Matching China's agricultural supply and demand data

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by

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1. Introduction

China's agricultural production and consumption have experienced impressive growth in the last decades. According to China's official statistics, China's grain production has increased from 325.5 million tons in 1980 to 572.2 million tons in 2011 (NBSCa, 2012), which means a steady growth rate of 1.8% sustained over a period of 31 years. The production of livestock products has enjoyed even much faster growth. Total meat production increased from 12.1 million tons in 1980 to 79.6 million tons in 2011, implying an annual growth rate of 6.3% while the annual growth rates for eggs and milk were 7.9% and 11.3%, respectively.

However, the gaps between official production and consumption data have also increased, which leads to ever growing concerns about the quality of these data. There are mainly two issues puzzling researchers regarding the balance of China's agricultural supply and demand data. One is the gap between the supply and demand of livestock products which has long been acknowledged since the late 1990s. The other one is the balance between grain supply and demand which seems to be changing in recent years. For example, while according to official statistics China's rice and wheat production continues to rise and per capita consumption continues to decline, China had to import 2.1 and 3.7 million tons of rice and wheat, respectively, to fulfill its domestic demand in 2012. Maize import also reached a record height in 2012 of 5.2 million tons.

Many researchers have argued that the gaps between meat supply and demand are mainly due to the overestimation of production and underestimation of consumption. They blame the hierarchy of the government reporting system for the overestimation of production, while demand is underestimated since food away from home (FAFH) is not included. A recent study by Bai et al (2013) in big and medium cities of China supports this view. However, there are also researchers such as Wang et al (2004) who claim that the underestimation of meat consumption due to neglect of FAFH is so large that the official meat production data are acceptable. Aubert (2008) examines the issue from the perspective of feed demand. Based on an estimate of available feed, he applies an 'official' feed-meat ratio to calculate China's meat production and finds that it must be overestimated by about 30%.

Exploring the reasons behind these gaps and creating a consistent agricultural supply and demand data set is not only important for policy makers but also for researchers of China's agricultural economy. China is the largest country in grain and livestock product consumption, and changing domestic conditions may have a large impact on the international food market. For example, OECD and FAO (2013) project that by 2022, China's coarse grain imports (mainly maize) may reach a level as high as 13.2 million tons. However, these projections are based on China's current production and consumption data. If the base year data of China's agricultural production and consumption are not correct, it will lead to large discrepancies in future projections.

The overall goals of this paper are to understand the discrepancies in China's official major agricultural production and consumption data and to provide a clear quantitative overview of the issues involved. Based on earlier work in analyzing China's agricultural production, consumption and trade, the paper analyzes China's grain and meat balances for all years since 2000. Compared with existing studies, it has the distinct feature that it gives a simultaneous review of the supply and demand balances, and does not just focus on grain or meat alone. This is important given the links between grain and meat balances via the animal feed requirements.

We consider 11 commodities explicitly, viz. 5 types of grain (rice, wheat, maize, minor cereals and soybeans) and 6 livestock products (beef, mutton, pork, poultry meat, eggs and milk). In addition to the official statistics on production, consumption and trade, we submit ourselves two data sets derived from the literature, viz. FAFH adjustment factors and an overview of feed use, which are necessary for setting up the supply-demand balance sheets. Then, we calculate and evaluate 'other use' as residual consisting for all commodities of stock changes and waste, and covering for grains also seed use and industrial (non-food, non-feed) use.

The paper is organized as follows. In the next section, we discuss the official agricultural supply and demand data of China and the way they are collected. In section 3, we assess the official data by comparing them to other data sources and the literature. In section 4 we focus on the internal consistency of the official data by constructing food balance sheets for 2000-2012 and discuss the implications of the residual values for 'other use'. Finally, section 5 concludes.

2. Basic official data

Here, we first give an overview of the process by which the National Bureau of Statistics of China compiles its agricultural production and consumption data. Subsequently, we briefly describe the official data sources that are used as basis for the compilation of the supply-demand balance sheets in this study.

Data collection by NBSC
The National Bureau of Statistics of China (NBSC) is the government agency that is responsible for releasing the production data of major agriculture commodities. NBSC has its rural and urban survey teams with branches in each province. In each year, the rural survey team randomly selects nearly 60 thousand rural households to collect the agricultural production data and consumption data. For example, for the production data of major crops, the rural survey team collects information on the changes of production area, yield, and output data. Given that these surveys are just random sampling, they can get the information of production changes, but are not able to get the national total output levels or total sown area data. To get these data, NBSC relies on two other sources: a) the national agricultural census data, conducted in 1996 and 2006; b) the agricultural production data from the Ministry of Agriculture (MoA), which is reported by local government agencies. In each year, before NBSC releases the agricultural production data, it works together with MoA to examine the discrepancy of the data collected from the two independent channels. The official production data are released based on their common assessment. Because NBSC's randomly sampling survey data is

more reliable in providing the data of each year's production instead of total output data, NBSC will normally adjust its official data based on National Agricultural Census data, as it has done following the two censuses in 1996 and 2006.

The data collection process for livestock production is similar to the process for crop production, but relies to a larger extent on the reports of local governments. Before 1996, China's official livestock production data were collected by local government agencies, and then reported to the higher level government agencies. In 1996, China conducted the first national agricultural census, and the livestock production data was adjusted largely based on the census data. In 1999, NBSC started the randomly sampling survey in major livestock production provinces, covering only major animals such as pig, cattle, goat/sheep, and poultry. For the production of other animals and the livestock productions in non-major provinces, the official data is still based on the report of local governments. In 2008, a national level sampling survey system for livestock production has been set up by NBSC, which has become the main source of livestock production data. But, just as for crop production, NBSC has to rely on the reports of local governments for the total output, inventory, and slaughtered number of animals. The reported data are adjusted to make it consistent with the meat output data and other data such as carcass weight data which is collected by randomly sampling survey data.

NBSC releases China's per capita consumption data based on large scale household surveys. By 2012, the total number of urban households being randomly selected for the survey is about 30 thousand, and the corresponding number for the rural sample is about 60 thousand across China. In each year, NBSC will regularly replace one third of its samples. According to the Statistical Law of China, the household selected for the survey has the responsibility to report monthly its income, expenditure, volume of consumption of different commodities, and in the rural sample also its agricultural production. As incentive to correctly report the production and consumption data, NBSC normally gives some cash payment to the sample household, say 200-500 Yuan per year. According to the requirements, ideally, the sample household should report their food consumption both at home and away from home. But in reality the sample households largely ignore the food consumption away from home because it is difficult to measure. It worthwhile to point out that, although the official data report food consumption per capita, the data is collected at household level in the survey, and then divided by the number of household members. Household members who stay less than half the year in the household, are not counted but, on the other hand, household members who stay more than a half year in the household are assumed to be at home for the whole year.

Official data sources used
Now, we briefly describe the official data sources that are used as basis for the compilation of the supply-demand balance sheets. Six tables are presented, showing selected years from the period 2000–2012.

Table 2.1 shows crop output, sown areas and yields. It is annually published in the Statistical Yearbook (NBSC,a), supplemented by more detailed information in the Agricultural Yearbook (MoA,a). The most striking trend in the past decade is the fast growth of maize area and output. Paddy and wheat grow at a more reduced pace while output of minor cereals and soybeans is declining.

Table 2.2 shows the output of products from the livestock sector, and the technical coefficients that link them to the animal stock. Also these data are published annually in the Statistical Yearbook. Supplementary information can be found in the Livestock Yearbook (MoA,b). The table reveals the fast growth of the pig, poultry and milk sectors in the past decade. The ovine sector grows also, albeit rather slowly, while the cattle and buffalo sector is being restructured. The total number of animals is declining (especially draught cattle) but slaughtering increases.

Table 2.3 and 2.4 show home consumption of grains and meat, respectively, for rural and urban households, as published each year in the Statistical Yearbook and in more detail in the special Rural Household Survey Yearbook (NBSC,b) and Urban Household Survey Yearbook (NBSC,c). One may observe that the shift from grain consumption to livestock products, in particular pork, poultry meat and milk, has continued steadily in the past decade, not only in urban areas but also in villages. Yet, rural meat consumption is still significantly lower than urban meat consumption. The data in these tables exclude food consumed away from home (FAFH), an issue that will be taken up in the next section.

Table 2.5 shows feed data (refined feed only) per animal, distinguished by livestock system. This data is published annually by the National Development and Reform Commission (NDRC,a), as part of a rather complete overview of costs and revenues in the livestock sector, distinguished by type and size of the farms. The same publication covers also cost-revenue data for cropping activities. Here, we focus on the feed intake parameters that are, admittedly, not very spectacular in terms of differences across systems and changes over time. In the next section we will discuss in more detail the implications of the feed intake data of this table.

Finally, table 2.6 shows the trends in net imports of grains and livestock products in the past decade. They are taken from the Statistical Yearbook of NBSC in combination with the Agricultural Yearbook of the Ministry of Agriculture, but are actually collected by the China General Administration of Customs. The dominant feature in table 2.6 is the huge increase of soybean imports, while also milk imports have grown steadily. Foreign trade in meat and eggs is rather limited. Regarding cereals, the most recent data show increasing import levels, in particular for maize but also for rice and wheat. If this trend continues, it will be a structural change compared to the trade pattern in the earlier years of the decade (although exports in those years were partly due to reduction of too large stock levels).

3. Assessment of basic official data

In this section, the official data will be compared with other sources and literature on the same subject. The consistency across the various official data sources themselves is not addressed here but in the next section.

Crop output
In general, the yield levels reported by NBSC are not considered to be overestimated or underestimated. Other sources that assess crop yields throughout the country such as the annual Rural Household Survey of NBSC itself or the Agricultural Production Costs and Returns Compilation

(NDRC, a) more or less confirm the yield levels reported in the Statistical Yearbook. If there is criticism concerning yield levels, it is mainly from agronomists who feel that higher levels should be possible, especially when taking into account the huge amounts of fertilizer used.

The sown areas reported by NBSC are hard to assess for individual crops but total sown area can be compared to available agricultural land. Building on the 2006 Agricultural Census, the Ministry of Land and Resources reports for 2008 a total cultivated area for annual crops of 121 million ha, down from 130 million ha in 1996 (due to urbanization and ecological land conversion). This gives for 2008 an average Multiple Cropping Index (MCI) of close to 1.3 for the country as a whole. More detailed provincial calculations lead to MCI's ranging from, say, 0.8 in the North to 1.8 in the South, which are plausible ratios. These observations support the common view that NBSC's official crop output data are well acceptable.

Livestock output
The general view is that the output of livestock products in the Statistical Yearbooks has long been overestimated. In this respect, we may refer e.g. to Ma et al (2004), Ma et al (2006), Aubert (2008) and Bai et al (2013). One of the few exceptions with an opposite view is Wang et al (2004). NBSC has responded to the criticism by downscaling its livestock series, also historically, on the basis of successive Agricultural Censuses (1996, 2006). However, it is not clear whether this has been a rather mechanical exercise (adjusting to newly counted animal numbers) or whether it was based on in-depth analysis of representative figures of slaughter (offtake) rates and yields per animal (meat, eggs, milk) across the country.

Due to lack of comprehensive direct evidence for checking the latter parameters, we cannot do much more than accepting the official output figures as they presented in the Yearbooks, until the supply-demand tests of the next section. In this respect, we remark that FAO, in spite of the general distrust, maintains the official Chinese output figures in its Food Balance Sheets (FAO, 2013).

Feed use
It is difficult to compare the feed requirements mentioned in NDRC's annual cost-revenue compilation (NDRC, a) directly with other information. Therefore, we consider the feed-meat conversion ratio. Indeed, NDRC also reports live weight per slaughtered animal (which can be converted into carcass weight), as well as the number of days that the animals are raised. However, interpretation of the resulting feed-meat ratios of the livestock systems is not straightforward, for several reasons. First, NDRC only reports volumes of refined feed. For coarse feed merely a value is mentioned that cannot be translated easily into a refined-feed equivalent. Yet, coarse feed is quite important for backyard systems, grazing systems and milk cows. In this respect, we mention that the Chinagro study (Fischer et al, 2007) estimates for 2005 that about half of the energy requirements of the total livestock sector comes from non-tradable feed such as grass, crop residuals, green fodder, and household waste. Secondly, NDRC merely focuses on raising slaughtered animals, which leads to incomplete coverage of the herd since there are also sows, breeding animals and less productive animals. Thirdly, NDRC does not include the grazing sector while the parameters specified for scattered animals are so close to those of small-scale and medium-scale farming that one may doubt whether backyard farming is really represented in its tables.

Having said this, one may nevertheless make a direct calculation of feed-meat ratios for pigs and poultry, applying a factor of 0.7 from live weight to carcass weight (for these animal types). With this factor the carcass weights are close to the ones used by NBSC. The resulting feed-meat conversion rates are around 2.5, 2.4 and 1.8 for pigs, broilers and layers respectively. One generally considers these factor too low. CCAP (2013b) mentions a ratio of 2.65 as national average for both layers and broilers, and suggests that the average ratio for pigs can even be close to 4. Also Aubert (2008) mentions higher ratios. These calculations confirm that the NDRC data are not fully representative.

Therefore, we replace NDRC's feed parameters by a more general calculation of refined feed requirements in China's livestock sector. This calculation starts from the animal stocks of NBSC, allocates them for each year to a more comprehensive list of livestock systems than NDRC uses, and makes assumptions on refined feed requirements using the NDRC parameters as benchmark for fully efficient systems.

Table 3.1 shows the resulting refined feed requirements by type of animal for 2005, and compares them to a comprehensive overview of refined feed requirements by source made for 2005 in the context of the Chinagro study mentioned above. The totals appear to match quite well, especially when one allows for differences due to the precise definition and unit of refined feed. Therefore, this table will be used as basis for calculating feed demand of different grains in the period 2000-2012 which we need for the supply-demand calculations in the next section. Changes over time follow from changes in total refined feed requirements and trends in availability of the various sources of refined feed. The results are presented in the next section and then used in the supply-demand balance calculations.

Household consumption
The quality of NBSC's household consumption data is also an issue that has long been debated (Ma et al, 2004; Ma et al, 2006). One commonly agrees that the NBSC surveys underestimate actual consumption for grain and even more so for meat, possibly due to underestimation of home consumption but certainly due to Food Away From Home (FAFH). Furthermore, the grain and meat content of processed food must be dealt with properly, while one should also be well aware of the units used in the survey for rice (paddy or milled), wheat (flour or grain) and meat (with or without bones).

Recent studies by Aubert (2008) and Bai et al (2013) have confirmed this view. Especially, Bai et el provide a detailed analysis of FAFH for 2012 that can lead in urban areas to an increase of 25-30% for grain consumption, 40-45% for meat consumption and 30-35% for egg consumption. For rural areas the estimated increases are lower but still 15-20% for grain, 20-30 % for meat and 15-25% for eggs. Aubert suggests for 2005 an adjustment factor of 1.33 for urban pork and 1.25 for urban grain consumption, due to FAFH.

Starting from the adjustments inspired by the older studies and taking into account this recent evidence, we specify in table 3.2 the adjustment factors that will be applied in this paper. They are

somewhat higher than the FAFH factors mentioned above,[1] since we also account for grain and meat content of processed food, while for meat there is also a conversion issue from dressed (boneless) meat into carcass weight (for which Aubert suggests a difference of 15%). The factors of table 3.2 will be used in the next section in calculating the supply-demand balances.

Foreign trade
The foreign trade data of NBSC and MoA for grain and meat do not provoke much debate in the country since there is in fact only one domestic source for it. Therefore, cross-checking must be based on trade data reported by the partner countries that can be retrieved from the bilateral international trade databases of UNCTAD or IMF. Here, however, we simply follow the Chinese trade data.

4. Data consistency: balance sheets

In this section we construct supply-demand balance sheets of grains and livestock products for the period 2000-2012. The approach is rather straightforward since the basic purpose is to validate the internal consistency of the official statistics. Therefore, the official figures on crop output of table 2.1 remain unchanged, just as those on the output of the livestock sector of Table 2.2, in spite of the doubts about the latter. Also the official net foreign trade data of table 2.6 remain unchanged. However, the household consumption figures of tables 2.3 and 2.4 are adjusted upwards since it is well-known that FAFH is not included in the original figures, while estimates of adjustment factors are available, viz. those of table 3.2. Furthermore, we cannot directly use the official feed data of table 2.5 since they have to be translated first into sources of feed. This is done as indicated in the previous section.

The resulting feed demand by source is presented in table 4.1. One may observe in particular the increasing roles of maize and soybean cake in the provision of refined feed. CCAP (2013b) mentions for 2011 rather similar figures for maize, soybean, wheat and bran although its total coverage of refined feed is somewhat lower. Other economy-wide studies to validate the data of table 4.1 are not readily available. Aubert (2008) merely makes a distinction between feed grains and milling sub-products while at the same time his total demand for refined feed is on the low side with 195 million ton in 2005. One may also refer to data of the China Feed Industry Association but, although the volumes of industrial feed are increasing rapidly, it is not yet fully representative for all refined feed with in 2012 a volume of, say, 200 million tons out of the total of 350 million ton of table 4.1.

Given the input data in tables 2.1-2.4, 2.6, 3.2 and 4.1, we can set up the balance sheets. The outcomes are presented in tables 4.2 (for grains) and table 4.3 (for livestock products). The item 'other use' is calculated residually. For livestock products it covers net stock increases and waste between the farm and the consumer. For grains it covers the same aspects but also seed use and industrial use (non-food, non-feed). The tables present the outcomes for all years in the period 200-

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[1] Wang et al (2004) mentions even higher scaling factors (close to 2) but we prefer to stay closer to the more recent studies of Aubert (2008) and Bai et al (2013).

2012, allowing us to look at structural patterns. In this way, we can avoid the cumbersome process of assessing time-specific stock changes on which reliable information is hardly available anyhow.

Outcomes for grains
For rice and wheat, the resulting outcomes for 'other use' show the same pattern. While generally low in the first part of the decade (and even significantly negative in some years due to sales from stocks), they gradually start increasing from 2005 onwards reaching levels of around 40 million ton in 2012. These amounts cannot be explained from seed and waste for which one usually assumes some 5% of production. Also industrial use can explain only part of the difference. This means that we either have to assume that the official consumption figures are even more underestimated than suggested by the studies quoted in the previous section, or that there is a significant increase in the use of paddy and wheat as feed, at least as long as we believe the production figures.

For maize, a similar pattern emerges from the outcomes but in this case the increasing amounts of 'other use' can indeed be explained from industrial use. According to the China National Grain Bureau, the use of maize for industrial use (non-food, non-feed) has increased considerably in the last decade. From a level of around 9 million tons in 2000, it may now be well above 35 million tons. If this is indeed the case, table 4.2 would even overestimate maize feed somewhat.

For minor cereals, the amounts of 'other use' are a bit too low. They cannot account for seed use and waste, but this problem is not a big issue and probably related to the residual character of the commodity which makes it difficult to apply exactly the same definition on the supply side and the demand side.

For soybean, the amounts of 'other use' are structurally negative. This could mean that the table overestimates feed use (food use is relatively small) but the problem may also be due to the measurement of foreign trade since higher import figures are circulating as well, e.g. in CCAP (2013a).

Outcomes for livestock products
For livestock products, the outcomes clearly indicate that the official supply and demand statistics are far from consistent. The resulting volumes of 'other use' are much too high even if one would allow for, say, 5% waste. Since consumption has already been increased in these calculations based on careful inspection of available studies, one cannot but conclude that the official output figures still overstate actual output significantly, even after the reductions applied by NBSC on the basis of the 2006 Agricultural Census. The problem exists for all products but is particularly prominent for pork and eggs where the gap is close to 30% and 40% of production, respectively! For beef and mutton the gap is also large as percentage of output but here the absolute volumes are lower. For poultry meat and milk, the unexplained gaps are relatively small, especially in recent years.

Hence, there is a clear need for downward adjustment of the official livestock output statistics. However, the way in which it will be done has consequences for other aspects discussed in this paper. When one reduces the number of animals, total feed use goes down affecting the grain balances discussed above. On the other hand, when one reduces the slaughter rate total feed use need not go down leading to higher feed-meat ratios, which would meet the criticism on the current levels

of these ratios in the official statistics. One could also reduce carcass weight but then again feed requirements would decline logically.

5. Concluding remarks

In this paper we have presented for the period 2000-2012 the main official data sources for production and consumption of grain and livestock products in China, compared them with the literature and checked their mutual consistency by constructing supply-demand balance sheets.

The main finding is that the output of livestock products is still considerably overestimated, in spite of downward adjustments by NBSC on the basis of the 2006 Agricultural Census. This conclusion holds even when raising the official consumption figures by more than 35% in rural areas and more than 50% in urban areas. Only if one raises these adjustment factors substantially more, the finding would be weakened but most researchers are not prepared to do so.

The second finding is that there is indeed a puzzle in explaining the increased demand for rice and wheat in recent years. It may be due to increased feed use or to accelerating industrial use but it is also possible that the upward adjustments of consumption are not sufficient to cover the increased demand for processed wheat and rice in recent years, in addition to food consumed away from home.

In the balance sheets we have confined ourselves almost exclusively to official data sources, with two exceptions: we made informed guesses of feed use by commodity and consumption of food away from home, two elements that are missing in the official statistics but necessary for assessment of the gaps in the supply-demand balances. One can always make more adjustments in order to arrive at plausible supply-demand balances (and if one plans to make projections it is even indispensable) but this is not the purpose of the current paper. Here, we prefer to reveal the data inconsistencies clearly.

Nevertheless, if one would make further adjustments, one has to know also how to reduce the output of livestock products, i.e. via animal numbers, the slaughter rate or yield parameters. Due to the interaction between the grain and livestock sector the mode of adjustment has a direct impact on the grain balances via feed demand and on the feed-meat conversion ratios, which are generally considered too low in the current official statistics.

Given the persistency of the problems in the construction of the balance sheets of livestock products, it is important in our view that the statistical authorities come up with a regular representative assessment of feed demand by commodity and livestock system, and with a regular own survey of food consumed away from home, instead of leaving the initiative fully to individual research teams. Possibly, they can then also address the problem of the strict dichotomy of urban and rural consumption data which may currently be the cause of overstated consumption changes from year to year. Admittedly, these regular new surveys will not automatically lead to improved supply-demand balances but it will definitely help researchers in making more informed data adjustments and, hence, allow them to make better projections for future grain and meat demand.

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List of tables

Table 2.1   Crop production 2000-2012, official statistics

Crop	Year	Sown area (1000 ha)	Yield (ton per ha)	Output (1000 ton)
Paddy	2000	29962	6.27	187908
	2003	26508	6.06	160656
	2006	28938	6.28	181718
	2009	29627	6.59	195103
	2012	30244	6.75	204236
Wheat	2000	26653	3.74	99636
	2003	21997	3.93	86488
	2006	23613	4.59	108466
	2009	24291	4.74	115115
	2012	24421	4.94	120580
Maize	2000	23056	4.60	106000
	2003	24068	4.81	115830
	2006	28463	5.33	151603
	2009	31183	5.26	163974
	2012	33842	6.15	208190
Minor cereals	2000	5593	2.09	11680
	2003	4237	2.67	11313
	2006	3917	2.35	9205
	2009	3301	2.23	7371
	2012	3150	2.63	8300
Soybean	2000	9307	1.66	15409
	2003	9313	1.65	15393
	2006	9304	1.62	15074
	2009	9190	1.63	14982
	2012	7407	1.84	13600
P.M. All seasonal crops	2000	156300		
	2003	152415		
	2006	152149		
	2009	158614		
	2012	163000		

Source: Statistical Yearbook, NBSC (soybean from Agricultural Yearbook, MoA)

Table 2.2　　　　**Livestock production 2000-2012, official statistics**

Animal type	Year	Animal stock (millions)	Animals slaughtered (millions)	Meat in kg/animal (carc.wt)	Meat output (1000 ton)	Milk/egg output (1000 ton)
Cattle and buffalo	2000	123.5	39.0	131.6	5131	
	2003	114.3	40.5	134.0	5425	
	2006	104.7	42.2	136.6	5767	
	2009	107.3	46.0	138.1	6355	
	2012	103.0	47.5	139.4	6620	
of which: milk cows	2000	3.9				8274
	2003	7.6				17463
	2006	10.8				31934
	2009	12.6				35188
	2012	14.6				37100
Goat and sheep	2000	279.5	197.5	13.4	2641	917
	2003	293.1	220.5	14.0	3087	1023
	2006	283.7	247.3	14.7	3638	1091
	2009	284.5	267.3	14.6	3894	1589
	2012	284.0	275.0	14.6	4010	1580
Pigs	2000	416.3	518.6	76.5	39660	
	2003	413.8	557.0	76.1	42386	
	2006	418.5	612.1	76.0	46505	
	2009	470.0	645.4	75.8	48908	
	2012	480.0	694.0	76.9	53350	
Poultry	2000	4230.0	7000.0	1.5	10481	21820
	2003	4450.0	7830.0	1.5	11545	23331
	2006	4840.0	9310.0	1.5	13631	24240
	2009	5330.0	10610.0	1.6	17340	27425
	2012	5700.0	11900.0	1.5	18230	28610

Source: Statistical Yearbook , NBSC (combined with Livestock Yearbook, MoA)

Table 2.3   **Grain consumption (at home) by households, 2000-2012, official statistics**

Commodity	Year	Rural		Urban		Total population	
		kg/cap	1000 ton	kg/cap	1000 ton	kg/cap	1000 ton
Rice (milled)	2000	88.8	71762	50.5	23183	74.9	94945
	2003	83.5	64184	44.5	23307	67.7	87491
	2006	78.4	57322	42.3	24627	62.3	81948
	2009	74.0	50993	42.0	27095	58.5	78088
	2012	67.3	43247	40.7	28946	53.3	72193
Wheat	2000	80.3	64888	37.0	16971	64.6	81859
	2003	73.2	56278	35.0	18332	57.7	74610
	2006	66.1	48366	34.0	19818	51.9	68184
	2009	59.6	41059	37.2	24022	48.8	65082
	2012	53.9	34616	35.9	25553	44.4	60168
Maize	2000	16.5	13338	2.3	1033	11.3	14371
	2003	15.5	11912	2.1	1074	10.0	12986
	2006	14.6	10681	2.1	1224	9.1	11905
	2009	12.0	8273	2.1	1322	7.2	9595
	2012	12.0	7707	2.2	1593	6.9	9299
Minor cereals	2000	12.3	9927	2.9	1308	8.9	11235
	2003	10.5	8069	2.5	1309	7.3	9379
	2006	9.0	6584	2.0	1166	5.9	7750
	2009	7.0	4826	2.0	1290	4.6	6116
	2012	6.4	4121	2.0	1424	4.1	5545
Soybean	2000	2.5	2045	2.8	1285	2.6	3331
	2003	2.1	1575	3.1	1599	2.5	3173
	2006	2.1	1529	3.4	1953	2.6	3482
	2009	1.7	1165	3.4	2161	2.5	3326
	2012	1.4	899	3.4	2385	2.4	3284

Source: Statistical Yearbook and Rural resp. Urban Household Survey Yearbook, NBSC
(underlying rural-urban population numbers reflect actual place of residence)

Table 2.4 **Meat/egg/milk consumption (at home) by households, 2000-2012, official statistics**

Commodity	Year	Rural		Urban		Total population	
		kg/cap	1000 ton	kg/cap	1000 ton	kg/cap	1000 ton
Beef	2000	0.52	420	2.31	1060	1.17	1481
	2003	0.50	384	1.98	1037	1.10	1421
	2006	0.67	490	2.34	1364	1.41	1854
	2009	0.59	407	2.38	1535	1.46	1942
	2012	1.02	655	2.49	1774	1.79	2429
Mutton	2000	0.61	493	1.35	620	0.88	1113
	2003	0.76	584	1.33	697	0.99	1281
	2006	0.90	658	1.44	839	1.14	1498
	2009	0.81	558	1.32	852	1.06	1410
	2012	1.02	655	1.21	861	1.12	1516
Pork	2000	13.28	10375	16.73	7680	14.53	18415
	2003	13.78	10590	20.43	10700	16.47	21290
	2006	15.46	11311	20.00	11658	17.47	22968
	2009	13.96	9624	20.50	13225	17.12	22849
	2012	14.22	9132	21.20	15091	17.89	24223
Poultry meat	2000	2.81	2272	7.38	3388	4.46	5659
	2003	3.24	2490	9.21	4824	5.66	7314
	2006	3.51	2568	8.34	4861	5.65	7429
	2009	4.25	2930	10.47	6754	7.26	9684
	2012	4.70	3018	10.75	7652	7.88	10670
Eggs	2000	4.77	3856	11.21	5146	7.10	9002
	2003	4.81	3697	11.19	5861	7.40	9557
	2006	5.00	3658	10.41	6068	7.40	9726
	2009	5.32	3668	10.57	6819	7.86	10486
	2012	5.90	3789	10.50	7474	8.32	11263
Milk (fresh eq.)	2000	2.53	2047	11.00	5050	5.60	7097
	2003	3.10	2384	22.00	11523	10.76	13907
	2006	4.32	3159	30.25	17632	15.82	20791
	2009	5.20	3585	34.00	21934	19.12	25519
	2012	5.79	3719	36.43	25933	21.90	29652

Source: Statistical Yearbook and Rural resp. Urban Household Survey Yearbook, NBSC
(underlying rural-urban population numbers reflect actual place of residence)

Table 2.5   **Use of refined feed by livestock system, 2000-2012, official statistics**

System	2000	2003	2006	2009	2012
Refined feed in kg per head raised for slaughtering					
Scattered cattle	180	229	237	350	360
Scattered sheep	22	24	29	44	48
Scattered pigs	165	177	181	202	205
Small-scale pig farm	186	187	190	201	208
Middle-scale pig farm	185	186	185	201	205
Large-scale pig farm	178	178	183	191	200
Small-scale broiler farm	4.5	4.5	4.0	4.3	4.5
Middle-scale broiler farm	4.0	4.0	3.8	4.1	4.3
Large-scale broiler farm	3.2	3.2	3.2	3.6	4.0
Refined feed in kg per head per year					
Scattered milk cows	2000	2000	1897	1999	1850
Small-scale dairy farm	1750	1770	2000	1849	1800
Middle-scale dairy farm	2050	2060	2038	1866	1965
Large-scale dairy farm	2130	2160	2214	2284	2210
Scattered chicken (layers)	26.0	26.5	27.0	27.2	28.0
Small-scale layer farm	28.5	28.8	29.2	27.9	29.7
Medium-scale layer farm	27.9	27.9	27.8	27.7	29.0
Large-scale layer farm	27.5	27.6	27.8	27.2	28.3

Source: Annual agricultural production costs and returns compilation, NDRC

Table 2.6   **Net imports of grains and livestock products, 2000-2012, official statistics**

Net imports in 1000 ton	2000	2003	2006	2009	2012
Grains					
Rice (milled)	-2713	-2359	-523	-429	2090
Wheat (grain equivalent)	613	-2079	-896	896	3701
Maize	-10485	-16390	-3035	-45	4951
Minor cereals	1709	1718	1901	1409	1282
Soybean	10208	20474	27891	42205	60390
Livestock products					
Beef	41	31	-46	7	37
Mutton	13	32	3	57	119
Pork	-30	-136	-290	-119	456
Poultry meat	481	189	-120	669	-131
Eggs	-46	-81	-63	-79	-61
Milk (fresh equivalent)	1404	2190	2295	4232	6880

Source: Statistical Yearbook, NBSC and Agricultural Yearbook, MoA

Table 3.1   Refined feed comparison 2005

Composition by source in million ton		Use by type of animals in million ton	
Paddy	18	Cattle/buffalo (excl. milk cows)	17
Wheat	8	Milk cows	15
Maize	109	Other large animals	3
Other cereals	4	Sheep/goat	5
Tubers (in grain equiv.)	29	Pigs	128
Soybean cake	35	Poultry	83
Other oilseed cake	19		
Rice bran	20		
Wheat bran	10		
Molasses	4		
Fishmeal	3		
Sum	*259*	*Sum*	*251*
Source: baseyear data set Chinagro model (Fischer et al, 2007)		**Source: calculations current paper**	

Table 3.2   Upward adjustment factors of NBSC household survey consumption data, 2000-2012

Commodity		2000	2003	2006	2009	2012
Rice	Rural	1.15	1.19	1.23	1.26	1.30
	Urban	1.20	1.23	1.25	1.28	1.30
Wheat	Rural	1.09	1.10	1.12	1.13	1.15
	Urban	1.12	1.14	1.16	1.18	1.20
Maize	Rural	1.00	1.04	1.08	1.11	1.15
	Urban	1.15	1.16	1.18	1.19	1.20
Other cereals	Rural	1.04	1.05	1.05	1.06	1.15
	Urban	1.06	1.07	1.08	1.09	1.20
Soybean	Rural	1.05	1.06	1.08	1.09	1.06
	Urban	1.10	1.11	1.13	1.14	1.10
Beef	Rural	1.75	1.79	1.83	1.86	1.90
	Urban	1.85	1.89	1.93	1.96	2.00
Mutton	Rural	1.75	1.79	1.83	1.86	1.90
	Urban	1.85	1.89	1.93	1.96	2.00
Pork	Rural	1.25	1.28	1.30	1.33	1.35
	Urban	1.50	1.53	1.55	1.58	1.60
Poultry meat	Rural	1.25	1.28	1.30	1.33	1.35
	Urban	1.50	1.53	1.55	1.58	1.60
Eggs	Rural	1.25	1.28	1.30	1.33	1.35
	Urban	1.35	1.39	1.43	1.46	1.50
Milk	Rural	1.25	1.28	1.30	1.33	1.35
	Urban	1.35	1.39	1.43	1.46	1.50

Table 4.1 Demand for refined feed by source, 2000-2012

Refined feed in million ton	2000	2003	2006	2009	2012
Paddy	18.9	17.3	18.7	20.8	21.2
Wheat	8.2	7.7	9.1	10.1	10.9
Maize	83.6	97.6	122.3	137.8	159.2
Other cereals	4.5	4.6	3.7	3.3	3.7
Tubers (in grain equiv.)	31.0	31.6	23.3	26.7	28.7
Soybean cake	21.2	31.7	36.4	50.3	58.4
Other oilseed cake	17.6	18.4	18.8	21.2	22.2
Rice bran	21.0	19.2	20.8	23.1	23.6
Wheat bran	10.3	9.6	11.4	12.6	12.9
Molasses	3.3	4.4	4.6	5.6	5.6
Fishmeal	2.5	3.0	3.2	3.7	4.1
Sum	*222.1*	*245.2*	*272.3*	*315.3*	*350.6*

Source: calculations current paper

Table 4.2   Supply-demand balances for grains, 2000-2012, in 1000 ton

Other use is calculated residually: seed + industrial use (not for food/feed) + losses between farm and household + net stock increase

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Rice													
Production	131535	124306	122177	112459	125361	126412	127203	130224	134327	136572	137033	140701	142965
Net imports	-2713	-1577	-1753	-2359	-143	-164	-523	-870	-640	-429	-232	80	2090
Total available	128822	122729	120424	110100	125218	126248	126680	129354	133687	136143	136801	140781	145055
Food	110346	108266	106521	104770	104115	101733	101002	99654	103948	98925	97403	94747	93851
Feed	13223	12427	12127	12099	12850	12600	13095	13510	13836	14582	14386	14648	14857
Other use	5254	2036	1776	-6769	8253	11915	12582	16189	15902	22636	25011	31385	36347
Total use	128822	122729	120424	110100	125218	126248	126680	129354	133687	136143	136801	140781	145055
Wheat													
Production	99636	93873	90290	86488	91952	97445	108466	109298	112464	115115	115181	117401	120580
Net imports	613	-77	-345	-2079	6171	2939	-896	-2971	-83	896	953	932	3701
Total available	100249	93796	89945	84409	98123	100384	107570	106327	112381	116011	116134	118333	124281
Food	89736	86119	84689	83022	82223	78830	77049	75736	77943	74809	73667	71428	70315
Feed	8234	7729	7382	7682	7747	8000	9138	9327	9531	10116	10149	10474	10852
Other use	2279	-52	-2126	-6295	8153	13554	21383	21263	24907	31086	32318	36431	43114
Total use	100249	93796	89945	84409	98123	100384	107570	106327	112381	116011	116134	118333	124281
Maize													
Production	106000	114088	121308	115830	130287	139365	151603	152300	165914	163974	177245	192781	208190
Net imports	-10485	-5959	-11667	-16390	-2320	-8640	-3035	-4885	-220	-45	1440	1614	4951
Total available	95515	108129	109641	99440	127967	130725	148568	147415	165694	163929	178685	194395	213141
Food	14526	14333	14111	13607	13254	13066	12922	12424	11852	10776	10898	10865	10777
Feed	83591	89950	94091	97611	104428	109000	122258	124817	134371	137824	144041	148410	159234
Other use	-2602	3845	1439	-11779	10285	8660	13388	10175	19471	15328	23746	35120	43130
Total use	95515	108129	109641	99440	127967	130725	148568	147415	165694	163929	178685	194395	213141

Table 4.2 (continued) Supply-demand balances for grains, 2000-2012, in 1000 ton

Other use is calculated residually: seed + industrial use (not for food/feed) + losses between farm and household + net stock increase

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Minor cereals													
Production	11680	10941	11851	11313	10246	10361	9205	8691	8200	7371	8184	8211	8300
Net imports	1709	2080	1727	1718	1312	1941	1901	457	673	1409	2194	1192	1282
Total available	13389	13021	13578	13031	11558	12302	11106	9148	8873	8780	10378	9402	9582
Food	11725	11553	10673	9845	9788	9036	8182	7337	6925	6505	6294	6112	5941
Feed	4480	4227	4445	4618	4079	4000	3746	3581	3439	3258	3468	3729	3715
Other use	-2816	-2759	-1541	-1431	-2310	-734	-822	-1770	-1491	-982	617	-438	-73
Total use	13389	13021	13578	13031	11558	12302	11106	9148	8873	8780	10378	9402	9582
Soybean													
Production	15409	15406	16505	15393	17400	16348	15074	12725	15542	14982	15083	14485	13600
Net imports	10208	13691	11038	20474	19895	26194	27891	30361	36971	42205	54634	52245	60390
Total available	25617	29097	27543	35867	37295	42542	42965	43086	52513	57187	69717	66730	73990
Food	3561	3576	3213	3451	3421	3508	3840	3636	3704	3725	3742	3645	3731
Feed (to cake)	25842	29209	27528	38684	38694	42683	44361	44878	54387	61288	65429	69291	71262
Other use	-3786	-3688	-3198	-6268	-4821	-3649	-5236	-5428	-5577	-7827	546	-6206	-1003
Total use	25617	29097	27543	35867	37295	42542	42965	43086	52513	57187	69717	66730	73990

Table 4.3   Supply-demand balances for livestock products, 2000-2012, in 1000 ton

Other use is calculated residually: losses between farm and household + net stock increase

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Beef													
Production	5131	5086	5219	5425	5604	5681	5767	6134	6132	6355	6531	6475	6620
Net imports	41	25	17	31	0	-20	-46	-48	-18	7	2	-2	37
Total available	5172	5111	5236	5456	5604	5661	5721	6086	6113	6363	6532	6473	6657
Food	2699	2545	2531	2646	2997	3339	3521	3937	3445	3771	4137	4867	4792
Other use	2473	2566	2705	2810	2607	2322	2199	2149	2669	2591	2395	1606	1865
Total use	5172	5111	5236	5456	5604	5661	5721	6086	6113	6363	6532	6473	6657
Mutton													
Production	2641	2718	2835	3087	3329	3501	3638	3826	3803	3894	3989	3931	4010
Net imports	13	23	34	32	28	11	3	25	41	57	43	2	119
Total available	2655	2742	2869	3119	3358	3512	3642	3851	3844	3951	4032	3933	4129
Food	2011	1961	1920	2360	2552	2639	2818	2665	2436	2712	2666	2911	2967
Other use	644	780	948	759	806	873	824	1186	1409	1240	1366	1022	1162
Total use	2655	2742	2869	3119	3358	3512	3642	3851	3844	3951	4032	3933	4129
Pork													
Production	39660	40517	41231	42386	43410	45553	46505	42878	46205	48908	50712	50531	53350
Net imports	-30	-118	-160	-136	-273	-295	-290	119	135	-119	91	387	456
Total available	39630	40399	41071	42250	43137	45259	46214	42997	46340	48788	50804	50918	53806
Food	24939	26052	29022	29820	29050	32499	32773	29712	30555	33581	34873	35385	36474
Other use	14691	14347	12049	12430	14087	12760	13441	13285	15785	15208	15931	15533	17332
Total use	39630	40399	41071	42250	43137	45259	46214	42997	46340	48788	50804	50918	53806

Table 4.3 (continued)   Supply-demand balances for livestock products, 2000-2012, in 1000 ton

Other use is calculated residually: losses between farm and household + net stock increase

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Poultry meat													
Production	10481	10650	10997	11545	11891	12451	13631	14476	16647	17340	16561	17088	18230
Net imports	481	308	55	189	-130	-295	-120	-75	89	669	107	-63	-131
Total available	10962	10958	11052	11734	11761	12156	13511	14401	16736	18009	16668	17025	18099
Food	7921	8173	9898	10531	9849	11304	10873	12738	11863	14520	14562	15643	16318
Other use	3041	2786	1155	1203	1912	852	2638	1663	4874	3489	2106	1382	1780
Total use	10962	10958	11052	11734	11761	12156	13511	14401	16736	18009	16668	17025	18099
Eggs													
Production	21820	22101	22657	23331	23706	24381	24240	25290	27022	27425	27627	28114	28610
Net imports	-46	-37	-62	-81	-77	-78	-63	-67	-87	-79	-78	-78	-61
Total available	21774	22064	22595	23250	23629	24303	24177	25223	26935	27345	27549	28036	28549
Food	11767	11543	11909	12845	12325	12794	13402	13419	14751	14832	14459	15152	16326
Other use	10007	10521	10686	10405	11304	11509	10775	11804	12184	12513	13090	12885	12223
Total use	21774	22064	22595	23250	23629	24303	24177	25223	26935	27345	27549	28036	28549
Milk (fresh eq)													
Production	9191	11229	14004	18486	23684	28648	33025	36334	37815	36777	37480	38107	38680
Net imports	1404	1354	1801	2190	2385	2114	2295	1500	1925	4232	5355	6322	6880
Total available	10595	12583	15805	20676	26069	30762	35320	37834	39739	41009	42835	44428	45560
Food	9376	11176	13203	19027	22314	25515	29233	33080	32221	36828	39530	42065	43919
Other use	1219	1407	2602	1649	3755	5248	6087	4754	7518	4180	3305	2363	1641
Total use	10595	12583	15805	20676	26069	30762	35320	37834	39739	41009	42835	44428	45560