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Animal Product Consumption Trends in China [1]

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Abstract

How much animal product do the Chinese consume at present? How much animal product will the Chinese consume in the near future? Plausible estimates that can answer these questions seem to be extremely scarce. On the other hand, there has been strong demand for such estimates by many in trade and government departments who are concerned about China's livestock industry development and animal product market potential but are puzzled by the fact that China's consumption of animal products only accounts for about 40% of their availability. We believe that the present level of animal product consumption in China is underestimated, which subsequently causes enormous difficulty in projecting China's future animal product consumption. This paper contributes to the literature by estimating a set of animal product consumption levels for China at present and in the near future. It first derives the present level of animal product consumption in China by establishing a production-consumption balance sheet. Based on this adjusted consumption level, the paper then projects likely scenarios of China's animal product consumption in 2010 by

considering the key factors that may affect China's future animal product consumption.

1. Introduction

Since the rural economic reforms in the early 1980s, China's livestock industry has grown rapidly and animal products have increased significantly. According to official statistics by the State Statistical Bureau (SSB), total output of pork, beef, mutton and poultry meat amounted to 65.87 million tonnes in 2002, 5.5 times the output in 1980. Output of milk and eggs increased even faster, reaching 14 million tonnes and 24.63 million tonnes, respectively, 10 times and 9.5 times the output in 1980 (SSB 2003, pp. 436-7). China has become not only the largest producer but also the largest consumer of animal products in the world.

In the mean time, the consumption of animal products by the Chinese has also increased significantly. SSB data (based on household surveys) show that, in rural areas, per capita meat consumption had increased from 9.4 kg in 1981 to 17.7 kg in 2002. During the same period, per capita egg consumption increased from 1.3 kg to 4.7 kg, and per capita aquatic products from 1.3 kg to 4.4 kg. The corresponding figures for urban areas are 20.5 kg to 32.5 kg (meat), 5.2 kg to 10.6 kg (eggs), and 7.3 kg to 13.2 kg (aquatic products) (SSB 2003, pp. 352, 374).

However, the per capita consumption data provided by SSB are most likely lower than the actual consumption level. For example, according to SSB, average per capita consumption of pork, beef and mutton in urban areas was 23.28 kg and that of poultry was 9.24 kg in 2002. The corresponding level of consumption in rural areas was 14.87 kg and 2.91 kg, respectively. Using a weighted average, per capita meat consumption in China was 23.54 kg in 2002. However, per capita meat output in 2002 was 51.28 kg. Considering that the amount of China's meat export is small, there is a huge gap between production and consumption that was not explained. In fact, since 1994, the SSB's consumption data can only explain an average of about 42% of the production (lowest being 37.3% in 1995).

Some believe that the output level of China's animal products is inflated. Zhong (1997) believes China's meat production statistics could have been inflated by 50% or even more. Lu (1998) believes output of meat, poultry eggs and aquatic products for 1981-1995 could have been inflated by at least 40%. Aubert (1999), Colby et al. (1999), and Fuller et al. (2000) also believe that China's official meat production statistics have been overstated. However, Yuan (1999) disagrees with these claims and argues that the level of inflation for meat output is significantly below 40%. Jia (1999) even believes that the previously published meat production statistics are reasonable and there is little inflation.

On the other hand, some may have underestimated the consumption of animal products by the Chinese; for example, Huang and Bouis (1996), Liang (1998), Fuller et al. (2000), and the SSB surveys. In many studies, away-from-home consumption and retail processed animal products, which have become an increasingly important part of total animal product consumption, are often overlooked.

In response to the increasing gap between production and consumption data and aided by the 1996 national agricultural census findings, the Chinese government adjusted downwards the output level of animal products for 1996. Yuan (199 9) believes that, after the adjustments, pork, beef and mutton output figures since 1996 are now reasonable, although poultry and egg output remain inflated to some extent. Keeping this fact in mind, then the still present gap between production and consumption levels in recent years suggests that it is most likely that consumption level was seriously underestimated.

Reliable information about animal product consumption in China is extremely important for policy formulation and marketing activities. Without it, any attempt to project the consumption trend of animal product into the future may

become futile. On the other hand, due to the significant position of China's livestock market, an accurate understanding of the current situation and the longer-term trend of China's animal product consumption is crucial to those who are involved in China's longer-term livestock industry planning and animal product market development. The need for reliable information has been intensified by China's entry into the WTO in 2001: easier access to the market for overseas products will result in increased competition in the Chinese meat market.

In this paper, we estimate a set of animal product consumption levels for China at present and in the near future. We first derive the present level of animal product consumption in China. Based on this adjusted consumption level, we then project likely scenarios of China's animal product consumption in 2010 by considering key factors that may affect China's future animal product consumption.

2. Past experience and current situation

To better understand animal product consumption in China, especially the likely trend into the future, it is invaluable to understand China's animal product consumption in the past and present. In this section, we will first look into China's animal product consumption over time, rural–urban differences and regional differences. We will then derive the estimates of current level of animal product consumption in China to lay the foundation for projecting future consumption levels.

2.1 Long-term trends in animal product consumption

Since the People's Republic of China was founded in 1949, China's animal product consumption has experienced three main stages according to changing diet patterns. During the first stage (1949-78), foodgrain was the main component of the Chinese diet. In the second stage (1979-85), changes in the Chinese dietary structure took place and livestock product consumption started to increase rapidly. In the third stage (1986 to present), foodgrain consumption began to decrease while livestock product consumption continued to grow steadily (see Table 1).

Table 1. Per Capita Consumption of Foodgrain, Livestock Products, and Aquatic Products (selected years, kg) *

Year	Food Grain	Red Meat	Pork	Beef and Mutton	Poultry Meat	Poultry Eggs	Milk	Aquatic Products
1952	227	6.84	5.92	0.92	0.43	1.02	-	2.67
1957	233	6.19	5.08	1.11	0.50	1.26	-	4.34
1960	164	2.56	1.53	1.03	0.36	0.49	-	-
1965	210	7.31	6.29	1.02	0.36	1.42	-	3.33
1978	225	8.42	7.67	0.75	0.44	1.97	-	3.50
1980	246	11.99	11.16	0.83	0.80	2.27	-	3.41
1985	239	12.81	11.83	0.98	1.55	3.19	-	2.93
1990	239	14.09	12.63	1.45	1.82	3.69	-	3.60
1995	222	13.73	12.51	1.21	2.45	5.11	-	5.06
1999	206	15.76	14.00	1.76	3.23	6.33	3.10	5.83
2000	199	16.46	14.53	1.93	3.76	7.10	4.28	6.07
2001	189	16.24	14.33	1.91	3.79	6.86	5.23	6.46
2002	185	18.16	16.27	1.89	5.38	6.97	6.87	7.82

* Foodgrain is unmilled raw grain. Consumption data for 1952-1980 are obtained directly from SSB publications. Those

for 1985-2002 are weighted average based on SSB statistics for urban and rural residents. There was severe food shortage at the time when the People's Republic of China was founded. Following the land reforms in the early 1950s, agricultural supply increased rapidly and per capita consumption of food, chiefly foodgrains, started to increase. There was a drop in per capita consumption of foodgrains in 1960 as shown in this table. This was the consequence of the damage to agricultural production resulting from the so-called Great Leap Forward movement in the late 1950s followed by further natural disasters in the early 1960s. From the mid 1960s, agricultural supply started to recover.

Source: SSB, China Statistical Yearbook, various issues.

1949-1978: low level of animal product consumption

There was severe food shortage at the time when the People's Republic of China was founded in 1949. Following the land reforms in the early 1950s, agricultural supply increased rapidly and per capita consumption of food, chiefly foodgrains, started to increase. At that time, having enough food (chiefly cereal food) was the priority and limited effort could be devoted to the production of animal food. The increase in agricultural supply, however, was shortly reversed. Starting in 1958, the so-called Great Leap Forward movement caused serious damage to agricultural production and this was further aggravated by adverse weather conditions during 1960-62. Having enough food of plant origin to eat had become a great challenge during 1960-63, let alone having food of animal origin. Agricultural production recovered somewhat in 1964-65 but in 1966 another political movement, the Cultural Revolution, started and lasted for ten years, resulting in overall economic slowdown. The agricultural sector managed to increase its output but at a very slow pace. However, due to faster growth in population, per capita availability of food remained low. The Cultural Revolution ended in 1976 and agricultural production slightly increased in 1977-78, resulting in slightly improved per capita availability of food.

Without a substantial increase in cereal food supply during 1949-78, cereal production was paramount and few resources could be spared to produce animal products. Not surprisingly, the level of animal product consumption by the Chinese was very low and the increase in absolute terms was nominal. As shown in Table 1, per capita meat consumption (including pork, beef, mutton, and poultry meat) was only 7.3 kg in 1952 and increased marginally to 8.9 kg in 1978. Per capita consumption of poultry eggs increased from 1 kg in 1952 to about 2 kg in 1978. For aquatic products, it increased from 2.7 kg in 1952 to 3.5 kg in 1978. In terms of calorie intake, 90% came from food of plant origin. The proportion from food of animal origin was very small.

1979-1985: fast increase of animal product consumption

Rural economic reforms that started in the late 1970s greatly motivated the farmers to work their land to increase agricultural supply. Grain production increased rapidly. As a result, for the first time in the recent history, the Chinese had enough foodgrain to eat. The consecutive bumper harvests of foodgrains in the early 1980s enabled farmers to spare some grains to feed more animals, resulting in increased supply of animal products to the market. Improved agricultural supply coupled with increased consumer income led to the changes in Chinese people's dietary structure with increased consumption of animal products. Although the consumption of foodgrain was also increasing, the rate of growth was much slower than the increase in consumption of animal products. According to Table 1, from 1978 to 1985, the increase in the consumption of foodgrain was 14 kg, an increase of 6.2%. However, for the same time period, the increase in meat consumption and egg consumption was 5.5 kg (62.1%) and 1.22 kg (61.9%), respectively.

1986-present: continuing increase in animal product consumption

Since 1986 China's GDP has been growing rapidly. In the meantime, China's livestock sector has also expanded

dramatically. Animal products have become widely available in the market. Higher consumer income has led to further increased consumption of animal products. On the other hand, consumption of foodgrains has started to decline. Comparing 2002 with 1985, consumption of foodgrains has dropped to 185 kg from 239 kg while the consumption of animal products has increased. For example, the increase in the consumption of aquatic products, milk, eggs, and poultry meat has more than doubled. The consumption of beef and mutton, though still very low in absolute terms, has also almost doubled. However, the consumption of pork seems to have slowed down and its rate of increase is the lowest, being about 38%.

The long-term consumption trends of animal products in China in the past five decades clearly indicate that the dietary structure of Chinese consumers has changed, largely since the late 1970s after the rural economic reforms were launched. Since then, animal product consumption has increased quite rapidly in the diet of the Chinese. However, there is a notable difference between the levels of animal product consumed by the rural and by the urban residents.

2.2 Differences in consumption levels between urban and rural areas

Table 2 shows that per capita consumption of animal products is much higher in urban areas than in rural areas. According to Table 2, although per capita pork consumption by urban residents has exhibited a declining trend since the early 1990s (from 18.46 kg in 1990 to 15.95 kg in 2001),[2] the consumption of beef and mutton, poultry meat and poultry eggs increased rapidly, by 47%, 185% and 54%, respectively, between 1985 and 2002. In the case of per capita consumption of aquatic products, it increased by 86%.

Table 2. Urban-Rural Differences: Per Capita Income and Animal Product Consumption (¥, kg)

Item	1985	1990	1995	1999	2000	2001	2002
			Urban				
Per capita income (¥)	739	1510	4283	5854	6280	6860	7703
Total Meat	21.96	25.16	23.65	24.92	25.50	24.42	32.52
Pork	16.68	18.46	17.24	16.91	16.73	15.95	20.28
Beef and Mutton	2.04	3.28	2.44	3.09	3.33	3.17	3.00
Poultry	3.24	3.42	3.97	4.92	5.44	5.30	9.24
Poultry Eggs	6.84	7.25	9.74	10.92	11.21	10.41	10.56
Aquatic Products	7.08	7.69	9.20	10.34	9.87	10.33	13.20
			Rural				
Per capita income (¥)	398	686	1578	2210	2253	2366	2476
Total Meat	12.00	12.59	13.12	16.35	17.48	17.37	17.74
Pork	10.32	10.54	10.58	12.70	13.44	13.35	13.70
Beef and Mutton	0.65	0.80	0.71	1.17	1.19	1.15	1.17
Poultry	1.03	1.25	1.83	2.48	2.85	2.87	2.91
Poultry Eggs	2.05	2.41	3.22	4.28	4.97	4.72	4.66
Aquatic Products	1.64	2.13	3.36	3.82	3.92	4.12	4.36

Source: SSB, *China Statistical Yearbook*, *Various issues*.

Compared with their urban counterparts, animal product consumption by rural residents is lower. In terms of the rate of growth, rural areas experienced faster growth. Between 1985 and 2002, per capita consumption of pork increased

by 33%, and beef and mutton together increased by 80%. During the same time period, per capita poultry meat, poultry eggs and aquatic product consumption increased by 183%, 127% and 166%, respectively. These higher rates are due to the low level consumption in 1985. Despite these higher rates, the consumption by rural residents in absolute terms is still much lower than that by urban residents in 2002.

In addition to the different levels of animal product consumption between rural and urban areas that Table 2 reveals, four other important observations are also borne out by further examining the data in Table 2.

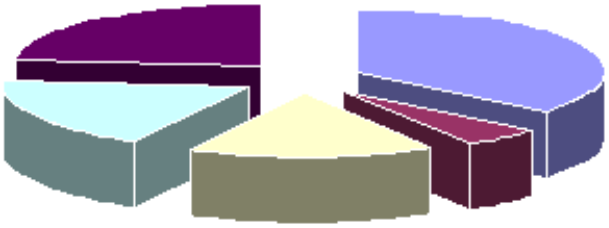
(1) As income increases, the demand for animal products increases in both rural and urban areas. The important exception is that when income is high enough, the increase in pork consumption tends to slow down as has been exhibited in the urban areas.

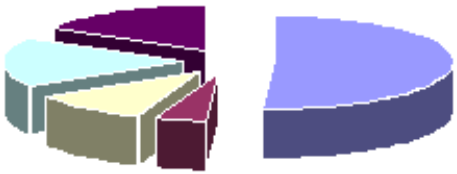
(2) Although total meat consumption is still increasing in urban areas, the rate of increase is relatively small (2002 being an exception but the government sources provided no explanations). On the other hand, the increase in the consumption of poultry meat and aquatic products seems to be much greater.

(3) While there exist differences in the compositions of animal products consumed by urban and rural residents, they seem to be largely comparable (see Figure 1). Pork is still the major meat consumed in both urban and rural areas, being about 1/3 of animal products consumed in urban areas and 1/2 in rural areas. Urban residents consume a higher proportion of poultry meat, poultry eggs and aquatic products. The share of beef and mutton consumed in both urban and rural areas is quite similar.

(4) Although the gap between rural and urban consumption levels is reducing due to the faster increase in animal product consumption in rural areas, rural consumption of animal products is still far below the urban consumption level. Table 2 indicates that the consumption level of rural residents in 2002 had not reached that of urban residents in 1985. Indeed, the consumption level of rural residents in 2002 was even lower than that of urban residents in 1981. In 1981, per capita consumption by urban residents was 20.52 kg meat (including pork, beef, mutton and poultry meat), 5.22 kg poultry eggs and 7.26 kg aquatic products. This implies that the consumption level of rural residents is lagging behind that of urban residents by at least 20 years.

Figure 1. Composition of Animal Product Consumption (2002)





Sources: SSB, China Statistical Yearbook, 2003

2.3 Regional variations in animal production consumption

Not only are there differences in the levels of consumption between rural and urban residents, there are also distinct variations in the levels of consumption and the patterns of consumption between regions. Tables 3 and 4 reflect such regional differences. Table 3 shows the level of per capita consumption of major animal products in rural China by province. Data comparable to Table 3 for urban residents are not available and instead per capita expenditure on major animal products is used as given in Table 4.

Table 3. Per Capita Consumption of Major Animal Products by Rural Residents in 2002 (kg)

Region	Pork, Beef and Mutton	Poultry Meat	Eggs and Related Products	Aquatic Products
National Average	14.87	2.91	4.66	4.36
Beijing	15.03	3.57	9.74	4.24
Tianjin	10.65	0.73	9.98	7.09
Hebei	7.40	0.40	5.63	2.18
Shanxi	5.21	0.24	6.11	0.55
Inner Mongolia	18.60	1.20	3.48	1.52
Liaoning	15.09	1.67	8.48	4.64
Jilin	12.05	2.05	7.67	3.73
Heilongjiang	7.69	2.50	6.45	3.63
Shanghai	16.79	8.25	10.70	16.36
Jiangsu	12.31	4.16	6.18	8.54
Zhejiang	16.13	5.47	4.89	14.03
Anhui	9.37	3.86	4.74	4.63
Fujian	18.26	5.34	3.54	12.58
Jiangxi	12.86	2.47	2.90	4.42
Shandong	8.05	2.64	11.47	3.88
Henan	12.12	1.77	9.30	1.09
Hubei	18.74	2.07	3.47	7.13
Hunan	19.37	3.85	3.39	5.59
Guangdong	21.56	8.97	2.70	12.04
Guangxi	14.33	7.02	1.12	3.55
Hainan	15.11	8.32	0.60	16.30
Chongqing	25.82	2.33	4.60	1.83
Sichuan	25.33	2.81	3.64	1.55
Guizhou	27.99	1.14	1.22	0.32
Yunnan	24.11	2.35	1.73	1.25
Tibet	12.05	0.03	0.61	
Shaanxi	6.64	0.34	2.06	0.27
Gansu	9.31	0.96	2.26	0.22
Qinghai	20.30	0.45	0.68	0.45
Ningxia	11.01	2.74	2.69	0.77
Xinjiang	11.04	1.36	1.10	0.35

Source: SSB, *China Statistical Yearbook*, 2003, p. 374.

Table 4. Per Capita Expenditure on Animal Products by Urban Residents in 2002 (yuan)

Region	Meat including Poultry Meat	Poultry Eggs	Aquatic Products	Milk and Dairy Products
National Average	455	59	170	105
Beijing	566	70	163	219
Tianjin	427	87	232	114
Hebei	330	74	96	96
Shanxi	225	64	35	99
Inner Mongolia	305	44	40	27
Liaoning	386	74	173	101
Jilin	334	57	101	75
Heilongjiang	304	57	80	77
Shanghai	633	68	592	246
Jiangsu	496	66	241	128
Zhejiang	457	48	553	120
Anhui	418	79	106	95
Fujian	609	65	546	130
Jiangxi	417	48	111	79
Shandong	332	75	121	130
Henan	294	63	38	66
Hubei	390	51	115	82
Hunan	434	43	102	62
Guangdong	852	46	365	108
Guangxi	689	39	187	71
Hainan	657	26	354	53
Chongqing	574	65	98	135
Sichuan	531	59	69	110
Guizhou	431	41	42	66
Yunnan	474	49	71	66
Tibet	605	45	59	226
Shaanxi	254	46	49	85
Gansu	273	44	40	83
Qinghai	382	41	49	78
Ningxia	308	35	41	86
Xinjiang	421	44	54	84

Source: SSB, *China Statistical Yearbook*, 2003, pp. 356-58.

The following regional differences can be established from the data in Tables 3 and 4.

(1) In general, the southeast coastal region (including Guangdong, Hainan, Fujian, Zhejiang, Shanghai and Jiangsu) has a higher level of meat consumption. This is a wealthier region of China.

(2) The consumption level of aquatic products in the above-mentioned six southeast coastal provinces is also higher. On the other hand, the consumption level of aquatic products in the northwest provinces, e.g., Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang, is minimal.

(3) Major meat-producing regions in China's southwest also tend to have a higher meat consumption level (chiefly, pork), e.g., Guangxi, Sichuan, and Hunan.

(4) Northwest pastoral regions tend to consume more beef and mutton. Per capita beef and mutton output in provinces such as Inner Mongolia, Xinjiang, Ningxia, and Qinghai is much higher than the national average.

(5) Central and northeast China tends to consume more poultry eggs. For example, the consumption level of eggs in Shandong, Henan, Hebei, Anhui, Tianjin and Liaoning is much higher than in other provinces.

(6) The per capita consumption of all animal products in Shanghai and Guangdong, two wealthier coastal provinces in China, is the highest. The two provinces with the lowest per capita consumption of all animal products are Shaanxi and Shanxi, two poorer inland provinces in China.

The above analyses suggest that the different levels and patterns of animal product consumption between regions are largely affected by two factors: local income level and availability of the product. Whether or not a product is consumed in a region and how much of it is consumed are largely determined by the product's output level in the region. Aquatic product is relatively abundant in the southeast coastal region but scarce in the northwest region. Consequently, the consumption levels of aquatic products between these two regions differ greatly. However, residents in the northwest region consume a higher level of beef and mutton. That the level and pattern of animal product consumption in a region is influenced by the local output level of an animal product is due to the fact that the animal product market in China was not well integrated, which is further attributable to the low level of marketable surplus and lack of specialised transport facilities. Residents have to eat what is readily available in the local market, which in turn "fosters" their "habit" of eating that particular product. One other major factor that affects the level and pattern of animal production consumption is ethnic background. For example, in areas where a large number of Muslims reside, e. g., some northwest provinces, the level of beef and mutton consumption is higher.

2.4 Current level of animal product consumption: adjusted estimates

How much animal product is the Chinese population consuming at present? A robust estimate of the current consumption level is indispensable not only for understanding the size of today's market but also for producing any meaningful forecast about the likely future animal product consumption level. However, as noted earlier, there has been a gap between China's production and consumption of animal products since the mid 1980s. This is clearly shown in Table 5. Indeed, the SSB's consumption data can only explain an average of about 42% of the production since 1994, the lowest being 37.3% in 1995. The gap between consumption and production remained sizeable despite the fact that in 1997 the government adjusted its inflated production data for 1996, and that output data since the adjustments have been considered to be largely reliable.

Table 5. Discrepancies between Meat Consumption and Production Data (1983 to 2002)

Year	Per Capita Meat Consumption (kg)	Per Capita Meat Output * (kg)	Consumption out of Production (%)
1983	13.33	13.62	97.9
1984	13.92	16.19	85.9
1985	14.37	18.20	79.0
1986	15.97	19.65	81.3
1987	15.84	20.27	78.1
1988	15.07	22.33	67.5
1989	15.39	23.32	66.0
1990	15.93	24.99	63.7
1991	16.98	27.15	62.6
1992	16.97	29.28	58.0
1993	16.48	32.41	50.8
1994	15.98	37.54	42.6
1995	16.21	43.43	37.3
1996	17.35	37.45	46.3
1997	18.24	42.62	42.8
1998	18.50	45.86	40.3
1999	18.89	46.23	40.9
2000	20.40	48.39	42.2
2001	20.03	49.63	40.4
2002	23.54	51.28	45.9

* Carcass weight.

Source: SSB, *China Statistical Yearbook*, various issues.

It is noted that the consumption data are based on retail weight. From carcass weight to retail weight, there are weight losses of varying degrees for different animal products. However, even taking this fact into consideration, the gap still cannot be closed. Hence, most likely the SSB consumption data are underestimates. Three factors may have contributed to the underestimation. (1) In the SSB household surveys, away-from-home consumption of animal products was largely overlooked. (2) Only fresh and frozen animal products were included. Retail processed animal products and foods with animal product ingredients were neglected. (3) The SSB surveys pay only a very small amount of money to surveyed households to compensate for time spent maintaining household records; this arrangement therefore offers little incentive for wealthier households to participate in the survey. Hence, the samples are likely to be biased in favour of lower income households.

To verify the likely underestimation by the SSB survey data, in 1999 the Ministry of Agriculture in Beijing funded a research project, for which one of the authors was the project leader. The project was chiefly designed to collect household consumption data in order to compare with those provided by SSB and also to gather more detailed consumption data that SSB is unable to provide.[3] The survey instruments used for the project accommodated away-

from-home consumption and the consumption of retail processed products.

- For urban households, animal product consumption includes at-home consumption, away-from-home consumption, and the consumption of processed products. At-home consumption includes both the purchased quantity and non-purchased quantity (given by their workplaces as staff welfare or by friends and relatives as gifts). Away-from-home consumption comprises all food containing animal products taken outside the house including breakfast, lunch and dinner. Retail processed products include those retail processed animal products and processed foods with animal product ingredients.

- For rural residents, animal product consumption includes the quantity consumed from self-produced products, the quantity purchased, and the quantity consumed away from home. For the majority of Chinese farmers, purchase of processed products is uncommon and its consumption was not included in the survey.

Based on this survey, per capita total meat consumption in 1998 in China was 33.7 kg (including pork 22.5 kg, beef and mutton 4.7 kg and poultry meat 6.5 kg), being 15.6 kg more than the SSB estimate of 18.1 kg. Per capita poultry egg consumption was 9.7 kg, being 3.6 kg more than the SSB estimate of 6.1 kg. The survey results confirm the underestimation of animal product consumption in China by the SSB data. For 1998, SSB data underestimated meat consumption by 46.4% and eggs by 36.7% (see Table 6).

Table 6. Discrepancies in Meat Consumption Data between Different Sources (for 1998 Data)

Item	Urban			Rural			All China		
	SSB	Wang et al.	SSB under-estimation (%)	SSB	Wang et al.	SSB under-estimation (%)	SSB	Wang et al.	SSB under-estimation (%)
Total Meat	23.9	49.8	52.1	15.5	26.8	42.1	18.1	33.7	46.4
Pork	15.9	30.7	48.3	13.2	19.0	40.0	15.0	22.5	44.9
Beef and Mutton	3.3	8.9	62.3		3.0			4.7	
Poultry Meat	4.7	10.2	54.6	2.3	4.8	51.8	3.0	6.5	52.9
Poultry Eggs	10.8	15.8	32.1	4.1	7.0	41.6	6.1	9.7	36.7

Sources: SSB, *China Statistical Yearbook* (1999); Wang et al. (2004).

Next, we attempt to derive a balance sheet for China's animal product consumption and production in 2000. It is a useful alternative, *vis-a-vis* household surveys, to estimate the consumption level of animal products in China. Due to the lack of essential data, it is unrealistic to employ more sophisticated techniques to estimate China's animal production consumption levels.

The derivation of a balance sheet between production and consumption is based on the assumption that the production data are largely accurate. As noted earlier, the inflated production figure for 1996 was adjusted downwards. Since then, there has been no exceptional growth of animal product between years and many have argued that the production data are relatively accurate. Hence, the official animal production data are used without further adjustments.

Since the consumption estimates from this balance sheet will be used as the baseline to project future consumptions, it is necessary to avoid yearly fluctuations. To this end, three-year average (1999-2001) is used. Three-year averages are calculated for total output, net export, and SSB consumption estimates; the latter for comparison with the consumption estimates from this balance sheet.

The balance sheet on China's animal product production and consumption for 2000 is presented in Table 7. In retail weight, China's per capita meat consumption in 2000 had reached 37.7 kg (including 24.23 kg of pork, 4.99 kg of beef and mutton and 8.5 kg of poultry meat). This is much higher than the consumption level of 19.75 kg as published by SSB. Based on the balance sheet, egg consumption in 2000 was 16.8 kg and milk consumption was about 7.5 kg. The consumption that falls into the categories of "at home", "away from home" and "processed products" is also given in Table 7.

Table 7. Adjusted Estimates of Animal Product Consumption in 2000 (three-year average 1999-2001)

	Total meat	Red meat	Pork	Beef	Mutton	Poultry meat	Milk	Eggs
Total output (mt) [a]	60.16	48.38	40.36	5.29	2.73	11.78	9.50	22.38
Net export (mt) [a]	0.59	0.15	0.12	0.03	0.004	0.44	0.04	0.04
Domestic consumption (mt)	59.57	48.23	40.24	5.26	2.726	11.34	9.46	22.34
Per capita availability (kg) Consumption	47.01	38.06	31.76	4.15	2.15	8.95	7.47	17.63 [b]
Carcass-retail loss rate [c]			23.7%	26%	11%	5%		5%
Per capita consumption in retail weight (kg)	37.72	29.22	24.23	3.07	1.92	8.50	7.47	16.75 [b]
Of which: Away from home Consumption								
(%) [d]			17%	29%	29%	33%	15%	14%
(kg)	8.37	5.57	4.12	0.89	0.56	2.81	1.12	2.34
Consumption of Processed Products								
(%) [e]			6.5%	14.0%	5.1%	12.9%		20.0%
(kg)	3.19	2.09	1.57	0.43	0.10	1.10		3.35

At home Consumption (kg)	26.16	21.56	18.55	1.75	1.26	4.60	6.35	11.05
Per capita consumption according to SSB data (kg) [a]	19.75	16.15	14.29	1.87		3.59	4.20	6.77

[a] Output, net export, and SSB per capita consumption are three year average (1999-2001). Output and per capita consumption data are from SSB China Statistical Yearbook, various issues. Red meat includes pork, beef and mutton in this study and total meat includes red meat and poultry meat. Net export data are from the production, supply and distribution (PS&D database), ERS, USDA.

[b] In China, conventionally, seed eggs are included in total egg production. There is no reliable information about the proportion of total egg output used to hatch chicks, and hence, it is difficult to deduct the seed eggs from the total output. Subsequently, the per capita availability of eggs, and thus the per capita egg consumption, is likely to be slightly higher then the actual.

[c] Carcass retail weight loss parameters are based on Putnam and Allshouse (1996). Due to the lack of a conversion ratio to account for milk retail loss, per capita milk consumption remains the same as per capita availability.

[d] Away from home consumption proportion was based on Wang et al. (2004).

[e] The consumption proportion of processed products is based on the assumption that rural residents consume half of processed products by urban residents. The consumption proportion of processed products is also from Wang et al. (2004).

The consumption figures derived from this balance sheet again confirm the underestimation by SSB data. For all meat, the underestimation is 47.6%. For red meat and poultry meat, it is 44.7% and 57.7%, respectively. The extent of the underestimation is comparable to that found in Wang et al. (2004) (see the last column in Table 6). The underestimation for eggs (59.6%) is much higher than that in Table 6 due to data complication (see note b to Table 7). We also calculated the consumption growth rates between 1998 and 2000 using two sets of data: (1) the consumption data by SSB for 2000 and 1998; and (2) the 2000 consumption level derived in the above balance sheet and the 1998 level in Table 6. The growth rates from the two sets of data for various categories of animal products are also largely comparable except for poultry meat and eggs. The above cross-checking tends to suggest that the consumption levels of various animal products derived for 2000 using the balance sheet method are in the main reasonable. Hence, it would be reasonably safe to use these estimates as baseline to project the likely consumption levels of animal products by the Chinese in the near future. However, before we predict future consumption levels, it is useful to examine the key factors that have affected and will continue to affect animal product consumption in China.

3. Factors affecting animal product consumption

Although the consumption level of animal products in absolute terms is still low in China, particularly when compared with many other countries, the speed of increase in the past two decades has been indeed very impressive. What has

led to such fast increase in consumption? Will this trend continue into the near future and if so what are the key factors that will drive this trend? Identification of such factors is valuable not only for understanding China's demand for animal product in the past and present, but also for foreseeing its future animal product consumption and its changing patterns of animal product consumption.

Rising income: the major driving force

Fast economic growth has resulted in increased consumer income. Table 8 shows the magnitude of income increase in both rural and urban China since 1978 when the country's economic reform started. As income increases, the proportion of income spent on food had also declined as shown by the Engle Coefficients. On the other hand, consumption of food of animal origin has increased steadily as income increases (see Table 2). Table 2 clearly shows that there is a strong relationship between consumer income and the level of animal product consumption. A number of recent studies have also confirmed that rising income is the major driving force leading to increased consumption of animal products in China (see, for example, Huang and Rozelle 1998, Ma 2000, Fuller et al. 2001, Zhou and Tian 2003).

Table 8. Per Capita Annual Income and Engle Coefficients in China

Year	Per Capital Income (¥)		Engle Coefficients (%)	
	Rural	Urban	Rural	Urban
1978	133.6	343.4	67.7	57.5
1979	160.2	387.0	64.0	57.2
1980	191.3	477.6	61.8	56.9
1981	223.4	491.9	59.9	56.7
1982	270.1	526.6	60.7	58.7
1983	309.8	564.0	59.4	59.2
1984	355.3	651.2	59.2	58.0
1985	397.6	739.1	57.8	53.3
1986	423.8	899.6	56.4	52.4
1987	462.6	1002.2	55.8	53.5
1988	544.9	1181.4	54.0	51.4
1989	601.5	1375.7	54.8	54.4
1990	686.3	1510.2	58.8	54.2
1991	708.6	1700.6	57.6	53.8
1992	784.0	2026.6	57.6	52.9
1993	921.6	2577.4	58.1	50.1
1994	1221.0	3496.2	58.9	49.9
1995	1577.7	4283.0	58.6	49.9
1996	1926.1	4838.9	56.3	48.6
1997	2090.1	5160.3	55.1	46.4
1998	2162.0	5425.1	53.4	44.5
1999	2210.3	5854.0	52.6	41.9
2000	2253.4	6280.0	49.1	39.2
2001	2366.4	6859.6	47.7	38.2
2002	2475.6	7702.8	46.2	37.7

Source: SSB, *China Statistical Yearbook*, various issues.

How will the income factor affect China's future consumption of animal products? This is largely determined by the income growth rate and the income elasticity of demand for animal products. *Ceteris paribus*, the greater the income elasticity, the greater the demand for animal product when income rises. However, there is little consensus about the likely size of income elasticities of demand for various animal products. Table 9, summarising the elasticities estimated by some recent studies, shows that significant variations exist between studies. For example, in the case of pork, the income elasticity is as low as 0.30 but as high as 1.

Table 9. Estimates of Income Elasticities of Demand for Animal Products in China

Author	Year, income level, or rural and urban		Income Elasticities of Demand for						
			Meat	Pork	Beef and mutton	Poultry	Eggs	Milk	Fish
Zhu et al. (1991) [a]				0.57	0.57	1.46	0.66		1.34
Pinstrum-Anderson et al. (1991) [a]				0.63	1.23	1.16	1.18	1.71	0.86
RGCFDS (1993, p. 14) [b]	1995		0.580				0.936	1.400	0.468
	2000		0.540				0.673	1.189	0.606
	2020		0.426				0.553	1.100	0.472
Huang and Rozelle (1998, p. 245)	Rural	1999-2000	0.757	0.765	0.343	0.854	0.512	1.557	1.053
		2000-2010	0.835	0.782	0.789	0.985	0.455	1.637	1.244
		2010-2020	0.835	0.782	0.789	0.985	0.455	1.637	1.244
	Urban	1999-2000	0.835	0.782	0.689	0.985	0.455	1.637	1.244
		2000-2010	0.870	0.797	0.686	1.064	0.491	1.912	1.290
		2010-2020	0.870	0.797	0.686	1.064	0.491	1.912	1.290
Cai, Brown, Longworth and Wan (1999, p. 155) [c]	Low income		1.102	0.610		1.392			
	Medium income		1.756	0.627		0.541			
	High income		1.482	0.731		0.710			
Wang et al. (2004) [d]	Rural, 1998			0.25	0.57	0.22	0.36	0.32	0.37
	Urban, 1998			0.32	0.49	0.48	0.26	0.49	0.51
Average [e]			0.928	0.583	0.712	0.954	0.661	1.225	0.879
Huang (1996), USA estimates				0.66	0.39 [f]	0.08	0.29	0.12	

[a] Recited from Garnaut and Ma (1992, p.72).

[b] Numbers in the 'Fish' column are for aquatic products; no separate estimates for individual meat.

[c] Expenditure elasticities for three income groups; numbers in 'Meat' column are for ruminant meat. Based on a small sample.

[d] Numbers in the 'Fish' column are for aquatic products.

[e] This average is calculated from those estimates that are largely based on consumption data in the 1990s and those estimates beyond 2000 are not included.

[f] For beef only.

Source: Adapted from Zhou et al. (2003); Huang (1996).

The data in Table 9 suggests three points: (1) Researchers have attempted to estimate the income elasticities for rural and urban residents separately. This is essential as rural and urban population in China are two very distinct groups of consumers as has been shown earlier in this paper. (2) Attempts have also been made to estimate elasticities for consumers of different income strata. Such estimates are also essential (although their availability is limited and more research in this direction is called for) because the size of income elasticities of demand for a particular product tends to vary for consumers of different income levels. As an example, the income elasticity of demand for pork may be relatively small for poorer consumers as they have to acquire sufficient life essentials before they can afford to consume such “luxury” food. It becomes larger for consumers with higher incomes. However, when consumer income is high enough, their taste may change and may shift to some other food. As such, the income elasticity may decline. (3) Researchers suggest that elasticities may vary over time. This is reasonable. Over time, consumers’ income will change and thus elasticities will change as argued above in point 2. However, studies have generated conflicting estimates. RGCFDS (1993) suggests that the elasticities for all the animal products by 2020 will be lower than those of 2000. Huang and Rozelle (1998), on the contrary, believe that the elasticities for all the animal products by 2020 will be higher than those of 2000. Our judgement is that the income elasticities of demand for animal products in China may become slightly higher in the next decade, say till 2010, or at least will remain at the current level. In the long term, they will decline. This is based on the fact that, currently, a large proportion of the population in China still has relatively low income and on the assumption that future consumer income will continue to increase at a rate similar to that in the past decade.

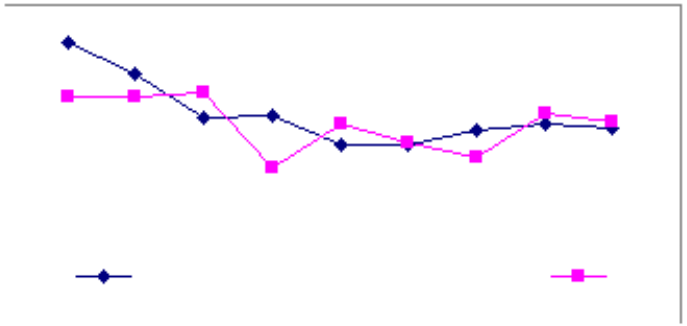
Given that the elasticity estimates generated by different studies differ greatly, a simple way to work out a general size of the elasticity is to derive an average based on those earlier estimates. The average reported in Table 9 (see the note to the table for its calculation) suggests that the income elasticites for all the animal products in China are greater than those in more mature markets (such as the United States, see the last row in Table 9). This implies that if consumer income continues to increase, there will be substantial room for the increase in animal product consumption in China.

It is noted that while the rising income will generally increase the level of animal product consumption, how the income is distributed among the population may also affect animal product consumption to some extent. Currently, the income gap between different groups of consumers is rising. Some have become very rich while others have become relatively poorer. As pointed out earlier, the level and composition of animal products demanded by high- and low-income consumers are different. How China’s income distribution will evolve and how this may affect animal production consumption also deserve close attention.

Low and stable price: encouraging animal product consumption

Animal product market was among the first deregulated by the Chinese government in 1985. Since then, the price of animal product has been determined by the market. Prices gradually increased but this increase was arrested in the mid 1990s (see Figure 2). Since 1997, the price has been relatively stable and low; this in turn has to some extent encouraged consumption.

Figure 2. Consumer Price Index of Animal Products (previous [M4]year=100)



Sources: SSB, China Statistical Yearbook (1999); Wang et al. (2004).

To understand how responsive the Chinese are to changes in animal product prices requires the estimates of price elasticity of demand. Unfortunately, such estimates for China seem to be scarce, chiefly due to lack of reliable data. Limited available estimates vary dramatically. For example, Pudney and Wang (1991) found that own-price elasticities of demand for animal products in urban areas are unusually low, being -0.003 for beef and mutton and -0.04 for pork. Lewis and Andrews (1989) show that urban price elasticities for non-staple food (including animal products) were -0.76, close to -0.957 by Wang (1989), but rural price elasticities were lower (-0.23 for pork, and -0.09 for poultry meat). It is further noted that these estimates were largely based on the data of 1980s and can hardly reflect the situation in the 1990s when quite different price regimes were dominant.

How the price level will affect future consumption will be largely determined by the actual price level of an animal product and the corresponding price elasticity for that animal product. With given price elasticity of demand for an animal product, the price level will have an important effect on consumption. The current price level for animal products is still relatively low in China. How this will evolve, however, is not certain and will be significantly affected by China's feedgrain supply and its trade of feedgrains and animal products.

Urbanisation: driving effect becomes stronger

Urbanisation generally brings about a higher income to those new urban residents. These new urban residents are also readily exposed to urban cultures, including consumption behaviours. This tends to influence and change their dietary behaviours. According to Huang and Rozelle (1998, p. 18), urbanisation affects not only food consumption level, but also food structure. When a rural resident moves to a city, the consumption of foodgrains and vegetables tends to decrease but that of other foods including animal product tends to increase. For example, depending on whether the city is small, medium or large, the consumption of animal product will increase in the range of 4.2 to 7.2kg and that of aquatic product, 1.5 to 1.7kg (see Table 10).

Table 10. Impact of Urbanisation on Per Capita Food Consumption

Foods	Consumption (kg)	
	Rural Migrants Moving to Small or Medium Cities	Rural Migrants Moving to Large Cities
Foodgrain	-58.3	-64.2
Animal product	+4.2	+7.2
Aquatic product	+1.5	+1.7
Vegetable	-23.0	-24.9
Fruit	+8.2	+9.6
Other foods	+1.8	+3.0

Source: Huang and Rozelle (1998, p. 18).

China's urbanisation level was very low at the end of the 1970s, being less than 20% (see Table 11). Economic reforms have led to accelerated industrialisation and urbanisation. By 2002, the urbanisation level had doubled that of 1980, reaching 39%. Based on the findings of Huang and Rozelle, China's accelerated urbanisation must have contributed to the increase in animal product consumption. Urbanisation is currently being promoted by both China's central and local government officials and its level is expected to continue to increase. Hence, urbanisation is likely to continue to stimulate animal product consumption.

Table 11. China's Population and the Level of Urbanisation (million persons, %)

Year	Total Population	Urban		Rural	
		Population	Proportion	Population	Proportion
1978	962.59	172.45	17.92	790.14	82.08
1979	975.42	184.95	18.96	790.47	81.04
1980	987.05	191.40	19.39	795.65	80.61
1981	1000.72	201.71	20.16	799.01	79.84
1982	1016.54	214.80	21.13	801.74	78.87
1983	1030.08	222.74	21.62	807.34	78.38
1984	1043.57	240.17	23.01	803.40	76.99
1985	1058.51	250.94	23.71	807.57	76.29
1986	1075.07	263.66	24.52	811.41	75.48
1987	1093.00	276.74	25.32	816.26	74.68
1988	1110.26	286.61	25.81	823.65	74.19
1989	1127.04	295.40	26.21	831.64	73.79
1990	1143.33	301.91	26.41	841.42	73.59
1991	1158.23	305.43	26.37	852.80	73.63
1992	1171.71	323.72	27.63	847.99	72.37
1993	1185.17	333.51	28.14	851.66	71.86
1994	1198.50	343.01	28.62	855.49	71.38
1995	1211.21	351.74	29.04	859.47	70.96
1996	1223.89	359.50	29.37	864.39	70.63
1997	1236.26	369.89	29.92	866.37	70.08
1998	1248.10	379.42	30.40	868.68	69.60

1999	1259.09	388.92	30.89	870.17	69.11
2000	1265.83	458.44	36.22	807.39	63.78
2001	1276.27	480.64	37.66	795.63	62.34
2002	1284.53	502.12	39.09	782.41	60.91

Source: SSB, China Statistical Yearbook, various issues.

Closely related to the urbanisation process, there are a large number of rural people working in urban areas. Some of them work in urban areas for a short time each year depending on agricultural seasons while others work for a much longer time. Statistically, they are not urban population but still rural population. Yet their level of animal product consumption is generally different from those in their home residence and is normally higher. The consumption behaviour of animal products by these migrating rural people invites further study.

Changing life style: increasing demand for retail processed food

Increase in income and urbanisation promote changes in life style. More and more Chinese have started to take holidays and to consume foods that require less or no time to prepare. The increase in the number of people taking inter-city and inter-province holidays has been phenomenal in recent years. For convenience and time saving, more and more people dine out and buy processed or semi-processed animal products. Many are also keen to try out Western-style fast foods, e.g., Kentucky Fried Chicken and McDonald's hamburgers. Changes in people's life style have significantly boosted the demand for retail processed food. The findings in Wang et al. (2004) based on household surveys suggest that the consumption of processed animal products and away-from-home consumption has already accounted for an important portion of the total animal product consumption (see Table 12).

Table 12. Proportion of Retail-Processed Animal Product Consumption and Away-from-Home Consumption in Total Animal Product Consumption (1998, %)

Animal products	Consumption of processed food in urban areas	Away from home consumption of animal products	
		Urban	Rural
All Meats	10.4*	33.6	11.5
Pork	9.5	26.6	9.9
Beef	20.6	37.5	16.7
Mutton	7.5		
Poultry meat	19.0	51.3	14.8
Eggs	na	13.0	13.4
Dairy	na	4.2	35.5
Aquatic products	3.4	43.5	13.3

* Average of the proportions of all processed animal products.

Source: Wang et al. (2004).

New cooking methods: encouraging the consumption of animal products not conventionally consumed

New methods of cooking animal dishes have encouraged consumers to eat more animal products, especially those such as beef and mutton, that are not conventionally consumed by China's majority, the Han people. The majority of the Chinese know well how to cook pork in the home kitchen, but not beef and mutton. Many used to cook beef and mutton by stewing, but this method produces a somewhat bland flavour. This lack of knowledge about cooking beef and mutton discourages their consumption to some extent.

Two cooking methods, "hot pot" and "meat strings", have recently become widespread, greatly encouraging many Chinese to increase their consumption of not only beef and mutton, but also other foods such as poultry meat and aquatic products. With the "hot pot" method, sliced mutton/lamb, veal, fish and other raw foods are quickly dipped into boiling seasoned soup in the "hot pot" and then eaten with other seasonings and a wide choice of side dishes. The "meat strings" method originated with the "roasted mutton string" which evolved chiefly in China's northwest regions, e.g., Xinjiang. It is similar to satay consumed in some Southeast Asian countries. Mutton, beef, pork and poultry meat, and even baby optus, are cut into small cubes, then placed onto bamboo or iron skewers and roasted over an open fire stove. Seasonings of choice may be added after the meat is cooked. Foreign methods of animal product cooking, such as the Korean and Japanese style barbecue, are also becoming popular. Such new methods of cooking will continue to encourage consumption of animal product both at home and away from home.

Changing tastes and preference: increased attention to cleanliness, nutrition and safety

Before the 1980s, having meat to eat was a luxury: regardless of whether it was fatty or lean. In fact when cooking oil was in short supply, people tried hard to buy fatty parts of the animals. Today, although some rural residents still prefer fatty meat, overall, consumers in China have for health reasons gradually moved away from eating a lot of fatty meat. According to Table 13, the consumption of fatty meats by both urban and rural residents accounts for only a very small portion of their meat consumption, being 2.3% and 7%, respectively. On the other hand, the consumption of lean meat accounts for 53.1% for urban residents and 34.7% for rural residents. In rural areas, there is still a relatively strong preference for meats that are not very fatty but not very lean either (44.5%). This is perhaps due to the need to perform heavy manual work and the fact that rural people are perhaps less aware of potential health problems that animal fats may cause. Table 13 also shows that the Chinese prefer some animal parts that are not commonly consumed in other cultures, such as heads, claws, tails and offal of pigs, and to a smaller extent those of cattle and sheep.

Table 13. Composition of Various Parts of Animals Consumed by Urban and Rural Residents (%)

	Animal	Head, Foot and Claws, Tails and Offal	Ribs	Fatty Meat	Lean Meat	Fatty and Lean Meat	Total
Urban	Pig	7.4	22.1	4.0	33.7	32.8	100
	Cattle	1.2	1.5	0.3	87.0	10.1	100
	Sheep	1.6	6.0	0.1	70.2	22.1	100
	Average	6.0	14.1	2.3	53.1	24.5	100
Rural	Pig	6.6	10.6	9.4	24.9	48.5	100
	Cattle	0.8	1.8	0.6	88.5	8.3	100
	Sheep	1.4	5.4	1.3	43.0	48.9	100

	Average	5.1	8.7	7.0	34.7	44.5	100

Source: Wang et al. (2004).

Consumers have also started to pay more attention to quality attributes of animal products such as cleanliness and safety (chemical residues, transferable bacteria, meats of dubious quality, the use of preservative in processed foods). Due to China's inability to implement quality controls, at times, particularly in some years of the 1990s, unsafe meats (e.g., the overuse of clenbuterol in pigs) dampened consumers' confidence in eating meat. Some consumers reacted by reducing or not eating such products. The lack of quality assurance has to some extent negatively affected the consumption of animal products in China. China has a long way to go to develop an institution to implement animal product quality assurance.

Related to changes in tastes and preferences, differences in consumption patterns between regions as noted earlier in Section 2 are likely to reduce when different kinds of products become readily available across China with improved transport facilities. On the other hand, when the Chinese become wealthier, whether they will consume more animal products or aquatic products is yet to be seen. Some argue that mainland Chinese may consume more aquatic products, following the dietary patterns in many other "Chinese communities" in the East Asian region (Shono et al. 2000). Further, with increased cultural exchanges between China and the rest of the world, it may also be expected that some Chinese will try out animal products that are commonly consumed in other countries but new to China.

Education level: affecting consumers' choice of animal product intake

With a higher education level, consumers become more conscious of nutritional aspects and the health implications of food intake, and families with a higher education level tend to consume more beef, poultry meat and aquatic products. However, at an even higher level of education, consumers tend to reduce their consumption of animal products, in favour of other foods such as vegetables and fruits (Shono et al. 2000; Wang et al. 2004). Families with a higher education level are likely to consume more dairy products.

Population: changing age structure affects the composition of animal products demanded

China's population is still increasing. However, as in many other societies, the proportion of aged population in China is also increasing. The one-child per family policy has and will continue to raise this proportion. The compositions of animal products demanded by aged population, middle-aged, and younger populations are different. A relatively higher proportion of the aged population is likely to have an impact on the kinds and amount of animal products demanded in China – an area that deserves close attention in the future.

Social welfare system reforms: short-term impact on animal product consumption

Under the centrally planned economy, the Chinese government paid the workers very low salaries but provided them with housing, education and Medicare at a very low price. In the 1990s, the government started to substantially reform these low price welfare systems. Consumers are asked to gradually take increased responsibility to look after their housing, education and Medicare. For those who used to work in the state-run enterprises, the government provided some sort of lump sum payments/subsidies based on the number of years of employment to help them buy their own house, e.g., selling public accommodation at a very low price to those who had worked for a long time, but at a higher price to those who had worked a relatively short time. Workers are also asked to contribute a certain proportion to their medical expenses, the proportion again depending on the number of years of employment. Those who start to work after the reforms are asked to pay for their housing, education and medical expenses at the market prices.

The welfare reforms have led consumers to spending a large proportion of their incomes on those services that used to be subsidised. Considering that the income of the majority of Chinese families is not high, a significant portion of their

expenditure on housing, education and Medicare competes with their expenditure on food, especially the more expensive animal products. Hence the welfare reforms have most likely restrained the consumption of animal products in the recent past. However, this impact is likely to be short term. In the long term, this negative impact is likely to be minimal.

We have addressed some key factors that have or will continue to affect the consumption of animal product in China. Some of them are inter-related; e.g., income, education, tastes and preferences, and lifestyles. In addition, some other factors may have also played a role in affecting animal production consumption in China. Nonetheless, an understanding of the key factors, such as those we have discussed in this paper, should prove invaluable for assessing current animal product consumption in China and in particular for forecasting the likely future consumption scenarios presented in the next section.

4. Possible scenarios of China's animal product consumption in 2010

In making projections, it has been popular to employ structural equations (such as partial equilibrium systems or general equilibrium systems) or time-series auto-regression equations. For consumption research, many have opted to use demand system equations. Due to the lack of data and the poor quality of the available data, no attempt is made to use sophisticated econometric techniques for our projections. Instead, we use some conventional simpler methods. To "compensate" for the inability to use complex econometric methods, we use three conventional methods to project China's demand for animal product in 2010; this approach allows us to carry out cross-checking and comparison of the results of the different methods. These three methods include trend extrapolation, analogies method, and the income elasticity method.

Trend extrapolation

From the mid 1980s, China experienced a period of very fast increase in animal product consumption. Given that the 1985 per capita consumption data by SSB were not underestimated, using the adjusted 2000 per capita consumption data in Table 7, we can calculate the annual growth rate of consumption from 1985 to 2000 for each of the major animal products. The growth rates are 4.9% for pork, 11.5% for beef and mutton, 12% for poultry meat, and 11.7% for eggs, respectively. Because the growth rate of consumer income has slowed down significantly in recent years, it is reasonable to assume that these high growth rates of animal product will not continue into the future.

In fact, given that China's import and export of animal products is so small, to a great extent, the production is largely equal to the consumption. In this sense, the slower growth rate of animal production in recent years also reflects a slower growth rate of animal consumption. During 1996-2000, the annual growth rate of meat production was 7.5% (8.2% during 1985-1996). For poultry meat, it was 3.3% (18.9% during 1985-1996). It was 3.4% for eggs (12.6% during 1985-1996). The growth rates for poultry meat and egg production dropped by a greater extent.

Based on the above, we assume that the consumption growth rate during 2001-2010 will be 3% for pork, 6% for beef and mutton, 6% for poultry meat, 2.5% for eggs and 7% for milk. The projected consumption level in 2010 is given in Table 14.

Table 14. Per Capita Animal Product Consumption in 2010 (kg)

Method	Total meat	Pork	Beef and mutton	Poultry meat	Eggs	Milk
Baseline (2000)	37.72	24.23	4.99	8.50	16.75	7.47

Trend Extrapolation	56.72	32.56	8.94	15.22	21.44	14.69
Analogies method	56.50	33.90	9.60	13.00	21.50	14.26
Income elasticity method	60.36	36.07	8.10	16.18	26.31	17.06
Range	56-60	32-36	8-10	13-16	21-26	14-17

Based on the trend extrapolation, by 2010, per capita meat consumption in China will be 56.7 kg, comprising 32.6 kg of pork, 8.9 kg of beef and mutton and 15.2 kg of poultry meat. Egg consumption will be 21.4 kg and milk consumption will reach about 15 kg.

Analogies method

By comparing consumption and income levels of China and some other "Chinese communities" such as Taiwan, Hong Kong and Singapore, Garnaut and Ma (1992, pp. 23-37) found that there is a strong relationship between the income level and the consumption level of meat consumption among the “Chinese communities”. This, however, is subject to the multiplication of the mainland China per capita GDP by a factor of 2 to 3, due to the likely underestimation of GDP in China. For example, meat consumption of 37.7 kg in 2000 in mainland China (based on our adjusted estimates) was equal to Taiwan's average consumption in 1978 and 1979 when Taiwan's per capita GDP was about 1700 US$ (Xiao 1993), which is twice the mainland's per capita GDP of 855 US$ in 2000 (7078 Yuan RMB, SSB 2001).

This finding provides a useful way to predict animal product consumption in China by comparing the income levels between China and other “Chinese communities”. This approach also possesses another advantage, that is, changes in consumer tastes and preferences have been “built in” in the projection, due to the similarities in their ethnic background. The following assumptions are made when using this “analogies method”:

(1) Consumers in mainland China and other “Chinese communities” have similar tastes and preference in meat consumption.[4]

(2) China's per capita GDP will grow at an annual rate of 7% from 2000 to 2010. China's GDP annual growth rate was 12.0% during 1991-1995, and 8.3% during 1996-2000. Many believe that China's GDP will increase at an annual growth rate of about 8% from 2000 to 2010 (Li 1999, Lin 1999, Xu 2002). At the same time, population growth rate is slightly less than 1%. Thus, per capita GDP will grow at about 7%.

(3) The amount of meat consumption in mainland China is equal to the consumption in other Chinese communities such as Taiwan, Hong Kong and Singapore at the same income level when China's per capita GDP is multiplied by 2. However, the composition of meat will follow China's own pattern as exhibited in the past few decades.

China's per capita GDP in 2000 was 7078 Yuan RMB. At an annual rate of 7%, it will reach 13924 Yuan RMB (1682 US $, constant price in 2000) by 2010. Based on Assumption 3 above, China's per capita meat consumption will be equal to the consumption of Taiwan at its income level of 3364 US$ (1682 US$ $\times$ 2). Taiwan’s per capita GDP was about 3364 US$ in 1985-1986 and at that time its per capita meat consumption was 56.5 kg. As a result, per capita meat consumption in mainland China is likely to reach 56.5 kg by 2010.

In the past decade, the share of pork consumption in China’s total meat consumption has decreased from almost 80% in 1990 to 64% in 2000. Beef and mutton’s share increased from 9% to 13%, and the share of poultry meat increased

from 11% to 22%. Based on our judgement, we believe that the share of pork will continue to decline but that of beef and mutton will increase because beef and mutton are likely to become more popular with the Chinese, particularly with the emergence of new cooking methods. On the other hand, the fast increase in poultry meat consumption is unlikely to continue. Hence, we assume that by 2010, the share of pork, beef and mutton, and poultry meat out of total meat consumption will be 60%, 17% and 23%, respectively. Subsequently, per capital pork, beef and mutton, and poultry meat consumption will be 33.9kg, 9.6kg and 13kg, respectively (see Table 14). As such, the consumption of beef and mutton in 2010 will be higher than Taiwan's (2.5kg) in the mid 1980s, while poultry meat will be lower than Taiwan's (20kg) in the mid 1980s.

Income elasticity method

This method depends heavily on an important parameter: income elasticity of demand for animal products. The accuracy of this parameter is crucial. However, as shown in Table 9, available elasticity estimates for China vary greatly. Hence, an average is used and its calculation is explained in the note to Table 9. As for the "analogies method", we assume China's per capita GDP will increase at an annual rate of 7% from 2000 to 2010. Based on the income elasticity method, by 2010, total meat consumption will be 60.4 kg per capita, which includes 36.1 kg of pork, 8.10 kg of beef and mutton, and 18.2 kg of poultry meat. Egg consumption will be 26.3 kg while that of milk will be 17.1 kg. (see Table 14).

Table 14 presents results derived from three different methods and shows that the differences in projection by these methods are relatively small. The differences in projections between the income elasticities approach and the other two methods are slightly larger, but the magnitude should be quite acceptable. The differences between the results from the trend extrapolation and analogies method are nominal although those for beef and mutton and poultry are slightly greater. This tends to suggest the projections are acceptable.

According to the results in Table 14, consumption of animal products in China will continue to increase. Per capita total meat consumption will increase from 37.7 kg in 2000 to about 56-60 kg in 2010. Per capita egg consumption will increase from 16.8 kg in 2000 to 21-26 kg in 2010, and per capita milk consumption will increase from 7.5 kg in 2000 to 14-17 kg in 2010. While the consumption of all animal products will increase, the speed of increase among different animal products differs. The annual growth rate of milk consumption of 7.6% is the fastest, followed by beef and mutton (6.1%) and poultry meat (5.5%). The increase in pork and eggs will be relatively slower, at 3.4% for both.

5. Conclusions

In this paper, we first examined China's animal product consumption over time and consumption differences between rural and urban residents and between different regions. We then estimated the current level of animal product consumption in China, which laid the foundation for us to project the consumption levels of animal product consumption by 2010.

Since the early 1950s, China's animal product consumption level has increased significantly. This increase in consumption has taken place chiefly since the mid 1980s. However, there is a notable difference in the level of animal product consumption by the rural and urban residents. In absolute terms consumption is much lower by rural than by urban residents. Our analyses show that the consumption level of rural residents is lagging behind that of urban residents by at least 20 years. Lower income in rural areas is largely responsible for the rural–urban difference. In addition, there are also distinct variations in the levels and patterns of consumption between regions. Apart from the local income level, whether and how much a product is consumed in a region is closely related to the region's output level of that product. Ethnic background is another major factor that affects the levels and patterns of animal production consumption between regions.

Our estimation reveals that the current consumption of animal products in China has reached a much higher level than previously held. The SSB household surveys significantly underestimate the consumption level of animal products by the Chinese consumers. Take 2000 as an example. For all meat, the underestimation is 47.6% (37.7 kg vs 19.8 kg). For red meat and poultry meat, it is 44.7% (29.2 kg vs 16.2 kg) and 57.7% (8.5 kg vs 3.6 kg), respectively. The estimates derived using a balance sheet approach in our analyses offer a valuable understanding of the current level of animal product consumption in China.

Projections by three different methods indicate that the consumption level of animal products in China will continue to increase. By 2010, per capita total meat consumption will increase to about 56-60 kg, egg consumption to 21-26 kg, and milk consumption to 14-17 kg. While the consumption of all animal products will increase, the speed of increase among different animal products differs. The increase in milk consumption will be the fastest, followed by beef and mutton and poultry meat. The increase in pork and eggs will be relatively slower.

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[2] There was an irregular jump in per capita pork consumption in urban areas in 2002, together with poultry and aquatic product consumption. The government official publications offered no explanation. There was no such jump for rural consumption.

[3] Full details will be made available from the authors on request.

[4] However, it is noted that there are some differences in the composition of meat demanded and also the consumption level of eggs, milk and aquatic products. For example, at a comparable level of income, consumers in Taiwan seem to consume more poultry meat than those in the mainland while the latter seem to consume more beef and mutton than the former. On the other hand, egg consumption level in the mainland tends to be higher but that of milk is much lower than that of Taiwan. Further, per capita aquatic product consumption in the mainland is also much lower, partly perhaps due to the lower per capita production of aquatic products.

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