
1989	97.95	9.43	16.61	7.18	105.13	100.75	-4.38
1990	100.75	10.88	17.23	6.35	107.10	102.88	-4.22
1991	102.88	13.04	18.07	5.03	107.92	104.59	-3.32
1992	104.59	15.19	18.91	3.72	108.31	107.84	-0.47
1993	107.84	18.68	20.79	2.11	109.95	112.01	2.06
1994	112.01	25.00	24.8	-0.20	111.81	123.32	11.51
1995	123.32	30.00	28.37	-1.63	121.69	132.06	10.37

Sources: Agricultural Publishing House of China: Agricultural Statistics of China; Agricultural Yearbook of China, various issues.

The problem of over-reporting can also be proven by cross-checking the officially published data on livestock inventory. In Table 4-3, data in the first four columns and the column 6 are all official statistics from SSB. Year-end inventory can be derived from the inventory at the year-beginning, slaughtered numbers in the year and the number of the newborn. There seems to be a systematic deviation between the such calculated figures and the statistics, which is around 4-5 million heads, due to mortality and other reasons. If adjusted by this systematic deviation, the over-report of cattle inventory in 1995 was about 15 million heads, which is the same as the personal estimations of the several officials from the Ministry of Agriculture according to author interviews.

An agricultural census was conducted in January 1997, the first of this kind in China. According to the senior SSB officials interviewed by this study team, the preliminary results of the census will be available very soon. There are high possibilities that some downward adjustments will be made with the agricultural statistics to correct the distortion caused by over-reporting.

The SSB data are the only official one, and there is no other alternative. Hence, these production figures must be used until they are revised. The following analysis is based on these official figures. Even if absolute figures may not be accurate, the direction of the changes and the relative portion of the different meat categories might still be in order.

5. Livestock Products Production (Based on Official Statistics)

5.1 Recent Trend in Production

Pig Sector

Pig inventory remained somehow constant in the first half of the 1980s at around 300 million

heads, and then increased steadily to over 400 million heads in 1995, as shown in Table 5-1. The slaughtered number showed the same trend, but at a larger pace. During the last decade, the slaughtered number has doubled, from around 240 million heads in 1985 to 480 heads in 1995.

The changes in technical variables and other factors effecting efficiencies find expression in changes of a number of production parameters. The offtake rate (annual slaughtered animal as a percentage of inventory at the year-beginning) has increased steadily and considerably, from 62% in 1980 to 116% in 1995. At the same time, slaughtered animals have become heavier. Slaughtering weight of hogs on the average has increased from 57 kg to 76 kg. The productivity measured with meat production per head of inventory, the combined result of offtake rate and slaughtering rate, has more than doubled in the past 15 years.

Table 5-1 Pig and Pork Production in China

Year	Inventory at year- beginning million heads 1 年初存栏	Slaughtered million heads 2 全年出栏	Meat Output million t. 3 产量	Offtake Rate 4=2/1 出栏率	Carcass Weight kg/head 5=3/2 平均出肉量	Productivity per year kg/head 6=3/1=4*5
1980	319.7	198.6	11.34	62	57	35.5
1981	305.4	195.0	11.88	64	61	38.9
1982	293.7	200.6	12.72	68	63	43.3
1983	300.8	206.6	13.16	69	64	43.8
1984	298.5	220.5	14.45	74	66	48.4
1985	306.8	238.8	16.55	78	69	53.9
1986	331.4	257.2	17.96	78	70	54.2
1987	337.2	261.8	18.35	78	70	54.4
1988	327.7	275.7	20.18	84	73	61.6
1989	342.2	290.2	21.23	85	73	62.0
1990	352.8	309.9	22.81	88	74	64.7
1991	362.4	329.0	24.52	91	75	67.7
1992	369.7	351.7	26.35	95	75	71.3
1993	384.2	378.2	28.54	98	75	74.3
1994	363.0	421.0	32.05	116	76	88.3
1995	414.6	480.5	36.48	116	76	88.0

Source: SSB; SYC; SYA

The introduction of private incentives and market mechanism have triggered changes in producers' traditional production attitude, objectives or utilities. Many producers now pay high attention and place high priority on the economic returns. Now it is the amount of the income, not the size of the herd, that earns respect to a producer from his or her fellow society. In addition, the technical progress in the field of feed and improvement in other areas, including in breeding, feeding method and disease control have greatly contributed to the expansion of the livestock production.

Table 5-2 Changes in Regional Patterns of Pork Production

	in million tons		Increment 1995 over 1980		Share in the Nation	
	1980	1995	million tons	%	1980	1995
China	11.34	36.48	25.14	222	100.00	100.00
Beijing	0.13	0.24	0.11	85	1.14	0.66
Tianjin	0.06	0.12	0.06	104	0.53	0.33
Hebei	0.40	1.87	1.47	364	3.56	5.14
Shanxi	0.16	0.43	0.27	168	1.43	1.19
Inner Mongolia	0.12	0.48	0.36	312	1.02	1.31
Liaoning	0.42	1.42	0.99	235	3.73	3.88
Jilin	0.24	0.77	0.54	227	2.08	2.12
Heilongjiang	0.35	0.80	0.45	130	3.07	2.20
Shanghai	0.16	0.24	0.08	46	1.44	0.66
Jiangsu	1.04	1.96	0.92	89	9.15	5.37
Zhejiang	0.69	1.00	0.31	45	6.06	2.74
Anhui	0.49	1.37	0.87	177	4.36	3.75
Fujian	0.24	1.03	0.79	334	2.09	2.82
Jiangxi	0.36	1.89	1.52	420	3.19	5.17
Shandong	0.86	2.68	1.82	211	7.60	7.34
Henan	0.49	2.10	1.61	326	4.36	5.77
Hubei	0.54	2.40	1.85	343	4.77	6.57
Hunan	0.91	3.10	2.19	239	8.06	8.50
Guangdong	0.67	1.89	1.22	183	5.89	5.17
Guangxi	0.40	1.96	1.56	393	3.50	5.36
Hainan		0.18			0.00	0.50
Sichuan	1.64	5.26	3.62	220	14.48	14.43
Guizhou	0.25	0.93	0.68	266	2.25	2.55
Yunnan	0.29	1.12	0.82	282	2.58	3.06
Tibet	0.00	0.01	0.00	153	0.02	0.02
Shaanxi	0.22	0.60	0.38	170	1.97	1.65
Gansu	0.12	0.44	0.32	261	1.08	1.21
Qinghai	0.02	0.06	0.04	185	0.17	0.15
Ningxia	0.01	0.06	0.05	324	0.13	0.17
Xinjiang	0.03	0.08	0.05	155	0.29	0.23

Regional patterns of the pork production and their changes in the past 15 years are indicated in Table 5-2. All of the provinces have achieved significant production growth in pork. However, the development is uneven between different provinces. As a result, the shares of some provinces have risen and others have fallen. The trend is that the economically most developed regions have a smaller share. Those regions include Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang and Guangdong. The largest gainers are mostly located in the central part of the country, including Henan, Hubei, Hunan, Hebei, Jiangxi and Guangxi. With nearly 15% of the national pork production, Sichuan Province has maintained its position as the largest swine producer in China, followed far behind by Hunan, Shandong, Hubei, Henan, Jiangsu, Jiangxi and Hebei. These eight provinces produce nearly 60% of the total pork production in the country.

Cattle Sector

The cattle sector is the fastest growing livestock sector in China, though there seems to have some over-reporting problems with the official statistics as mentioned earlier. Several factors explain the reasons for this fast growing pace in beef production. First, the reform policy has greatly increased the incentives of farmers to expand livestock production, as mentioned earlier. Second, the production level at the beginning of the observation period, i.e. at the beginning of the 1980s, was very low. The Chinese beef production in 1980 was only slightly over a quarter of a million tons, or a quarter of one kilogram per capita. The inventory was large, at over 70 million heads in the early 1980s. However, the offtake rate was very low, only 4-5%, as indicated in Table 5-3. The most important reason for that was that the draught cattle had a large share in the total cattle inventory. Beef from extensive pastoral system, mostly located in Tibet, Inner Mongolia, Qinghai, Sichuan and Xinjiang, accounted the dominant part of the total beef production. In the eastern farming provinces, beef production was only a by-product from the fallen and eliminated draught animals. Third, considerable technical progress has been made. New breeds and artificial insemination, new production methods, especially the progress in exploring new feed resources such as ammoniation of crop straws, have significantly expand the scope of the efficiency of the production. The offtake rate has risen markedly and the slaughtered cattle have become much heavier, as indicated in Table 5-3. The argument, that the major reason for the beef growth is the mechanization, namely, the mechanization has led to larger slaughter (Simpson *et al.*, 1994), seems to be implausible, because the numbers of draught cattle have not fallen, but rather doubled from 30 million heads to 60 million heads over the 1980-1995 period (SSB, 1996). The mechanization might have played some role, but in any case, it is unlikely that the mechanization to be the major reason. According author observation and interviews in the field study, many of the increased numbers of tractors are purchased primarily for transportation, but not for farming. The small farm scale has significantly prohibited the mechanization process.

Cattle is held very extensively. According to officials from MoA, the target for intensive cattle raising, animals held in flocks larger than 10 heads each, should be 15% of the total slaughtering by the year 2000. This let assume that the intensive raising may be around 10% in the total beef production.

As a result of the unbalanced development, the regional patterns of the beef production have changed remarkably, as shown in Table 5-4. The five pastoral provinces mentioned above have lost its share considerably from 55% in 1980 to only 13% in 1995. The major beef providers are no longer the pastoral provinces in the West, but the farming regions in the central and eastern part of the country. Five major cropping provinces, Shandong, Henan, Hebei, Liaoning and Anhui, have become the most important beef producers in China, with its combined share rising from 10% in 1980 to 57% in 1995.

This shift in regional patterns of beef production reflects a structural change process, which has been both resource-driven and demand-driven. Cattle inventory in the western pastoral regions, such as Tibet, Xinjiang, Qinghai and Sichuan (the west half) have shown only slight growth in cattle numbers (Table 5-4). The widely recognized problem of over-grazing and desertification in those areas indicates the feed resource constraint. The extensive nomadic production system has also been weak in adopting new technology. The remote distance and transportation bottleneck have posed further constraint to the market access. In contrast, the farming areas have been favored with close access to fast growing demand market, much better natural, technical and economical conditions for development of intensive producing system. Intensive beef cattle raising in farming areas has been encouraged by the government. According to the Ministry of Agriculture, 122 counties have been selected as "beef production bases" by 1996. Special support in loan and technical assistance have been provided through a support program.

Table 5-3 Beef and Milk Production in China

Year	Inventory at year-beginning million heads 年初存栏	Slaughtered million heads 全年出栏	Meat Output million t. 产量	Offtake Rate % 出栏率	Carcass Weight kg/head 平均出肉量	Productivity per year kg/head	Dairy Cattle million	Milk million t	Dairy Cattle Productivity kg/cow
1980	71.35	3.32	0.269	4.7	81	3.8	0.641	1.141	562
1981	71.68	3.02	0.250	4.2	83	3.5	0.698	1.291	541
1982	73.30	3.10	0.270	4.2	87	3.7	0.817	1.618	505
1983	76.07	3.47	0.320	4.6	92	4.2	0.951	1.845	515
1984	78.08	3.87	0.370	5.0	96	4.7	1.336	2.186	611
1985	82.13	4.57	0.467	5.6	102	5.7	1.627	2.499	651
1986	86.82	5.55	0.589	6.4	106	6.8	1.846	2.899	637
1987	91.67	7.40	0.792	8.1	107	8.6	2.164	3.301	656
1988	94.65	8.58	0.958	9.1	112	10.1	2.222	3.660	607
1989	97.95	9.43	1.072	9.6	114	10.9	2.526	3.813	662
1990	100.75	10.88	1.256	10.8	115	12.5	2.691	4.157	647
1991	102.88	13.04	1.535	12.7	118	14.9	2.946	4.644	634
1992	104.59	15.19	1.803	14.5	119	17.2	3.139	5.031	624
1993	107.84	18.68	2.336	17.3	125	21.7	3.421	4.987	686
1994	112.01	25.13	3.276	22.4	130	29.2	3.843	5.288	727
1995	123.32	30.50	4.150	24.7	136	33.7	4.174	5.764	724

Sources: SSB; SYC; SYA

Table 5-4 Changes in Regional Patterns of Beef Production

	in million tons		Increment 1995 over 1980		Share in the Nation	
	1980	1995	million tons	%	1980	1995
China	0.2687	4.154	3.885	1446	100.00	100.00
Beijing	0.0003	0.020	0.020	6383	0.11	0.48
Tianjin	0.0003	0.028	0.028	8789	0.12	0.67
Hebei	0.0040	0.546	0.542	13398	1.51	13.14
Shanxi	0.0016	0.070	0.068	4352	0.59	1.69
Inner Mongolia	0.0455	0.094	0.048	106	16.94	2.26
Liaoning	0.0046	0.297	0.292	6312	1.72	7.15
Jilin	0.0076	0.175	0.167	2216	2.81	4.21
Heilongjiang	0.0158	0.237	0.221	1404	5.87	5.71
Shanghai	0.0004	0.000	0.000	-100	0.16	0.00
Jiangsu	0.0041	0.054	0.050	1202	1.54	1.30
Zhejiang	0.0049	0.009	0.004	83	1.83	0.22
Anhui	0.0060	0.238	0.232	3892	2.22	5.73
Fujian	0.0027	0.021	0.018	688	0.99	0.51
Jiangxi	0.0079	0.044	0.036	459	2.93	1.06
Shandong	0.0089	0.648	0.639	7197	3.30	15.60
Henan	0.0069	0.644	0.637	9193	2.58	15.50
Hubei	0.0049	0.083	0.078	1606	1.81	2.00
Hunan	0.0055	0.053	0.048	870	2.03	1.28
Guangdong	0.0081	0.057	0.049	604	3.01	1.37
Guangxi	0.0034	0.084	0.081	2346	1.28	2.02
Hainan		0.019				0.46
Sichuan	0.0356	0.187	0.151	425	13.26	4.50
Guizhou	0.0047	0.055	0.050	1062	1.76	1.32
Yunnan	0.0102	0.063	0.053	516	3.81	1.52
Tibet	0.0209	0.062	0.041	197	7.8	1.49
Shaanxi	0.0025	0.073	0.071	2851	0.92	1.76
Gansu	0.0047	0.077	0.072	1549	1.74	1.85
Qinghai	0.0249	0.063	0.038	153	9.27	1.52
Ningxia	0.0003	0.022	0.022	7486	0.11	0.53
Xinjiang	0.0215	0.131	0.110	510	7.99	3.15

Dairy Cattle

There were very few dairy cattle in China prior to the 1980s. In Chinese statistics, dairy cattle implies improved milk cow. As of 1980, there were just 641 thousand heads such cow, an inventory that included crosses with beef type as well as purebreds or high-grade animals. However, it has since grown very fast and just 15 years later there were six times as many and, by 1995, 4.17 million head (Table 5-5). The dramatic rise in dairy cattle numbers has been mainly via dual-purpose animals (Simpson, *et al.*, 1992). As a result, the milk yields on the average have not increased in the past 15 years. There might be other reasons for the calculated declining yields. The over-report of inventory numbers as discussed earlier should also have contributed to this.

There is no data on the relative shares of different systems. It lacks a clear definition and distinction between intensive and extensive raising systems applicable for China's situation. The intensive dairy cattle system as understood in developed countries are almost only found in state farms, mostly located in the suburbs of large cities and in the northeast province of Heilongjiang, according interviews with officials from MoA.

Geographically, milk production is concentrated in the North. With a share of nearly 30% in the national total, the Heilongjiang Province is by far the largest milk producer in China, followed by Inner Mongolia and Xinjiang, each with around 8%(Table 5-6). The three municipalities, Beijing, Shanghai and Tianjin, are also important in milk production, taking account that they are very small in areas. The milk production system in the suburbs of those three large cities are highly intensive and productive. The milk yields there are over 3500 kg, more than doubled that of the national average. The pastoral areas in Xinjiang, Gansu, Tibet and Inner Mongolia, in contrast, have much lower yields, just 500-800 kg.

Similar to that of beef cattle, the rapid growth in milk production has been a result of technical progress and, especially, the fast growing demand. The development of milk-processing industry has provided more and diversified milk products and greatly stimulated milk demand. Prior to the reform in the late 1970s, there were hardly any other milk products except milk powder. The development of milk processing industry and related food industry, including ice cream, yogurt, butter, cheese, cakes and so on, have pose great demand for milk. On the other hand, market development, especially the expansion of retailer shops with refrigerator facilities, have significantly extended the market reach of milk products. Food shops with refrigerators now can be found everywhere in the cities and towns. Fifteen years ago, there were hardly any such shops, even in large city like Beijing.

Table 5-5 Milk Production in China

Year	Dairy Cow Inventory million	Milk Production million t	Dairy Cattle Productivity kg/cow
1980	0.641	1.141	1780
1981	0.698	1.291	1850
1982	0.817	1.618	1980
1983	0.951	1.845	1940
1984	1.336	2.186	1636
1985	1.627	2.499	1536
1986	1.846	2.899	1570
1987	2.164	3.301	1525
1988	2.222	3.660	1647
1989	2.526	3.813	1510
1990	2.691	4.157	1545
1991	2.946	4.644	1576
1992	3.139	5.031	1603
1993	3.421	4.987	1458
1994	3.843	5.288	1376
1995	4.174	5.764	1381

Source: SSB, SYC, various years.

Table 5-6 Milk Production by Province in China, 1995

	Inventory, Year-begin				Cow Milk					
	1000 head		%		1000 t		%		Yield, kg/head	
	1980	1995	1980	1995	1980	1995	1980	1995	1980	1995
China	641	3843	100.0	100.0	1141	5764	100.0	100.0	1780	1500
Beijing	20	56	3.1	1.5	61	206	5.4	3.6	3060	3679
Tianjin	8	25	1.2	0.7	22	107	2.0	1.9	2800	4213
Hebei	40	438	6.2	11.4	27	325	2.3	5.6	663	742
Shanxi	13	99	2.0	2.6	23	260	2.0	4.5	1785	2640
Inner Mongolia	127	587	19.8	15.3	70	486	6.1	8.4	548	829
Liaoning	23	64	3.6	1.7	97	171	8.5	3.0	4200	2668
Jilin	23	59	3.6	1.5	25	102	2.2	1.8	1087	1720
Heilongjiang	78	732	12.2	19.1	124	1646	10.8	28.6	1585	2248
Shanghai	27	59	4.2	1.5	73	218	6.4	3.8	2715	3676
Jiangsu	14	37	2.2	0.9	27	100	2.4	1.7	1929	2740
Zhejiang	17	31	2.7	0.8	35	91	3.1	1.6	2071	2935
Anhui	5	22	0.8	0.6	7	25	0.6	0.4	1440	1142
Fujian	7	21	1.1	0.5	14	61	1.3	1.1	2057	2961
Jiangxi	7	22	1.1	0.6	9	32	0.8	0.6	1314	1429
Shandong	7	63	1.1	1.6	13	179	1.2	3.1	1914	2855
Henan	9	21	1.4	0.5	8	55	0.7	1.0	889	2619
Hubei	11	22	1.7	0.6	24	38	2.1	0.7	2182	1704
Hunan	4	4	0.6	0.1	7	8	0.6	0.1	1750	1860
Guangdong	17	24	2.7	0.6	23	55	2.0	1.0	1335	2321
Guangxi	4	5	0.6	0.1	5	9	0.4	0.2	1175	1915
Hainan	0	1	0.0	0.0	0	1	0.0	0.0		1429
Sichuan	20	39	3.1	1.0	132	277	11.6	4.8	6620	7158
Guizhou	4	18	0.6	0.5	5	14	0.5	0.2	1325	769
Yunnan	10	72	1.6	1.9	15	95	1.3	1.6	1510	1329
Tibet	0	300	0.0	7.8	70	141	6.2	2.4		469
Shaanxi	10	75	1.6	2.0	17	174	1.5	3.0	1700	2320
Gansu	17	163	2.7	4.2	25	96	2.2	1.7	1453	588
Qinghai	7	74	1.1	1.9	116	200	10.1	3.5	16514	2703
Ningxia	2	41	0.3	1.1	4	140	0.4	2.4	2100	3457
Xinjiang	110	671	17.2	17.4	58	452	5.1	7.8	531	674

* Milk production derived from all cattle and buffalo in China.

Sources: MoA, 1995, China Agricultural Statistics. Animal Husbandry Statistics in China.

Sheep and Goat Sector

Numbers of sheep and goat sector have also increased over the past fifteen years, but far slower than cattle sector. Sheep inventory increased very moderately, from 103 million heads 1980 to 117 million heads in 1995, less than 1% annually (Table 5-7). Goat inventory has shown a higher growth rate of nearly 3%, from 81 million heads in 1980 to 123 million heads in 1995.

Mutton production has more than quadrupled during 1980-1995. The increase of offtake rate, from 23% in 1980 to 69% in 1995, has made the major contribution to the growth of mutton production. The growth of inventory and increase in slaughtering weight have also some effects.

Milk and wool are another two important products from sheep and goat sector. Sheep and goat milk production has also quadrupled, form 226 thousand tons in 1980 to over one million tons in 1995. Wool and cashmere production increased moderately, from 191 thousand tons in 1980 to 316 thousand tons in 1995, a growth of 65% over the whole fifteen years. (Again, this gives some hints to the problems of over-report of mutton production. Wool and mutton production should be closely linked together, especially in the long run. It is to assume that the statistics for wool is somehow more reliable than that for meat, because wool marketing in much more concentrated.)

Table 5-7 Mutton, Sheep and Goat Milk and Wool Production in China

Year	Inventory at year-begin million heads			Slaughtered million heads	Mutton million t.	Offtake Rate	Milk million t	Wool and Cashmere million t
	Total	Sheep	Goat					
1980	183.41	102.57	80.57	42.24	0.444	23.0	0.226	0.191
1981	187.31	106.63	80.68	42.42	0.480	22.6	0.389	0.207
1982	188.09	109.47	78.62	44.81	0.520	23.8	0.342	0.219
1983	181.79	106.57	75.22	48.74	0.550	26.8	0.505	0.209
1984	166.95	98.92	68.04	49.24	0.590	29.5	0.410	0.205
1985	158.40	95.19	63.21	50.81	0.593	32.1	0.395	0.191
1986	155.88	94.21	61.67	52.27	0.622	33.5	0.430	0.200
1987	166.23	99.01	67.22	60.53	0.719	36.4	0.487	0.226
1988	180.34	102.66	77.69	68.27	0.802	37.9	0.529	0.241
1989	201.53	110.57	90.96	81.23	0.962	40.3	0.545	0.259
1990	211.64	113.51	98.13	89.31	1.068	42.2	0.594	0.262
1991	210.02	112.82	97.21	98.16	1.180	46.7	0.599	0.262
1992	206.21	110.86	95.36	102.67	1.250	49.8	0.608	0.262
1993	207.33	109.72	97.61	111.47	1.373	53.8	0.650	0.266
1994	217.31	111.62	105.70	131.25	1.609	60.4	0.801	0.287
1995	240.53	117.45	123.08	165.37	2.020	68.8	1.104	0.316

Sources: SSB; SYC; SYA

Table 5-8 Sheep and Goat Sector by Province in China

Mutton, Milk and Wool Production by Province in China

	mutton, 1000 t		Share in the Total		Inventory 1995, million		Milk	Wool
	1980	1995	1980	1995	Sheep	Goat	1000 t	1000 t
China	445	2015	100.0	100.0	117.44	123.08	964	315.8
Beijing	1	11	0.3	0.5	0.37	0.41		0.6
Tianjin	1	16	0.1	0.8	0.42	0.28	4	0.9
Hebei	13	168	2.9	8.3	5.77	6.42	64	22.0
Shanxi	10	56	2.2	2.8	4.55	3.50	33	9.2
Inner Mongolia	77	169	17.3	8.4	19.91	10.37	26	63.0
Liaoning	2	26	0.5	1.3	1.86	1.16	12	10.6
Jilin	2	19	0.4	0.9	2.48	0.24	11	12.3
Heilongjiang	7	27	1.6	1.3	3.40	0.60	20	15.8
Shanghai	1	4	0.3	0.2	0.09	0.31		0.1
Jiangsu	27	165	6.2	8.2	0.58	10.72	4	3.0
Zhejiang	5	19	1.2	0.9	1.13	0.93	1	2.2
Anhui	18	53	4.1	2.6	0.09	4.56		0.5
Fujian	3	11	0.6	0.5		0.81	2	0.0
Jiangxi	0	5	0.1	0.2		0.34		0.0
Shandong	31	392	6.9	19.5	7.81	27.75	489	47.9
Henan	29	211	6.5	10.5	1.76	15.25	42	7.5
Hubei	8	28	1.8	1.4	0.02	1.83		0.3
Hunan	5	19	1.0	0.9	0.01	1.39		0.0
Guangdong	1	4	0.3	0.2		0.19	2	0.0
Guangxi	2	9	0.4	0.4		1.09		0.0
Hainan		6		0.3		0.67		0.0
Sichuan	37	83	8.3	4.1	3.62	7.09	4	3.6
Guizhou	7	18	1.6	0.9	0.26	1.64		0.4
Yunnan	6	26	1.4	1.3	1.19	5.47	6	1.9
Tibet	24	48	5.5	2.4	11.25	5.69	36	9.8
Shaanxi	6	42	1.4	2.1	1.57	4.91	152	5.5
Gansu	12	58	2.7	2.9	8.32	2.45	3	19.8
Qinghai	40	61	8.9	3.0	14.63	2.14	6	18.1
Ningxia	4	17	0.9	0.8	1.88	0.81		4.1
Xinjiang	65	245	14.6	12.2	24.47	4.59	45	57.3

Sources: MoA, 1995, China Agricultural Statistics.

As indicated in Table 5-8, there is a tendency that the major sheep and goat producing areas have been shifted from the pastoral areas, in the provinces of Inner Mongolia, Qinghai, Sichuan (west part), Tibet and Xinjiang, to the agricultural areas, including Shandong, Henan, Hebei, and Jiangsu. The mutton share of Inner Mongolia, previously the top producer, has dropped sharply from 17% in 1980 to 8% in 1995. The share of Xinjiang has also declined from 14.6% to 12.2% in the same period. In contrast, Shandong's share has increased from 6.9% to 19.4%, making it by far the top mutton producer in China.

In terms of inventory, the pastoral areas still overweight the agricultural areas in sheep numbers. Together, the five provinces with largest pastoral areas, Xinjiang, Inner Mongolia,

Qinghai, Tibet and Gansu, make up two thirds of the total sheep inventory in China. The picture for goat is somehow different, where the inventory is geographically more scattered, and the agricultural provinces of Shandong, Henan and Jiangsu top the first three positions, with 44% jointly on the national total.

China produced nearly one million tons of sheep and goat milk. Shandong Province alone contributed half of the total. Shaanxi is the second largest sheep and goat milk-producing province according to the data given in Table 5-8. However, it seems the figure is too high, for there is an apparent inconsistency between the milk data and the inventory figures. Other major production areas include the five major pastoral areas mentioned above, and Shandong, Hebei, Shanxi, and Henan.

The pastoral areas still have the dominant position in wool production. The above mentioned five pastoral provinces have 53% in the national total of wool production. In the agricultural areas, Shandong, Hebei and the three northeastern provinces are the major producers.

To sum up, the sheep and goat production are concentrated in the pastoral areas and the north part of the agricultural areas. The pastoral areas has lost its overall dominant position in the sheep and goat sector, but still plays a major role in wool production. The agricultural areas have increased its share, especially in milk and mutton production. This is presumably because that the sheep and goat production in agricultural areas have meat and milk production as the primary goals due to the market demand derived from the dense and large population.

Poultry Sector

Poultry meat production has seen the fastest growth in the past 15 years among all meat categories, from 1 million tons in 1980 to 9.35 million tons in 1995, as indicated in Table 5-9. Egg production has shown almost the same growth rate, from 2.57 million tons to 16.77 million tons in 1995. Poultry inventory stood at 3740 million birds in 1995, an increase of 3.4 times over that of 1980. This implies a significant improvement in offtake rate, which increased from 105% in 1991 to 170% in 1995.

According to the MoA officials, the intensive poultry raising should be 40% for broilers and 60% for layers. However, this seems to be overestimated if the data on inventory and slaughtered numbers are reliable. The intensive share should not be very high, given the low offtake rate.

The share of intensive system should be much higher in Shanghai and Guangdong Province, for they have an offtake rate of over 400%, as shown in Table 5-10. For poultry meat production, Shandong ranks first, with 21% in the national total in 1995, followed by Guangdong with 12% and Jiangsu with 9%. Shandong is also the largest egg producer, with 19% on the total. Hebei, Jiangsu and Henan are also important in egg production, with a share between 8-12%.

Table 5-9 Poultry Production in China

Year	Total, million t		Per capita, kg		Inventory* million bird	Slaughter million bird
	Poultry	Eggs	Poultry	Eggs		
1980	1.00	2.57	1.01	2.60	850	
1981	1.10	2.65	1.10	2.65	936	
1982	1.20	2.81	1.18	2.77	1025	
1983	1.30	3.32	1.27	3.23	1181	
1984	1.49	4.32	1.43	4.16	1670	
1985	1.60	5.35	1.51	5.05	1979	
1986	1.88	5.55	1.75	5.16	1966	
1987	2.19	5.90	2.01	5.40	2040	
1988	2.74	6.96	2.47	6.27	2261	
1989	2.82	7.20	2.50	6.39	2268	
1990	3.23	7.95	2.82	6.95	2434	
1991	3.95	9.22	3.41	7.96	2672	2824
1992	4.54	10.20	3.88	8.71	3193	3193
1993	5.74	11.80	4.84	9.96	3300	3978
1994	7.55	12.00	6.30	10.01	3500	5128
1995	9.35	16.77	7.72	13.85	3740	6302

* Year-begin.

Sources: China Agricultural Statistics, Animal Husbandry Statistics in China.

Table 5-10 Poultry and Eggs Production by Province in China, 1995

Regions	Poultry		Eggs		inventory million	Slaughtered million	Offtake %
	1000 t	%	1000 t	%			
China	9347	100.0	16767	100.0	3740	6302	168
Beijing	105	1.1	285	1.7	40	70	176
Tianjin	45	0.5	241	1.4	26	31	121
Hebei	444	4.7	2053	12.2	297	315	106
Shanxi	34	0.4	361	2.2	61	29	46
Inner Mongolia	51	0.5	188	1.1	39	30	77
Liaoning	463	5.0	1028	6.1	172	264	153
Jilin	361	3.9	489	2.9	98	194	199
Heilongjiang	278	3.0	790	4.7	133	172	129
Shanghai	335	3.6	148	0.9	33	149	458
Jiangsu	843	9.0	1753	10.5	297	591	199
Zhejiang	182	1.9	317	1.9	93	127	137
Anhui	306	3.3	512	3.1	161	236	147
Fujian	197	2.1	270	1.6	95	156	165
Jiangxi	258	2.8	334	2.0	154	174	112
Shandong	1957	20.9	3174	18.9	585	1214	208
Henan	310	3.3	1400	8.3	297	276	93
Hubei	285	3.0	879	5.2	198	225	113
Hunan	280	3.0	466	2.8	151	232	153
Guangdong	1099	11.8	311	1.9	197	776	393
Guangxi	451	4.8	147	0.9	159	316	198
Hainan	110	1.2	22	0.1	40	73	181
Sichuan	679	7.3	792	4.7	229	463	202
Guizhou	46	0.5	58	0.3	39	32	82
Yunnan	73	0.8	69	0.4		47	
Tibet	0	0.0	7	0.0	1		
Shaanxi	66	0.7	401	2.4	73	47	64
Gansu	33	0.4	124	0.7	37	29	79
Qinghai	2	0.0	12	0.1	3	2	52
Ningxia	16	0.2	39	0.2	9	9	101
Xinjiang	36	0.4	95	0.6	24	26	106

Source: MoA, 1995, China Agricultural Statistics.

Discussion on changes in regional patterns and of the relative shares of meat in total production

Due to the uneven development paces among meat categories, the composition of meat production has changed. Share of pork continuously fell, from 87% in 1980 to 69% in 1995, while that of all other meat categories has risen. Poultry's share registered the largest increase from 8% to 18%, followed by beef from 2% to 8%, and sheep from 3% to 4%.

The changes in the meat production structure reflect changes on the technical side and on the economic environment. Given its efficient feed-meat conversion ratio, commercialized

chicken industry has developed fastest. Cattle raising, under the prevailing raising systems in China, needs less grain than pigs. Furthermore, mechanization process in crop production has reduced the number of draught animals and increased beef and milk cattle. Sheep and goat meat production has increased, but due to the constraint in grazing areas, the growth rate is slower than that of cattle.

Development and changes in product prices, feed prices, feed industry, technical innovation and extension, as well as policy reforms, have all contributed to the development features of the livestock sector in China. Those factors are discussed in more details in the following.

5.2 Product Price Development

As displayed in Table 5-11, prices for major livestock products in China have risen dramatically over the past 15 years. The average producer price for slaughter animals, including hags, was in 1996 five times as high as in 1980. The egg price quadrupled over the same period. Prices for hides and skins also have risen, though the rate is slightly lower than that for slaughter livestock.

Table 5-11 Producer Price Index for Livestock Products in China

	Nominal Price Index					Deflated Price Index			
	Overall Retail Price	Slaughter Livestock	Fattened Hog	Eggs	Hides & Skins	Slaughter Livestock	Fattened Hog	Eggs	Hides & Skins
1980	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1981	102.4	100.2	100.2	106.7	104.5	97.9	97.8	104.2	102.1
1982	104.3	100.5	100.3	108.4	104.1	96.4	96.1	103.8	99.7
1983	105.9	100.5	100.0	116.3	101.0	94.9	94.4	109.8	95.4
1984	108.9	103.4	102.1	120.6	109.1	95.0	93.8	110.8	100.2
1985	118.5	126.9	123.6	138.8	152.1	107.1	104.3	117.2	128.4
1986	125.6	132.6	129.0	155.6	178.0	105.6	102.7	123.9	141.7
1987	134.8	157.8	153.1	192.5	200.4	117.0	113.6	142.8	148.7
1988	159.8	235.2	230.5	228.5	245.5	147.2	144.3	143.0	153.7
1989	188.2	257.8	254.7	264.2	250.2	137.0	135.4	140.4	133.0
1990	192.1	240.0	236.7	263.9	202.4	124.9	123.2	137.4	105.3
1991	197.7	233.8	228.6	247.0	220.0	118.3	115.6	125.0	111.3
1992	208.3	250.9	243.0	247.3	258.7	120.4	116.7	118.7	124.2
1993	235.8	287.7	278.3	280.1	308.2	122.0	118.0	118.8	130.7
1994	287.0	438.5	430.2	351.3	410.2	152.8	149.9	122.4	142.9
1995	329.4	509.5	499.1	398.8	468.8	154.7	151.5	121.0	142.3

Source: SSB: Statistical Yearbook of China; MA: Unpublished reports.

Taking inflation rate (overall retail price index) into consideration, the producer price development trend has also been favorable for livestock production. Deflated prices for livestock fell only slightly in the first years of 1980s. In the following years, the deflated livestock prices have been continuously over the inflation rate as indicated in Table 5-11. This favorable price development has been a very important factor stimulating livestock production in China. The rise in producer prices reflected the expansion of demand sustained by improved income and living standards. This price development has been one of the major

stimulants for the rapid production development mentioned in the previous sections.

5.3 Feed Prices and Feed Industry

Systematic data on industrial feed price development is not available, for the feed industry has developed in China only very recently. However, prices for corn and soybean, the two major energy and protein supplier of feed, can be taken as feed price indicators.

Corn and soybean prices have risen considerably since 1980, but at a slower pace than inflation and livestock price indexes. As shown in Table 5-12, deflated price indexes for corn and soybean have fallen over the whole period except for corn in 1995 and 1996.

This feed price development trend has provided very favorable incentives to livestock producers, as price ratios between feed input and livestock products has considerably widened in favor of the latter.

Table 5-12 Feed Grain Price Development in China

	Market Price Yuan/tn		Nominal Price Index 1980=100		Deflated Price Index	
	Corn	Soybean	Corn	Soybean	Corn	Soybean
1980	382.0	1001.0	100.0	100.0	100.0	100.0
1981	361.0	989.0	94.5	98.8	92.3	96.5
1982	386.0	985.0	101.0	98.4	96.8	94.3
1983	387.0	890.0	101.3	88.9	95.6	83.9
1984	337.0	786.0	88.2	78.5	81.0	72.1
1985	344.0	798.0	90.1	79.7	76.0	67.3
1986	422.0	934.0	110.5	93.3	87.9	74.3
1987	463.0	1039.0	121.2	103.8	89.9	77.0
1988	514.0	1211.0	134.6	121.0	84.2	75.7
1989	719.0	1653.0	188.2	165.1	100.0	87.8
1990	669.0	1526.0	175.1	152.4	91.1	79.3
1991	580.0	1383.0	151.8	138.2	76.8	69.9
1992	576.0	1685.0	150.8	168.3	72.4	80.8
1993	730.0	2200.0	191.1	219.8	81.0	93.2
1994	1010.0	2450.0	264.4	244.8	92.1	85.3
1995	1580.0	2710.0	413.6	270.7	125.6	82.2

Sources: SSB, SYC; MoA, unpublished price data.

The increased grain production, the development of industrial feed sector and the exploration of new feed resources have contributed to a much-improved feed supply, in term of both quantity and quality.

Grain production has increased by a large margin during the past 15 years, from 321 million tons in 1980 to 467 million tons in 1995. This translates, on per capita term, to 325 kg in 1980 to 385 kg in 1985. During the same time, the food consumption declined. Cereals (in FAO definition, excluding potato and beans in Chinese definition of grain) used for feed has increased from 45 million t in 1980 to 120 million t in 1995. In Chinese grain definition, feed grain was estimated to amount to 140 million t.

Table 5-13 Industrial Feed Production in China, million tons

	Complete	Concentrate	Premix	Capacity *	
1980	2.00				
1981	4.00				
1982	6.00				
1983	8.00				
1984	12.00				
1985	15.00				
1986	20.00				
1987	24.00				
1988	30.00				
1989	31.00				
1990	31.22		0.51	0.21	59.38
1991	34.94		0.59	0.30	62.54
1992	36.38		1.26	0.32	68.62
1993	37.04		1.73	0.45	77.53
1994	42.33		2.31	0.60	81.81
1995	48.58		3.46	0.64	90.00

* Production capacity in two shifts.

Source: Unpublished report of the Ministry of Agriculture.

Feed industry has developed from the very ground during the past 15 years. Industrial feed production soared from merely 2 million t in 1980 to over 50 million t in 1995, including complete feed, concentrated and premixed feed (Table 5-13). In its development process, the quality and the credit of the industrial feed has also been improved gradually. Many livestock producers, including in the traditional sector, have changed their reticence toward using industrial feed and have become accustomed to it. The robust development of the industrial feed sector has been the decisive factor for the rising share of the intensive livestock systems, especially for poultry and pig sectors.

As indicated in Table 5-14, pig feed has the lion share in the total industrial feed production, and was 43% in 1995. Layer feed and broiler feed have the similar shares, together accounting for 50% of the total production. Fish feed has 5%, and the remaining 2% is divided for cattle and other animals. Hints can be drawn from this composition of feed that the layer and broiler sector should have been to a much greater extent commercialized than cattle and other livestock sectors.

Table 5-14 Composition of Compound Feed Output in China million tons

	Pig Feed	Layer Feed	Broiler Feed	Fish Feed	Other Feed
1990	14.30	4.66	5.68	0.96	0.80
1991	11.58	6.64	6.02	0.75	1.40
1992	12.91	7.08	6.85	1.08	1.26
1993	12.32	7.69	8.05	1.29	0.94
1994	14.61	9.30	8.33	1.59	1.22
1995	17.91	10.82	9.94	2.10	1.20

Source: National Feed Industry Office, Feed Industry Statistics (1990-1995).

Table 5-15 Feed Production by Province in China, in %, 1995

	Complete	Concentrate	Premix	Pig Feed	Layer Feed	Broiler Feed	Fish Feed	Other Feed
China	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Beijing	4.7	0.9	2.8	6.6	7.4	1.8	3.2	5.8
Tianjin	1.9	0.4	4.8	1.0	4.3	1.1	6.2	0.8
Hebei	5.0	5.6	8.0	3.6	9.6	2.5	3.9	1.7
Shanxi	1.5	0.1	0.0	1.5	2.8	0.7	0.0	2.8
Inner Mongolia	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.8
Liaoning	3.9	4.5	0.5	2.1	6.9	3.9	9.7	3.2
Jilin	2.5	5.6	1.6	2.5	1.5	2.0	1.0	1.7
Heilongjiang	2.9	3.6	2.5	1.7	6.8	2.5	5.0	0.5
Shanghai	3.9	0.5	2.0	4.6	6.7	2.6	1.1	2.9
Jiangsu	6.6	1.0	4.7	9.0	4.4	3.6	10.9	6.1
Zhejiang	3.9	0.1	1.4	4.2	1.5	6.3	2.2	11.3
Anhui	3.0	0.7	0.9	3.7	1.0	2.4	0.4	0.0
Fujian	2.5	0.2	1.9	2.7	2.5	1.1	3.9	1.2
Jiangxi	2.9	7.2	9.4	5.1	1.0	1.0	1.7	4.0
Shandong	8.9	4.1	8.8	5.4	13.0	13.3	5.7	12.3
Henan	4.7	1.8	2.2	4.7	6.8	2.8	2.0	1.2
Hubei	5.9	9.2	4.7	6.4	2.4	2.2	3.3	1.7
Hunan	4.5	26.4	3.0	7.1	1.8	1.4	4.0	5.9
Guangdong	12.2	7.5	6.3	6.4	7.7	36.3	9.1	2.3
Guangxi	0.5	0.0	0.0	4.2	2.1	6.9	3.2	5.1
Hainan	4.4	2.8	3.0	0.1	0.6	0.8	1.0	0.0
Sichuan	7.2	6.2	17.3	12.0	3.6	1.9	14.2	17.2
Guizhou	0.3	2.1	0.0	0.6	0.3	0.1	0.1	0.1
Yunnan	1.3	1.3	4.8	1.0	1.4	1.5	1.7	0.7
Tibet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shaanxi	1.0	7.1	8.4	0.8	1.7	0.2	2.6	1.6
Gansu	2.0	0.0	0.2	1.5	1.4	0.0	0.2	1.5
Qinghai	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Ningxia	0.3	0.0	0.0	0.3	0.2	0.2	1.3	1.3
Xinjiang	1.5	0.1	0.9	0.7	1.1	1.0	2.4	1.3

Source: National Feed Industry Office, Feed Industry Statistics (1990-1995).

Geographically, feed industry is located in a pattern that reflects the pig and poultry production. The major pig and poultry producers (or feed consumers) are also the most important industrial feed producers. As indicated in Table 5-15, leading pig-producing provinces, including Sichuan, Shandong, Jiangsu, Hunan and Hubei, are also important pig feed producers. Guangdong, Shandong, Hebei and Jiangsu, the major poultry production regions, are also the major broiler and layer feed producers. This location of feed industry is different from that of feed grain resources, which are more based in the northeast provinces.

5.4 Technical Progress and Other Factors

Technical progress in the fields of breeding, feeds, growth stimulants, raising, veterinary service, etc. have contributed greatly to the continued production growth in the livestock sector. For example, with technical progress, new sources of feed resources have been brought into utilization. This includes the ammoniation of rice and wheat straw and detoxification of rapeseed cake, which has provided for new feed resources in China. The new feed resources are very important for China, for China has limited land resource and hence feed resources.

Policy variables have had very important impacts on livestock production development in China. The reform policy in the land tenure system and production management system has provided a more favorable policy environment and incentives for producers. Besides these policy variables, product price, feed availability and price, and technological progress have also played a major influential role.

The introduction of private incentives and market mechanism have triggered changes in producers' traditional production attitude, objectives or utilities. Many producers now pay high attention and place high priority on the economic returns. Now it is the amount of the income, not the size of the herd, that earns respect to a producer from his or her fellow society. In addition, the technical progress in the field of feed and improvement in other areas, including in breeding, feeding method and disease control have greatly contributed to the expansion of the livestock production.

6. Demand for Livestock Products

6.1 Recent Trend

Changes in meat consumption should have followed very closely to development on production side as trade accounts for a very small part share of total supply. Hence, in line with the above-mentioned production development, meat consumption has also increased. However, due to the over-reporting of production mentioned above, there are large differences between the consumption data from the household surveys and that derived from the food balance sheet, as indicated in Table 6-1 and Table 6-2.

According to the household surveys (Table 6-1), pork consumption has the lowest growth rate for both the urban and rural residents, while poultry meat and eggs have the fastest growth rates, more than doubled since 1980. For urban consumers, pork consumption has actually stagnated or fluctuated between 17-19 kg during the past fifteen years. Beef and mutton consumption for both the urban and rural consumers have doubled, though the absolute amount increased only by around 1.5 kg and 0.5 kg respectively.

On the other hand, according to the data based on food balance sheet, the growth rate are much higher for all products (Table 6-2). However, the relative growth relationship between different products are roughly the same. Pork consumption has registered lowest growth. Poultry meat consumption has shown a much higher increase rate. Beef consumption has shown an extraordinary high growth, especially since 1990.

As a result of this unbalanced development between different meat categories, the structure of the meat consumption has changed. The pork share in the total meat consumption has dropped from over 80% to about 70% in the urban households, and from over 85% to about 80% for the rural residents. In contrast, poultry share increased from 9% to 17% for the urban and from 8% to 14% for the rural consumers respectively. The share of beef and mutton as a whole remained largely unchanged.

**Table 6-1 Livestock Consumption Based on Household Surveys
kg/per capita**

Year	Urban Household					Rural Household				
	Meat Total	Pork	Beef & Mutton.	Poultry	Eggs	Meat Total	Pork	Beef & Mutton.	Poultry	Eggs
1980	19.8	16.5	1.5	1.8	5.0	8.4	7.3	0.5	0.7	1.2
1981	20.5	16.9	1.7	1.9	5.2	9.4	8.2	0.5	0.7	1.3
1982	20.9	16.9	1.8	2.3	5.9	9.8	8.4	0.7	0.8	1.4
1983	22.4	18.0	1.9	2.6	6.9	10.8	9.3	0.7	0.8	1.6
1984	22.7	17.1	2.8	2.9	7.6	11.6	9.9	0.7	0.9	1.8
1985	22.6	16.7	2.6	3.2	6.8	12.0	10.3	0.7	1.0	2.1
1986	25.3	19.0	2.6	3.7	7.1	12.9	11.1	0.6	1.1	2.1
1987	25.3	18.9	3.1	3.4	6.6	12.8	11.0	0.7	1.2	2.3
1988	23.8	16.9	2.8	4.0	6.9	12.0	10.1	0.7	1.3	2.3
1989	23.9	17.5	2.7	3.7	7.1	12.3	10.3	0.7	1.3	2.4
1990	25.2	18.5	3.3	3.4	7.3	12.6	10.5	0.8	1.3	2.4
1991	26.6	18.9	3.3	4.4	8.3	13.5	11.2	1.0	1.3	2.7
1992	26.5	17.7	3.7	5.1	9.5	13.3	10.9	0.9	1.5	2.9
1993	24.5	17.4	3.4	3.7	8.9	13.3	10.9	0.8	1.6	2.9
1994	24.4	17.1	3.1	4.1	9.7	12.6	10.2	0.8	1.6	3.0
1995	23.7	17.2	2.4	4.0	9.7	13.1	10.6	0.7	1.8	3.2

Source: SSB, Statistical Yearbook of China, various years.

**Table 6-2 Livestock Consumption Based on Food Balance Sheet
kg / per capita**

Year	Meat Total	Pork	Beef	Mutton	Poultry	Rabbits	Eggs	Milk
1980	13.3	11.5	0.3	0.4	1.0	0.0	2.6	1.4
1981	13.7	11.9	0.2	0.5	1.1	0.0	2.6	1.7
1982	14.5	12.5	0.3	0.5	1.2	0.0	2.8	1.9
1983	15.0	12.8	0.3	0.5	1.3	0.0	3.2	2.3
1984	16.3	13.9	0.4	0.6	1.4	0.0	4.2	2.5
1985	18.2	15.6	0.4	0.6	1.5	0.1	5.1	2.7
1986	19.6	16.7	0.5	0.6	1.7	0.1	5.2	3.1
1987	20.3	16.8	0.7	0.7	2.0	0.1	5.4	3.5
1988	22.3	18.2	0.9	0.7	2.5	0.1	6.3	3.8
1989	23.2	18.8	1.0	0.9	2.5	0.1	6.4	3.9
1990	24.9	20.0	1.1	0.9	2.8	0.1	7.0	4.2
1991	27.0	21.2	1.3	1.0	3.4	0.1	8.0	4.5
1992	29.1	22.5	1.5	1.1	3.9	0.2	8.7	4.8
1993	32.2	24.1	2.0	1.2	4.8	0.2	10.0	4.8
1994	37.3	26.7	2.7	1.3	6.3	0.2	10.0	5.1
1995	43.2	30.1	3.4	1.7	7.7	0.2	13.8	5.6
Growth, %	226	162	1157	271	662	628	432	301

Notes: Based on SSB data on production, trade and human population.

6.2 Urban and Rural Disparities and Income Effects

As hinted in the previous sections, there are remarkable differences in the consumption patterns between urban and rural households. On the average, urban residents have higher income and consume much more livestock products than their low-income rural fellows (Table 6-1). Largely, the urban residents consume double as much meat and three times eggs as the rural residents.

As a result of this urban-rural disparity, the total demand and consumption of livestock has also been influenced by the change in population composition. Given increased expansion of cities and rural-urban migration, China has undergone a dramatic urbanization process. Urban population has grown by over 4% per year, from 191 million in 1980 to 352 million in 1995. The urban proportion in the whole population increased from 19% to 29% during the same period. This figure will be still larger if it included the so-called `floating population`, the rural migrant, who are working in cities but without permanent urban residency status, and which is currently estimated at around 50 million (CERC, 1997). This process of urbanization is likely to continue at an even greater pace in the near future.

The primary driving force for the increase in livestock consumption is income improvement. The average income for urban and rural population has risen significantly in the past 15 years as shown in Table 6-3. The nominal income per capita rose by over seven folds for both urban and rural households. In real term, namely deflated by inflation rate, the per capita income has increased by 170% for urban and 150% for rural residents.

Table 6-3 Per Capita Income Development in China

	Yuan/per capita		Income Index		Price	Deflated Income Index	
	Urban	Rural	Urban	Rural	Index	Urban	Rural
1980	439	191	100	100	100	100	100
1981	464	223	106	117	102	103	114
1982	498	270	113	141	104	109	135
1983	526	310	120	162	106	113	153
1984	608	355	138	186	109	127	171
1985	685	398	156	208	119	132	175
1986	828	424	188	221	126	150	176
1987	916	463	208	242	135	155	179
1988	1119	545	255	285	160	159	178
1989	1261	602	287	314	188	152	167
1990	1387	686	316	359	192	164	187
1991	1544	709	351	370	198	178	187
1992	1826	784	416	410	208	199	197
1993	2337	922	532	482	236	226	204
1994	3179	1221	724	638	287	252	222
1995	3893	1578	886	825	329	269	250

Sources: Statistical Yearbook of China.

Cross sectional statistics of income also show a close co-relationship between income and

livestock consumption. As the case for rural residents indicated in Table 6-4, for every year in observation, the income group with a higher income level has a markedly higher consumption level of livestock products. The top income group consumes about 70% more pork than the lowest income group. For chicken, beef and mutton, the consumption disparity is about 100%. For rural households, disaggregated data by income group are not available.

There are few studies on the income elasticity of livestock consumption due the data constraints. Research staff of SSB has conducted a study on the income elasticity for food in rural households, releasing the results recently contained in Table 6-5. According to this study, the average income elasticity for poultry meat and fish were the highest in 1988, 1.46 and 1.34 respectively. The corresponding figures for pork, beef and mutton were at the same level of 0.57. The figure for egg was somehow higher, 0.66. In comparison with crop products, whose income elasticity was bellow 0.30, all livestock products had apparently higher income elasticity.

Table 6-4 Meat consumption by income group of urban households

	Average	0-10% Lowest	10-20% Low	20-40% Lower Medium	40-60% Medium	60-80% Upper Medium	80-90% High	90-100% Highest
Disposable Income, Yuan/per capita								
1982	495	231	296	401	538	697	878	
1983	526	242	305	407	548	706	895	
1984	608	285	410	559	712	839	1082	
1985	685	437	547	633	737	862	1012	1276
1986	828	446	570	663	773	905	1055	1347
1987	916	527	659	771	898	1050	1229	1582
1988	1119	625	789	930	1098	1292	1528	1977
1989	1261	693	880	1039	1231	1456	1720	2279
1990	1387	761	969	1144	1352	1598	1890	2448
1991	1544	888	1107	1293	1510	1767	2070	2676
1992	1826	975	1255	1494	1776	2107	2501	3322
1993	2337	1180	1529	1841	2222	2709	3299	4502
1994	3179	1525	2012	2461	3007	3707	4565	6263
1995	3893	1924	2506	3041	3698	4512	5504	7538
Pork Consumption, kg/per capita								
1982	16.8	6.7	9.8	13.8	16.7	21.6	25.9	
1983	18.0	8.5	10.4	14.3	17.5	21.1	22.3	
1984	17.1	7.3	12.0	15.5	18.7	23.3	23.2	
1985	17.2	12.8	14.6	15.8	17.3	18.7	20.3	22.5
1986	19.0	13.2	14.9	16.3	17.5	18.7	20.3	23.4
1987	18.9	14.1	16.0	17.8	18.8	20.4	22.3	24.9
1988	16.9	12.4	14.2	15.8	17.3	18.2	20.3	22.6
1989	17.5	12.9	14.8	16.8	17.7	18.9	20.6	23.9
1990	18.5	13.5	15.4	16.4	17.7	19.0	21.0	23.6
1991	18.9	14.3	15.9	16.9	18.2	19.4	20.8	23.7
1992	17.7	14.2	15.4	16.6	17.7	18.9	20.4	22.8
1993	17.4	14.2	15.5	16.2	17.2	18.8	20.1	21.7
1994	17.1	13.4	15.2	16.0	17.3	18.7	19.5	20.9
1995	17.2	13.2	15.3	16.3	17.2	18.6	20.0	21.4
Poultry Consumption, kg/per capita								
1982	2.3	0.2	0.7	1.3	2.3	3.0	4.0	
1983	2.6	0.5	0.6	1.4	2.3	3.5	4.8	
1984	3.9	0.8	1.4	2.3	3.1	3.9	5.8	
1985	3.8	2.3	2.9	3.4	3.9	4.6	5.0	6.0
1986	3.7	1.8	2.5	2.8	3.1	3.6	4.3	5.8
1987	3.4	2.0	2.7	2.9	3.4	3.8	4.4	5.7
1988	4.0	2.3	2.9	3.4	4.4	4.5	5.1	6.2
1989	3.7	2.1	2.7	3.1	3.7	4.3	4.8	5.8
1990	3.4	1.9	2.4	2.8	3.3	3.7	4.4	5.2
1991	4.4	2.7	3.3	3.7	4.3	4.8	5.3	6.4
1992	5.1	3.3	4.0	4.5	5.1	5.7	6.7	7.5
1993	3.7	2.4	2.9	3.3	3.8	4.3	4.6	5.1
1994	4.1	2.7	3.3	3.8	4.2	4.5	5.2	5.7
1995	4.0	2.6	3.3	3.6	4.0	4.5	4.8	5.4
Beef and Mutton Consumption, kg/per capita								
1982	1.8	1.0	1.0	1.4	1.9	2.3	2.7	
1983	2.9	0.8	1.2	1.4	1.8	2.3	2.4	
1984	2.8	3.6	2.0	2.5	2.8	3.3	3.9	
1985	3.0	2.2	3.0	2.7	3.2	4.1	3.8	4.4
1986	2.6	1.8	2.5	2.4	2.6	3.0	3.1	3.7
1987	3.1	2.0	2.4	2.8	3.1	3.5	3.8	4.3
1988	2.8	1.9	2.1	2.5	2.9	3.2	3.6	4.0
1989	2.7	1.8	2.1	2.5	2.8	3.1	3.3	4.0
1990	3.3	2.1	2.5	2.9	3.3	3.5	3.9	4.5
1991	3.4	2.2	2.9	2.9	3.2	3.6	4.0	4.6
1992	3.7	2.7	3.1	3.4	3.8	4.0	4.6	5.2
1993	3.4	2.4	2.8	3.3	3.5	3.5	3.9	4.3
1994	3.1	2.2	2.5	3.0	3.1	3.3	3.9	4.4
1995	2.4	1.6	2.1	2.2	2.5	2.7	2.9	3.4

Note: 1981-1984, households were grouped according monthly income range:
 1982 <20 20-25 25-35 35-50 50-60 >60
 1983 <20 20-25 25-35 35-50 50-60 >60
 1984 <25 25-35 35-50 50-60 60-70 >70

Table 6-5 Income Elasticity for Food in Rural Households, 1988

Products	Income Group					
	Average	Low	Lower Medium	Medium	Higher Medium	High
Pork	0.57	0.68	0.66	0.71	0.62	0.40
Beef and Mutton	0.57	0.50	0.33	0.17	0.12	0.34
Poultry	1.46	1.15	1.40	0.90	0.83	1.02
Egg	0.66	0.77	0.55	0.30	0.32	0.38
Fish	1.34	1.64	1.31	1.02	0.82	0.79
Food Grain Total	0.16	0.26	0.19	0.15	0.01	0.07
Rice and Wheat	0.26	0.35	0.31	0.26	0.24	0.13
Coarse Grain	-0.23	0.04	-0.20	-0.32	-0.29	-0.40
Vegetables	0.30	0.52	0.34	0.30	0.22	0.09

Source: SSB, 1996, Rural, Agricultural and Farmers' Issues in China.

Another study has been undertaken by the International Food Policy Research Institute (Huang, *et al.*, 1997), which shows a slight different picture of the income elasticity for livestock products in China (Table 6-6). One of the same results is that all livestock products have much higher income elasticity than crop products. The figure for fish is higher than that for all meat categories. Beef and mutton has the weakest income responses compared with other meat, especially in the rural households, a result different from that of the SSB study. One of the important features of results in Table 6-5 is that the income elasticity for all livestock products are higher in the urban households than that in the rural households, which is against the popular views in China that the rural consumers have a higher income response on livestock consumption due to the very low consumption level currently.

Table 6-6 Income Elasticity for Livestock Products in China, 1990-2020

	Early 1990s		1990-2000		2000-2010		2010-2020	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Livestock products	0.757	0.835	0.757	0.835	0.835	0.870	0.835	0.870
Pork	0.765	0.782	0.765	0.782	0.782	0.797	0.782	0.797
Beef and mutton	0.343	0.689	0.343	0.689	0.789	0.686	0.689	0.686
Poultry	0.854	0.985	0.854	0.985	0.985	1.064	0.985	1.064
Egg	0.512	0.455	0.512	0.455	0.455	0.491	0.455	0.491
Milk	1.557	1.637	1.557	1.637	1.637	1.912	1.637	1.912
Fish	1.053	1.244	1.053	1.244	1.244	1.290	1.244	1.290
Food Grain Total	0.246	0.092	0.150	0.000	0.000	-0.050	-0.050	-0.100
Rice	0.326	0.140	0.200	0.100	0.100	0.000	0.000	-0.050
Other Grain	0.175	0.052	0.105	-0.083	-0.089	-0.091	-0.095	-0.141

Source: Huang, Jikun, *et al.*, 1997, China Food economy to the 21st Century: Supply, Demand, and Trade, IFPRI Discussion Paper.

Population expansion will be the primary driving force for China future food demand. The

average annual population growth for the past decade was 1.4%. If this trend will continue into the next 35 years, China's population will then reach 2.0 billion by the year 2030. The Chinese government has set a high population control goal, according which the total population should be 1.4 billion in 2010, 1.5 billion in 2020, and 1.6 billion in 2030. Whether this goal can be realized will have substantial impacts on food demand growth and hence the Chinese food balance in the future. The high population growth scenario implies 25% more food need compared with the low population growth scenario, with other things equal. Given a grain consumption level of 400 kg per capita, this means 160 million tons additional grain need. How China will be successful in implementing her population control policy will play a crucial role in her future food balance.

Due to the rural-urban migration, the urban population growth is higher than the national average, and registered an annual rate of 3.4% over the past decade. This resulted a rising share of urban population, from 23.7% in 1985 to 29.0% in 1995. If this trend will continue into the next 35 years, the urban share will be nearly 50% by 2030. This will further increase the food demand and change the food demand structure, i.e. less food grain and more feed grain. As shown in Table 6-1, the urban residents and rural residents have significant differences in food consumption patterns. Generally speaking, urban population has a high food and grain (including direct consumption of food grain and indirect consumption of feed grain through livestock products) consumption level due to higher income and other factors.

6.3 Price and Consumers Preference

Consumer prices for different livestock products have developed unevenly. Mutton price has risen by ten folds, the largest margin among all animal products, over the past 15 years. The growth figure is eight-fold for beef, five-fold for pork and nearly three-fold for eggs (Table 6-7).

This uneven price development has resulted in a complete change of price ratios. Chicken traditionally used to be the most expensive meat in China, followed by pork, beef and mutton. Eggs were as expensive as pork. However, in the past 15 years, the price relation has been inverted. Mutton has become the most expensive meat, followed by beef and pork. In contrast, chicken has turned to be the cheapest meat. Relative price of eggs has also fallen from higher than beef and mutton in 1980 to less than half that of beef and mutton in 1995.

Together with shifts in production, the change in livestock price ratios also reflected changes in the quality of the meat and in consumers preference. Beef used to be a low-quality meat product in China, produced as a by-products draught animals, as beef from fallen cattle constituted the major part of supply in the pre-reform era. This situation has changed substantially with the development of the beef cattle sector. On the other hand, pork and especially chicken production has become increasingly industrialized, resulting lower production cost, but also to some extent lower quality of the meat. At the same time, consumers preference have also changed as income rose. For instance, prior to 1980s, pork was used as a major source of cooking oil, and therefore rated and priced according to the thickness of the fat. The fatter, the more expensive. Given an improved supply of vegetal oil and improved living standards, people have become to prefer lean to fat meat. Diversification of demand toward beef and mutton have driven up their prices, supported, in the case of beef, by the development of fast food restaurants which have become extremely popular in the larger cities.

Table 6-7 Consumer Price Development for Livestock in China

	Yuan/kg					Price Index, 1980=100					Deflated Price Index				
	Pork*	Beef**	Mutton**	Eggs	Chicken***	Pork*	Beef**	Mutton**	Eggs	Chicken***	Deflator	Pork*	Beef**	Mutton**	Eggs
1978	1.62	1.19	1.17	1.67		80	68	71	80		93	87	73	77	87
1979	1.78	1.40	1.34	1.75		88	80	81	84		94	93	84	86	89
1980	2.02	1.76	1.65	2.08		100	100	100	100		100	100	100	100	100
1981	2.11	1.88	1.70	2.09		104	107	103	100		102	102	105	101	98
1982	2.12	2.02	1.71	2.17		105	115	104	104		104	100	110	99	100
1983	2.19	2.05	1.78	2.25		108	117	108	108		106	102	110	102	102
1984	2.28	2.50	2.21	2.41		113	142	134	116		109	104	130	123	107
1985	2.75	3.20	2.86	2.50		136	182	174	120		119	115	153	146	102
1986	3.02	3.79	3.62	2.80	3.86	149	215	219	135		126	119	171	175	107
1987	3.50	4.53	4.18	3.10	4.93	173	258	254	149		135	128	191	188	111
1988	4.96	5.53	5.59	3.80	6.12	245	314	339	183		160	153	197	212	114
1989	5.40	6.41	6.73	4.50	6.71	267	364	409	217		188	142	194	217	115
1990	5.30	6.38	6.15	4.80	6.95	262	362	373	231		192	136	189	194	120
1991	5.34	6.43	6.71	4.74	7.27	264	365	407	228		198	134	185	206	115
1992	5.77	6.95	7.83	4.89	7.12	285	395	475	235		208	137	189	228	113
1993	7.20	8.16	9.58	5.02	8.10	356	464	581	242		236	151	197	247	102
1994	11.37	12.24	15.19	6.19	9.78	562	695	922	298		287	196	242	321	104
1995	13.70	16.95	19.45	7.00	11.95	678	963	1180	337		329	206	292	358	102
1996	12.13	16.09	18.13	7.94	12.77	600	914	1100	382		349	172	262	315	109

* Boneless leg; ** Boneless average; *** Slaughter weight.

Sources: 1980-1992, SSB: Statistical Yearbook of China. 1993-, MA: Unpublished reports of the Information Center.

Chicken price: 1986-1993, SSB, China Price Statistics.

6.4 Geographical Pattern of Consumption

One further striking feature in livestock consumption in China is the noticeable differences in regional patterns, especially for the rural households (Table 6-8). The general picture is that rural households in the southern provinces have higher consumption level of animal products than those in the north. The meat consumption in Guangdong, Yunnan and Sichuan is 4 to 5 times that in Henan, Shanxi and Shaanxi provinces.

Table 6-8 Regional Disparity in Livestock Consumption, Rural, 1995

	Net Income	Kg/per capita					
	Yuan	Grain	Meat Total	Red Meat	Poultry	Eggs	Fish
Guangdong	2699	254.4	25.0	17.6	7.4	3.0	12.0
Yunnan	1011	255.3	23.4	21.4	2.0	1.7	0.9
Sichuan	1158	244.3	21.4	20.2	1.2	2.6	0.8
Fujian	2049	288.2	19.9	14.9	5.0	3.1	9.4
Guizhou	1087	234.1	18.6	17.8	0.9	1.0	0.3
Shanghai	4246	250.7	18.1	13.9	4.2	5.6	9.9
Zhejiang	2966	264.5	17.2	13.6	3.6	3.8	11.4
Hunan	1425	306.6	16.8	14.8	2.1	2.6	4.2
Hubei	1511	293.2	15.8	14.5	1.3	3.1	4.7
Beijing	3224	192.8	14.9	13.5	1.4	5.9	3.7
Guangxi	1446	246.2	14.8	11.1	3.7	0.9	2.1
Inner Mongolia	1208	299.8	14.6	14.1	0.5	3.3	1.0
Liaoning	1757	264.6	14.5	13.3	1.2	6.5	4.2
Jiangsu	2457	264.8	13.7	10.5	3.2	7.6	7.3
Jiangxi	1537	325.4	13.6	11.8	1.9	2.6	3.6
China	1578	258.9	13.1	11.3	1.8	3.2	3.4
Jilin	1610	324.3	13.1	11.1	2.0	6.9	3.8
Hainan	1520	265.0	12.3	8.0	4.3	0.9	9.2
Qinghai	1030	241.1	12.2	12.0	0.2	0.5	0.1
Tibet	1200	264.6	12.1	12.1	0.0	1.1	0.0
Anhui	1303	257.0	10.5	8.0	2.4	3.5	2.9
Ningxia	999	286.9	8.8	8.0	0.8	1.1	0.5
Tianjin	2406	236.9	8.0	7.7	0.3	6.5	6.1
Heilongjiang	1766	315.1	8.0	6.1	1.8	5.3	3.7
Xinjiang	1136	237.7	7.9	6.9	1.0	0.8	0.3
Shandong	1715	237.6	6.8	6.0	0.8	6.2	3.1
Gansu	880	244.9	6.3	5.6	0.7	1.1	0.1
Hebei	1669	209.4	5.5	5.3	0.2	3.7	1.6
Shaanxi	963	229.1	5.0	4.8	0.2	1.2	0.1
Shanxi	1208	227.0	4.6	4.5	0.1	2.8	0.3
Henan	1232	234.9	4.6	4.2	0.4	2.7	0.5

Sources: SSB: SYC.

The regional patterns in meat consumption reflect differences in income, consumption preferences, abundance of own supply and of substitutes, as well as transportation and other marketing costs which determine the local prices.

The high consumption level of meat and eggs observed in Guangdong, Fujian, Shanghai, Zhejiang and Beijing can be explained with their high income, while the same high figures for Yunnan, Sichuan and Guizhou, three low income province, are attributed to the abundant local supply, and very unfavorable marketing conditions (the transportation is very poor due to the extremely mountainous topography), resulting in low consumer prices.

The three northeast provinces, the most important feed grain (corn and soybean) producers in China, have a rather low consumption level of meat. This is compensated by higher egg consumption, and larger intake of protein from vegetal origin associated with very abundant local soybean production.

Fish has played to some extent a role as a meat substitute in the eastern coast regions, such as in Tianjin and Jiangsu and Hainan.

In the pastoral provinces including Xinjiang, Inner Mongolia, Tibet and Qinghai, very little poultry is consumed, nor much pork. Beef and mutton account for the major part of meat consumption there. This reflects production-based diet habits, poor transportation and poor access to market. In Ningxia where the Islam religion plays a dominant role, pork consumption is low.

For urban households there are no direct regional consumption statistics available. However, conclusions can be drawn from household expenditure data that there do exist regional disparities in the consumption patterns of animal products, though maybe not as large as for rural households. The regional pattern in meat consumption for urban resident seems to be very similar to that for rural households. The meat expenditure in the South is two to three times that in the North. This regional disparity can be jointly explained by difference in income as well as in prices, as indicated in Table 6-9. Urban dwellers in the rich provinces earn as much as twice that in the less developed provinces. The price difference causes different expenditure for the same physical amount of meat product, or different physical consumption level of meat among people with the same income. This income disparity has impacts not only for the expenditure on meat, but also for the actual quantity of meat consumed.

Table 6-9 Income, Meat Expenditures and Prices in Cities, 1995

	Per Capita		Price, Yuan/kg				
	Income	Meat Expend.	Pork	Beef	Mutton	Chicken	Eggs
Beijing	5868	564	14.8	14.0	16.0	11.0	6.0
Tianjin	4626	446	17.0	10.4	17.6	11.0	6.0
Hebei	3592	300	15.6	10.0	14.0	11.0	6.2
Shanxi	2927	214	13.0	13.0	16.0	8.0	6.2
Inner Mongolia	2587	254	13.0	15.0	15.0	13.0	6.8
Liaoning	3307	352	13.0	12.0	14.0	8.4	5.8
Jilin	2914	280	14.0	12.0	16.0	9.0	7.0
Heilongjiang	2968	262	13.4	10.0	14.9	9.0	5.9
Shanghai	6822	679	18.0	13.0	13.0	13.0	7.0
Jiangsu	4209	481	15.6	13.0	12.0	10.8	6.5
Zhejiang	5718	502	16.7	15.5	13.0	13.0	6.9
Anhui	3406	408	14.0	8.0	11.0	19.0	6.4
Fujian	4024	539	16.0	18.0	28.0	14.0	7.6
Jiangxi	3046	392	22.0	20.0	18.0	18.0	9.0
Shandong	3953	312	14.6	10.0	16.0	9.0	5.6
Henan	3029	261	15.0	13.0	14.0	10.0	6.0
Hubei	3606	360	15.5	13.6	10.7	12.2	7.4
Hunan	4070	459	15.0	16.0	16.0	12.0	7.0
Guangdong	6850	903	20.0	24.0	26.0	22.0	7.6
Guangxi	4289	723	16.8	18.0	24.0	12.0	8.0
Hainan	4346	728	16.0	16.0	28.0	12.6	9.6
Sichuan	3586	495	12.0	13.0	14.0	20.0	7.0
Guizhou	3427	467	13.0	14.0	16.0	14.0	9.6
Yunnan	3684	453	15.1	17.1	15.0	16.0	8.2
Shaanxi	3048	237	14.0	11.0	16.0	9.0	6.0
Gansu	2894	253	13.0	13.0	13.0	12.0	6.8
Qinghai	3051	310	13.0	12.0	11.0	13.0	7.0
Ningxia	3026	271	12.3	12.0	14.3	8.6	6.6
Xinjiang	3853	403	15.0	16.5	18.0	10.5	7.8

Note: Price: December 1996

Sources: SSB, Statistical Yearbook of China, 1996; China Economic Information Center, Monthly Price Bulletin.

7. International Trade

China has kept its position as a net exporter of livestock products in the world market. The export value is about 5 to 8 times of that of import. Table 7-1 displays the composition of China's foreign trade of edible livestock commodities in the recent years. The annual net export value is in the range of 700 to 800 million US\$.

Major export commodities are live pigs and pork, live poultry and poultry meat. These four commodities account about 70% of the edible livestock products export of China. Major import products are practically only milk products and poultry, accounting for almost 90% of the total food livestock import.

**Table 7-1 Import and Export of Major Livestock Production in China
in million US\$**

Commodities	1988	1989	1990	1991	1992	1993	1994	1995	1990-95 Average
	Export		Export		Export		Export		
Live Animals	386.10	395.11	429.73	439.15	479.08	452.80	467.45	503.17	468.33
Horse, donkeys	0.12	0.36	0.24	1.55	0.92	0.01		0.04	0.51
Cattle	59.09	61.36	62.86	63.63	63.92	56.14	57.10	56.71	59.50
Pigs	233.06	243.10	270.91	276.40	290.46	271.72	269.66	278.71	277.39
Sheep & goat	4.10	0.76	0.87	6.97	10.43	15.95	13.22	12.45	11.80
Poultry	76.54	76.94	84.53	82.04	93.34	90.35	105.18	125.34	99.25
Others	13.19	12.59	10.32	8.56	20.00	18.63	22.30	29.93	19.88
Meat and entrails	343.88	399.98	522.66	529.90	357.56	347.24	634.31	1021.47	578.10
Beef	107.98	105.94	158.74	203.85	38.85	27.86	30.81	33.59	66.99
Pork	115.83	159.30	215.48	157.85	76.42	62.53	128.38	245.35	134.11
Mutton	4.75	4.06	4.46	3.29	2.39	2.95	2.37	3.09	2.82
Horse, donkeys	5.46	7.00	6.39	7.69	9.60	10.15	7.94	12.80	9.64
Entrails of large	3.63	3.56	7.29	4.49	2.39	1.49	2.54	4.76	3.13
a.									
Poultry	50.22	64.57	84.09	111.66	166.22	185.40	380.22	620.82	292.86
Entrails of others	56.01	55.55	46.21	41.05	61.70	46.60	59.18	79.64	57.63
Milk and products	14.13	16.58	13.18	15.61	22.17	27.06	22.71	27.28	22.96
Eggs	55.75	43.53	41.67	41.86	38.25	29.10	31.93	33.57	34.94
Subtotal	799.86	855.20	1007.24	1026.50	897.06	856.20	1156.41	1585.49	1104.33
Feed	862.65	743.57	632.47	693.65	491.86	455.50	466.30	351.02	491.67
Total	1662.51	1598.77	1639.71	1720.15	1388.92	1311.70	1622.71	1936.51	1596.00
	Import		Import		Import		Import		
Live Animals	16.52	10.94	13.62	19.69	20.26	18.67	22.89	36.61	23.62
Horse, donkeys	0.00	0.01	0.01		0.09	0.08	0.19	0.38	0.15
Cattle	1.03	0.64	1.63	0.10	0.36	0.41	0.33	0.50	0.34
Pigs	0.34	0.01	0.00	0.99	0.06	0.00	0.47	1.93	0.69
Sheep & goat	0.59	1.64	1.19	1.80	0.82	1.56	0.11	0.45	0.95
Poultry	14.12	8.56	10.72	16.60	16.65	11.32	10.50	15.18	14.05
Others	0.43	0.08	0.08	0.20	2.28	5.30	11.29	18.19	7.45
Meat and entrails	21.74	41.07	53.25	59.89	55.70	68.33	85.42	94.84	72.84
Beef	2.54	2.20	2.91	2.95	4.00	5.35	5.30	4.23	4.36
Pork	0.03	0.01	0.01	0.01	0.03	0.07	0.17	0.96	0.25
Mutton	0.30	0.24	0.25	0.22	0.30	0.27	0.59	0.72	0.42
Horse, donkeys					0.00			0.03	0.01
Entrails of large.	1.45	1.71	2.08	1.58	0.88	2.35	4.58	6.25	3.13
Poultry	17.30	36.79	47.81	54.88	49.92	57.85	71.62	79.91	62.83
Entrails of others	0.13	0.11	0.20	0.25	0.57	1.58	1.17	1.32	0.98
Milk and products	69.10	67.97	78.74	67.02	61.54	49.00	76.86	58.04	62.49
Eggs	0.33	0.76	2.04	0.95	2.99	1.36	1.28	1.68	1.65
Subtotal	107.69	120.74	147.65	147.55	140.48	137.36	186.44	191.17	160.60
Feed	324.39	323.81	182.47	434.15	461.52	308.76	347.67	420.87	394.59
Total	432.08	444.55	330.12	581.70	602.00	446.12	534.10	612.04	555.19

Sources: China Custom Statistics, various years.

Both the export and import has increased over the past decade, at an average annual growth rate of 5-6%. However, this rate is lower than overall trade. As a result, the livestock share in the total trade has declined steadily, from around 4.5% in the mid-1980s to only 1.5% in mid-1990s.

The main destinations of China livestock export are Hong Kong, Japan and Russia, accounting for some 80% of the total livestock export. The United State, with a share of over 60%, topped the supply country list, followed by West European and Australia, with around 10% and 5% respectively.

The total export and import volume is not significant to the domestic market. Live animals and various kinds and form of meat export, converted in meat equivalent, accounted only for 2-3% of the total domestic production in mid-1980s and for less than 1.5% in 1995. Meat imports have been only about 10% of the export, or about 0.1 -0.2% of the domestic consumption. As a result, trade in livestock products does not have a significant impact on overall domestic supplies.

8. Feed/livestock Relationship

As indicated in the previous sections, the livestock production in China is very diversified and small-scaled, especially for pig, cattle, sheep and goat. The feed/livestock relationship is very complicated, varying greatly among different systems.

The total feed requirement of the livestock measured in Livestock Unit (LSU) in 1995 is shown in Table 8-1. As will be discussed in more details later, the theoretically estimated feed requirement is met by very diversified feed resources. A significant part of feed requirement is satisfied by non-conventional feed.

Table 8-1 Feed requirement in China, 1995

		Inventory	Energy requirement
		1000	1000 LSU
Dairy Cattle	Pastoral	1793	1185
	Warm and Cold	1506	1411
	Tropical and Semitropical	479	449
Beef Cattle	Pastoral	15111	5137
	Warm and Cold	57826	21006
	Tropical and Semitropical	39040	15116
Sheep	Pastoral	76962	4309
	Semi-pastoral	7345	586
	Crop area	36096	2785
Goat	Pastoral	30833	1231
	Semi-pastoral	9528	378
	Crop area	107982	7449
Buffalo	Tropical and Semitropical	26295	13299
Pig	Combined	99308*	83721
Poultry	Combined	3579172*	24924
Grand Total			182986

* number of offtake.

Source: Sukigara and Steinfeld, 1997, Application of the LDPS2 to livestock production in China.

8.1 Pig Sector

According estimation of MoA officials, intensive system for pig raising accounts only 10-15% of the total production at present. This includes the industrialized large state pig farms in the suburbs of large cities and the so-called specialized farmers (normally with an annual production of 20 slaughter pigs and over).

For the intensive system, the pig producers are heavily dependent on concentrate feed, generally purchased from market. The feed/meat ratio in these intensive farms is somehow lower than that in the developed countries, due to the lower degree of technology, feed quality and management skill.

The traditional system still plays the predominant role in pig production in China. It is estimated that about 200 million farmers in China raise pigs, mostly with one or two heads each farm. Pig production in those small farms is by nature a sideline production, almost exclusively the job for household wives, grandparents or/and children. Household waste and crop by-products account for a large part of the feed. Only in the time prior to slaughtering will concentrate feed intensively used for fattening. This is especially the case in the South, where green feed resources are particularly abundant. As a sample survey in Sichuan Province indicates, almost 70% of the coarse protein and 40% of the energy need of the pigs in the traditional system is provided by green and roughage feed, as indicated in Table 8-2.

According to the survey (Xu, *et al.* 1994), the consumption level of green feed in Sichuan is around 2000 kg per head of pigs, or 20-25 kg per kg of pig weight gain. Major green feed includes sweet potato vines and leaves, several kinds of wild vegetables and fat leave grasses.

This feed structure, high green and roughage input and low use of concentrate feed, in the traditional pig system in China allows only a slow daily weight gain of 300-350 g. However, it saves the concentrate feed resources. It needs only about 150 kg concentrate feed (grain) to produce a slaughter pig of 90-100 kg, or the meat/feed (concentrate) ratio is as high as 1: 1.5.

Table 8-2 Nutrient composition of traditional pig system in Sichuan, 1990
%

Survey Group		young pig			fattening pig		
		primary	green	coarse	primary	green	coarse
1	Coarse protein	19.1	67.7	13.2	29.1	53.2	17.7
	Energy	44.8	39.7	15.5	57	30.3	12.7
2	Coarse protein	30.4	63	6.6	43.5	45.7	10.8
	Energy	69.5	27.2	3.3	81.3	14.1	4.6
3	Coarse protein	27.7	66.1	6.2	29.1	58.4	12.5
	Energy	52.4	32	15.6	53.1	37	9.9
4	Coarse protein	31.3	59.5	9.2	42.2	46	11.8
	Energy	60.1	34.1	5.8	66.1	20.5	13.4

Source: Xu, Zhenying *et al.*, 1994, Development of Animal Nutrition Research Chinese Agricultural Science and Technology Publishing House.

However, it is unlikely to expand further the scope of this kind of traditional raising based heavily on non-grain feed. The increase of pig inventory in the future will increasingly depend on concentrate feed input, placing more requirement of the development of the feed

mill industry. As a result, the share of intensive system including specialized sector will continue to increase, from the current 10-15% up to probably 25% by 2005 and 30% by 2010, according to estimations by MoA officials.

For the further increase of pork production in China, it is to estimate that the feed/meat relationship will align to that of the commercialized sector, i.e., 3.5 to 4 kg concentrate feed to 1 kg meat. Given other things equal, this means that the demand of concentrate feed (grain) supply will grow faster in percentage term than total pork production. However, there are two factors which must be considered. First, the overall technical advances in breeds, feeding, etc. will increase the feed/meat efficiency, lowering the feed demand. Second, the change in feed structure will also increase the feed efficiency. Currently, about two thirds of the concentrate (grain) are fed directly to the animals without processing. It is estimated that processed feed will increase the feed use efficiency by 20-25%. The potential in these two areas to increase feed efficiency will at least partially offset the increased feed demand in the future.

8.2 Cattle Sector

Cattle is held very extensively in China. According to officials from MoA, the target for intensive cattle raising, animals held in flocks larger than 10 heads each, should be 15% of the total slaughtering by the year 2000. This let assume that the intensive raising may be around 10% in the total beef production.

As mentioned in earlier sections, there is a substantial shift in geographical patterns of the cattle production from pastoral areas to crop areas. This implies a change in the feed structure of the cattle sector. However, this does not necessarily means an intensification of the cattle production. Increased cattle raising in crop areas is also non-grain based, using fodder, roughage and treated straw as feed. Very few concentrate feed is used. This is clearly shown by the fact that the feed share for cattle, goat and sheep jointly accounts only 3% of the total industrial feed production (Table 5-14).

Intensified cattle raising, mainly dairy cattle raising, is found mostly in the suburbs of big cities. It is estimated that the intensive sector based heavily on concentrate feed is unlikely to grow very fast. It share will remain very low in the foreseeable future.

8.3 Mutton Sector

Sheep and goat sector, like cattle sector, is raised very extensively in China, both in the pastoral regions and in the crop areas. There is hardly any intensification in mutton production. It is unlike the mutton sector will be intensified in the foreseeable future.

8.4 Poultry Sector

Poultry sector is the most intensified sector in China. According to the MoA officials, the intensive poultry raising should be 40% for broilers and 60% for layers. Poultry sector, in both the intensive system and traditional system, depend highly on concentrate feed. Though poultry share in the total meat production is only 18%, poultry feed accounts for 50% of the total industrial feed production in China, as shown in Table 5-14.

According to report from MoA, feed/poultry meat conversion ratio has changed from 3.0-3.5:1 in the early 1980s to 2.0-2.2:1 currently. In the most efficient chicken farms in China, the ratio is 1.8-1.9:1, while that in the industry countries is 1.5-1.6:1.

The high feed efficiency is one major reason that the intensive poultry sector has been

developing very fast. For the same reason that it is expected that the poultry sector will further rapidly expand. The production structure will also continue to change, resulting in a shrinking traditional sector both in the relative share and in absolute inventory numbers and an over-proportional increase of the intensive system. The share of intensive system will probably reach 60% for the broiler sector and 80% for layer sector by 2005.

8.5 Discussions on Overall Feed Requirement

It is estimated that around 140 million tons concentrate feed (including paddy rice, soybean, and potato and sweet potato in grain equivalent) have been used for livestock and artificial fishery production, which means 52.60 million tons meat, including 36.48 million tons pork, 4.15 million tons beef, 2.02 million tons mutton, 9.35 million tons poultry, 6.73 million tons milk, 16.77 million tons eggs, and 13.53 million tons aquaculture product. Based on these data, the feed/meat ratio should be 2:0-2.5:1.

Pork and poultry meat account nearly 90% of the total meat production in China. The major part of the future feed requirement will also come from these two sectors. Assuming an annual growth of 3% for pork and 5% for poultry and using the feed/meat ratio in intensive system for the growth, the feed requirement increase should be about 60 million tons for the period 1995-2005. If assuming a higher growth rate, 5% for pork and 8% for poultry, the feed requirement for the same period will increase by 100 million tons.

The grain production can possibly keep pace with the first scenario, but unlikely with the second scenario. The constraints for further increase concentrate (grain) production in China will be discussed later.

9. Feed Usage

Feed resources can be grouped into five major categories: grazing land, primary products, crop by-products, oil cakes, and other feed resources. For there are no complete set for all kinds of feed data available from a single source, efforts have to be made to seek data from different sources, including official statistics and various estimations. The such compiled feed data are summarized in Table 9-1.

As indicated in Table 9-1 that 19% of the total feed inventory is from grazing land, 30% from primary feed, i.e. grain including soybean and potato. The non-conventional feed, including crop by-products, by-products from processing industries and household waste, plays a very important role in China, providing nearly 50% of the total feed energy.

Table 9-1 Feed Resource Inventory in China, 1995

Category	Amount 1000 tons	Energy 1000 LSUs	Percent
1. Grazing land		34,022	19%
2. Primary Products	140,000	53,517	30%
cereal grain	120,000	46,270	26%
Soybean	4,000	1,674	1%
potato	16,000	5,573	3%
3. Oil cakes	18,056	5,572	3%
4. Crop by-products	548,956	53,214	30%
cereal bran	69,739	22,586	13%
straw	437,384	24,572	14%
potato vine	17,350	4,892	3%
fodder and silage	23,000	1,081	1%
Vegetable leaves	1,483	83	0%
5. Other resources	334,691	32,021	18%
dregs	1,665	521	0%
feed of animal origin	3,836	1,841	1%
sugar crops	16,507	4,529	3%
cassava	992	340	0%
pulse	722	332	0%
household waste	310,969	24,458	14%
Total		178,347	100%

- Sources: 1. MoA, 1996, Data on the grassland resources in China, China Agricultural Science and Technology Press, 1994.
2. MoA: unpublished report, 1996
3. Liang Yeseng *et al.* Development and Utilization of Non-conventional Feedstuffs, Agricultural Publishing House of China, 1996

10. Outlook of Future Feed Concentrates (Grain) Supply

The growth potentials for grain production in China are one of the most controversial issues in the recent hot debate on who will feed China.” The prevailing views of most Chinese scholars are that China has to rely on herself to basically meet the increasing demand mentioned above. Growth potentials exist in yield improvement which can be realized through intensification of land use, while there is hardly any possibility to expand the farmland areas.

In China, virtually all arable land has been put into cultivation. In many places, such as in Loess Plateau, semiarid regions in the Northwest and mountainous areas in the Southwest, very fragile lands which are not suitable for cultivation at all have also be explored for grain production.

The exact figure of the cultivated land area in China is a disputing issue. According to many estimations, the actual figure should be 30-40% higher than the officially released farmland figures. One major reason for the under-reporting of farmland is that most newly reclaimed farmland has not been included in the statistics. Farmers and local government do not like to report it due to economic and other reasons. Another reason is that a large part of the unreported land is marginal land and often is abandoned after one or two year’s cultivation.

According to SSB statistics, arable land areas have declined from 103.3 million ha in 1965 to 95.0 million ha in 1995, or a fall of 8% during the last three decades (Table 10-1). The modernization process in China will take more fertile farmland away from agriculture.

Though there are still reclaimable land resources, which are estimated at 14.7 million ha in total (IOSC, 1996), their reclamation needs heavy investment and is very expensive. Quantitatively, the annual reclaimed land might offset the farmland reduction and keep the total farmland areas not further declining. However, qualitatively, the productivity of the newly reclaimed land is not comparable with that lost. The lost land is mostly in the South and the East, and are usually flat and suitable for two or three crops a year, while the added land is usually in the North and the West, mostly under dry, cold and poor fertility conditions.

Table 10-1 Agricultural Areas in China, million ha

	Cultivated Areas	Paddy Fields	Irrigated	Sown areas Total	Grain Areas	Cropping Index, %
1965	103.6	25.0	33.1	143.3	119.6	138
1975	99.7	25.5	43.3	149.5	121.1	150
1985	96.8	25.0	44.0	143.6	108.8	148
1995	95.0	24.9	49.3	149.9	110.1	158

Source: SSB, Statistical Yearbook of China, various years.

Multiple cropping is one of the major measures to intensify the land use. Multiple cropping index was raised from 138% in 1965 to 158% in 1995, resulting an increase of 5% in sown areas despite the 8% decline in land areas. Irrigated areas have also been expanded substantially, from 32% in the total farmland to 52% during the same period.

Great efforts have also been made in building terraced fields, which accounts 8% of the total farmland. Another area-related measure is the rapid expansion of areas covered under plastic sheet. This practice improves significantly the temperature conditions of the fields and enables early planting, which is especially important in the northern provinces.

The application of chemical fertilizers has played a very significant role in intensifying the land use and improving the productivity. Chemical fertilizer input increased dramatically from 2 million tons in 1965 to 13 million tons in 1980 and 36 million tons in 1995, with an annual growth of 10% for the three decades. The quantity of pesticide uses did not increase much, fluctuated largely between 0.25-0.45 million tons during the 1965-1995 period. However, the quality should have been improved.

Technical progress in crop breeding and improved varieties have made substantial contributions to the yield growth in China. The development of hybrid rice and crossbred corn varieties and the continued expansion of areas with those varieties, coupled with other related measures including seed coating and improved seeding methods, have played a very important part in grain yield growth in China.

There are also a wide range of other measures intensifying the land use. Total power of agricultural machinery increased from 15 million kW in 1965 to 147 million kW in 1980 and to 361 in 1995. Progress in mechanization has enable a better timing for planting and harvesting, a reduction in post-harvest loss, and reduced number and thus the feed need of draft animals, increasing the available feed for meat and milk production. With the institutional and policy reform, individual farmers can make their own production decision as what and how to produce, resulting more rationalized production patterns, each adapting to the local natural and economical conditions. Regional specialization makes a better and more efficient use of land resources. The merging of corn belt in the north and northeast China centered in Jilin Province is an example.

The effects of all the intensification measures mentioned above reflect on the continued yield improvement, as indicated in Table 2. Through intensification of the land use, China has been able to increase her grain production from 200 million tons in the mid-1960s to 400 million tons in the mid-1980s, and to 467 million tons in 1995.

Table 10-2 Grain yield growth in China, ton/ha sown area

Year	Total	Paddy	Wheat	Corn	Soybean
1954/56	1.4	2.5	0.9	1.3	0.8
1964/66	1.6	3.0	1.0	1.5	0.8
1974/76	2.3	3.5	1.6	2.5	1.0
1984/86	3.5	5.3	3.0	3.8	1.4
1993/95	4.1	5.9	3.5	4.9	1.6

Source: SSB, Statistical Yearbook of China, various years.

Apart from domestic production, China has also actively involved in the world grain trade. Until the recent past, China used to import wheat and export rice and feed grain.

The total corn export in 1993 and 1994 amounted to 20 million tons. However, China began to be a net importer for both food grain and feed grain in 1995 and 1996. In the long run, many studies have projected that China would increase her food and feed grain import in the future. However, for a large country like China, the import could play no more than a supplementary role, and China has to rely mainly on herself to meet the increased concentrate feed requirements.

11. Conclusions

Important conclusions for the development of livestock sector in the past two decades and the future perspectives can be summarized as following:

- The livestock production in China has been over-reported, especially for beef. The extent of this over-reporting could be as high as 40%. The total meat production should be around 30 million tons in 1995, not 50 million tons from the official production statistics.
- Accordingly, the per capita meat consumption level was about 25 kg in 1995, far below the level suggested by the over-reported production figures. This also means that the growth rate in per capita meat consumption during the past decade was not as high as many people believe. This has very significant implications for projecting the further development of meat demand in the future. Over-estimation of the real income improvement and the income elasticity of meat demand are the major reasons leading to over-estimation of future meat demand development in China.
- Feed resources, both in pastoral areas and in crop areas, are the most important constraints for further increase of livestock production in China. Better and more efficient use of the available feed resources and the exploration of new feed sources in a sustainable way will play the decisive role in determining the future of livestock development in China.
- Technical advance, reflected on the yield and productivity improvement, has been the driving force for the growth of livestock production in the past two decades. This will

continue to be true for the future. This includes a better and wider adoption of the available technology and the development of new technology.

- The commercialization or intensification of livestock sector, especially for pork and poultry, is inevitable and should be welcomed in China. Commercialized production system is not only economic-efficient and feed-efficient, but also efficient in protecting environment from the whole nation's viewpoint. Commercialization of livestock production in an intensive system may cause some environmental problems for the production sites, but this is a tradeoff for protecting other more fragile land areas. Pollution caused by commercialized system is a point-pollution problem and relatively easy to be addressed. Technical progress in improving resource use efficiency will first find application in the intensive commercialized system, and leading to a much higher resource/product conversion ratio. This will lessen the pressure on the resource and environment for the whole country. Without a commercialized livestock sector based on efficient feed uses, the land, water and other natural resource and environmental degradation and deterioration problems will inevitably worsen under the pressing feed demand requirements.
- To sum up, both demand for and supply of livestock products will not increase very fast in the future, unlikely to exceed the range of an annual growth of 3-5% in the long-run, with pork on the lower side and poultry meat, beef and milk on the higher side. Concentrate feed production will keep pace with this moderate growth of livestock sector, given continued improvement in the application of the available and new technology, especially those enhancing the feed use efficiency.

References

- Beijing Custom, 1997, *Custom Declaration Manual*, Business and Administration Press.
- China Economic Research Center at Peking University (CERC), 1997, *Rural-urban migration and unemployment problems in the cities*, Bulletin No.15, March.
- Huang, Jikun, *et al.*, 1997, *China Food economy to the 21st Century: Supply, Demand, and Trade*, IFPRI Discussion Paper.
- Ke, Bingsheng, 1992, *Pig and pork marketing in China*, Science and Technology Publishing House of China.
- Lu, Weiguo, 1997, 'Estimation on the feed grain demand in China', *Chinese Grain Economy* No.3.
- National Office for Feed Industry (NOFI), 1996, *Statistical Data of feed industry*.
- Ministry of Agriculture (MoA), 1992, *Data of rural social and economic surveys*, Central Party School Press.
- Simpson, James R. *et al.*, 1994, *China livestock and related agriculture: projections to 2025*, CAB International, Wallingford, U.K.
- State Statistical Bureau (SSB): various years, *Statistical yearbook of China*.
- State Statistical Bureau (SSB): 1996, *Rural, Agricultural and farmers' Issues in China*, China Statistical Publishing House.
- Xu, Zhenyinq *et al.*, 1994, *Development of Animal Nutrition Research* Chinese Agricultural Science and Technology Publishing House.

List of Tables

Table 3-1	Import Tariff for Livestock in China
Table 4-1	Livestock Production and Growth in China
Table 4-2	Divergence in Livestock Consumption Data
Table 4-3	Official Statistics of Cattle Inventory and Imbalance
Table 5-1	Pig and Pork Production in China
Table 5-2	Changes in Regional Patterns of Pork Production
Table 5-3	Beef and Milk Production in China
Table 5-4	Changes in Regional Patterns of Beef Production
Table 5-5	Milk Production in China
Table 5-6	Milk Production by Province in China
Table 5-7	Mutton, Sheep and Goat Milk and Wool Production in China
Table 5-8	Sheep and Goat Sector by Province in China
Table 5-9	Poultry Production in China
Table 5-10	Poultry and Eggs Production by Province in China
Table 5-11	Producer Price Index for Livestock Products in China
Table 5-12	Feed Grain Price Development in China
Table 5-13	Industrial Feed Production in China
Table 5-14	Composition of Compound Feed Output in China
Table 5-15	Feed Production by Province in China
Table 6-1	Livestock Consumption Based on Household Surveys
Table 6-2	Livestock Consumption Based on Food Balance Sheet
Table 6-3	Per Capita Income Development in China
Table 6-4	Meat consumption by income group of urban households
Table 6-5	Income Elasticity for Food in Rural Households
Table 6-6	Income Elasticity for Livestock Products in China
Table 6-7	Consumer Price Development for Livestock in China
Table 6-8	Regional Disparity in Livestock Consumption
Table 6-9	Income, Meat Expenditures and Prices in Cities
Table 7-1	Import and Export of Major Livestock Production in China
Table 8-1	Feed requirement in China
Table 8-2	Nutrient composition of traditional pig system in Sichuan
Table 9-1	Feed Resource Inventory in China
Table 10-1	Agricultural Areas in China
Table 10-2	Grain yield growth in China