ODI Shockwatch: Managing Risk and Building Resilience in an Uncertain World

Working Paper

China: are changes afoot for cereals?

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Abbreviations

FAO	Food and Agriculture Organisation
FSI	Food, Seeds, and Industrial
GDP	Gross Domestic Product
GIEWS	Global Information and Early Warning System
Draft	High Income Country
IFPRI	International Food Policy Research Institute
kg	kilogram
k	thousand
LCU	Local Currency Unit
M	million
NBSC	National Bureau of Statistics China
OECD	Organisation for Economic Co-operation and Development
PIN	Production Index
PPP	Purchasing Power Parity
RMB	Renminbi, people's currency, also known as the yuan
t	tonne, metric ton
USDA	United States Department of Agriculture
WASDE	World Agricultural Supply & Demand Estimates (USDA)
WDI	World Development Indicators, World Bank data base

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SUMMARY

Since the economic reforms that began in 1978, China has seen rapid economic growth, backed up by similarly remarkable growth of farm output. This has coincided with exceptional progress in reducing poverty and malnutrition. China's policy-makers have long been concerned that the supply of staple foods be sufficient to meet domestic needs and that there be enough kept in reserve to cover for any unforeseen harvest failures. China has been reluctant to import cereals off the world market, since the risks of not being able to procure or having to pay a very high price are too great.

For some time, those analysing world cereals markets have been able to remove China from their considerations. China has not been expected to enter the market either for imported grain or to offload its large stocks on the world market. Within China, it has been expected that domestic prices would not necessarily vary closely with world prices. Indeed, during the world price spike of 2007/08, rice prices rose by no more than 10% in China, effectively insulated from the tripling of the rice price that took place on international markets in early 2008.

But in 2011, two things seemed to contradict this understanding of China's grain policies:

- Prices of some types of rice have risen by 30% since mid-2010; and,
- China plans to import 2M tonnes of maize from the world market during the July 2011 to June 2012 marketing year, mainly feedgrain for livestock. Some believe that this could rise to 5M tonnes.

Do these observations mean that China can no longer be discounted as a player on world cereal markets? If China does become a significant importer of grains, this will tend to raise world prices. Has the government ceased to try and hold down rice prices at almost any cost? Or are they isolated events, the product of unusual circumstances that do not indicate changes to the patterns seen before?

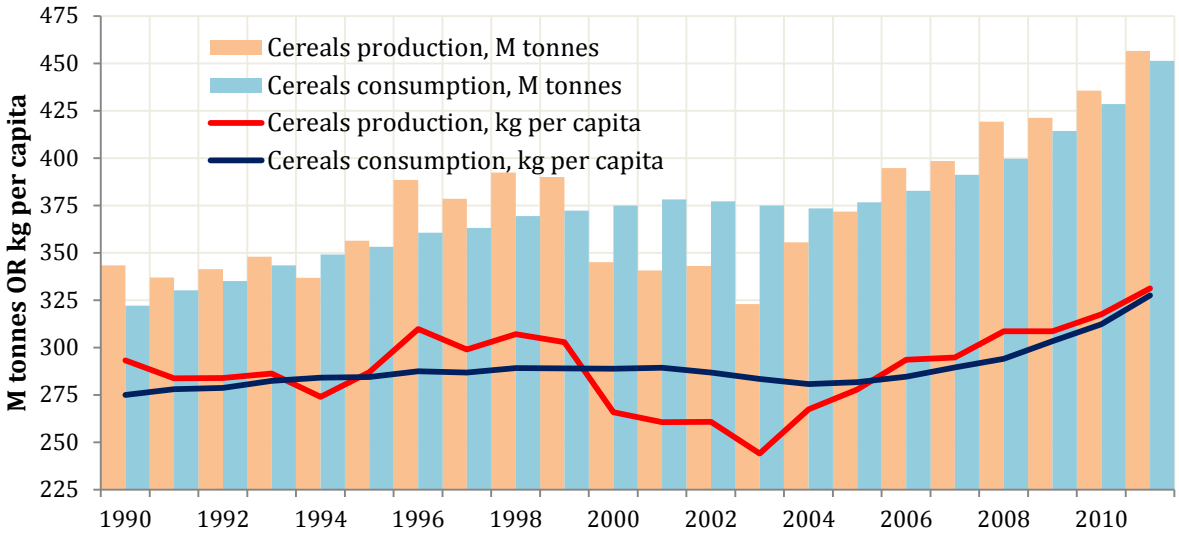
This review looks at these questions, set out in more detail as follows:

1. What has been the evolution of grain, especially feedgrain, production, consumption, trade and stocks since 1990? Are there signs that domestic demand may be outstripping the capacity of Chinese agriculture, and what may be the future patterns of grain production and use in China?
2. What prices are paid to farmers, what do consumers pay for rice and other grain staples? What are the typical costs of production for maize, rice and wheat in China and how do they compare to an import parity price?
3. What has been policy, both officially declared and implicit, for grains production, trade, stocks and prices since 1990? What changes have been announced or seem to have been implemented since 2000 and particularly since 2007?

Six things are clear from this review.

One, ***production of cereals — very largely maize, rice and wheat —in China has been growing sufficiently in the last twenty years to match increases in demand for human consumption***, see Figure A, in part since the latter demand is growing slowly. Growth was strong enough in the 1990s to allow very large public stocks to be built up.

Figure A Cereal production and consumption in China from 1990/91 to 2011/12



Source: Constructed with data from USDA FAS and FAOSTAT for population estimates.

Note: Rice is expressed on a milled basis.

Two, ***demand for feedgrain, on the other hand, has grown rapidly, since meat consumption is rising.*** Most of the additional meat has come from animals fed with grains, given the limited amount of good grazing available. Animal feed requirements have led to large imports of soybeans for their protein, while energy comes mainly from maize. From 1990 to 2007, feed use of cereals increased by 48M tonnes, while food use decreased by 3M tonnes. Growing demand for feedgrain has recently started to outstrip domestic production. China may well see increased feedgrain imports from this year into the future since most projections forecast meat consumption rising from their current levels of around 50 kg a head a year, to 70 or even 90 kg a head as and when incomes rise to levels seen in neighbouring Korea and Japan.

Three, ***demand for industrial use of some cereals, above all maize, is also growing quickly***.

Four, given rising demand for cereals for feed and industrial processing, ***cereals imports are rising***. As recently as 2006, China was a net exporter of over 5Mt of maize, but in 2011 it was a net importer of about 4Mt. This swing of 9Mt in 5 years is about 10% of the 91Mt of maize that was traded on world markets in 2010/2011 (USDA).

Five, ***consumer prices for rice and other cereals have risen surprisingly since early 2010***. Part of this reflects growing demand for feedgrain, but more important has been a large increase in costs of

domestic production, owing to rises in prices of inputs such as fertiliser and labour. Costs of production rose in current US dollars by 50–70% from 2005 to 2010.

Despite this sharp rise in costs, China remains a relatively low cost producer of rice: domestic costs remain well below import parity prices.

Six, although policy for cereals production was liberalised from 1978 onwards, ***the state intervenes actively when it seems that production is faltering or that public stocks may be drawn down too far.*** In the 2000s, the state has fostered production by investment in rural investment, research, extension, and by offering farmers attractive prices. Government is also trying to boost farm incomes, partly through direct payments, to reduce the gaps between urban and rural markets. It seems that social protection may be used as a way to cushion the impacts of rising domestic prices for staples on poor and vulnerable consumers.

Can China no longer be discounted as a player on world cereal markets?

For rice, it seems likely that China will continue to rely predominantly on local production, remaining a small net exporter. Demand for rice is growing slowly and stocks are high.

For maize and wheat, the story is different, since these can be used as feedgrain. Given the rapid growth in demand for meat, it seems likely the country will turn increasingly to international markets for feedgrains — mostly maize. USDA's projections from November 2011 estimate China's net maize imports in 2015 at 7.3M tonnes, or 7% of world trade: up from 1.3M tonnes of net imports (1.4% of world trade) predicted for 2015 in their 2008 projections.

In wheat, China may go from being a small net exporter to a small net importer, though much depends on relative prices of maize and wheat for feed. As the price premium on wheat compared to maize has withered in recent years, China's feedlots have been using more wheat, even if marginally so:11% of China's feedgrain in 2011 was wheat, compared to 89% maize; up from 3% wheat compared to 97% maize in 2005 (USDA). While China was a major wheat importer in the 1980s and 1990s, it achieved near self-sufficiency in the latest decade. With falling wheat consumption per capita, it is expected that China will not return to heavy imports of wheat from international markets, except when feed wheat is much cheaper than feed maize, and substitutes for it.

The great uncertainty here is how fast demand for animal products and thereby for feedgrains will grow. This in turn rests on two sets of assumptions, one being the current level of meat consumption, the other being the level at which individual demand for meat will level off. The former is contested, with some observers adamant that official statistics overstate consumption. The latter depends partly on consumer preferences, but may well be influenced by public policy: it is hard to imagine the leadership will do nothing to deter the adoption of Western diets widely considered to be less healthy than many Asian diets; especially when to do so would increase China's dependence on imported grains.

In sum, for the near and foreseeable future China is likely to become a significant importer of maize, with perhaps 5–10M tonnes a year through to 2015, and probably more after that, putting further

pressure on supplies of a grain that is already in high demand from the ethanol distilleries of the Midwest.

Has the government ceased to try and hold down rice prices at almost any cost?

As costs of production rise, owing largely to pricier inputs and rising wages, prices for consumers are being permitted to rise more than in the past. Some of the price rises may also be driven by people switching from low to high quality rice. That said, China is expected to import 1M tonnes of rice in 2012, 0.5M tonnes or more than in 2011, seemingly taking advantage of cheaper rice being available from Vietnam.

On average as people become wealthier, they demand less cereal for direct consumption. Given their rapidly rising incomes, this may not be a great concern for the urban middle class. Large numbers of poor people however continue to rely heavily on staple cereals. It is not clear how far prices may be allowed to rise beyond current levels. General inflation has been pushing up prices of more than just cereals, and surveys of urban residents show dissatisfaction with rises in food prices and the government's handling of the situation.

It appears that the government may be seeking to protect poor consumers more through safety nets than by holding down staple food prices. The sharp upward adjustment of the rural poverty line in 2011 to allow more people to qualify for state assistance suggests as much. It is to be hoped that these measures will be enough to prevent the social harm that has accompanied faltering cereal production and rising prices in the past.

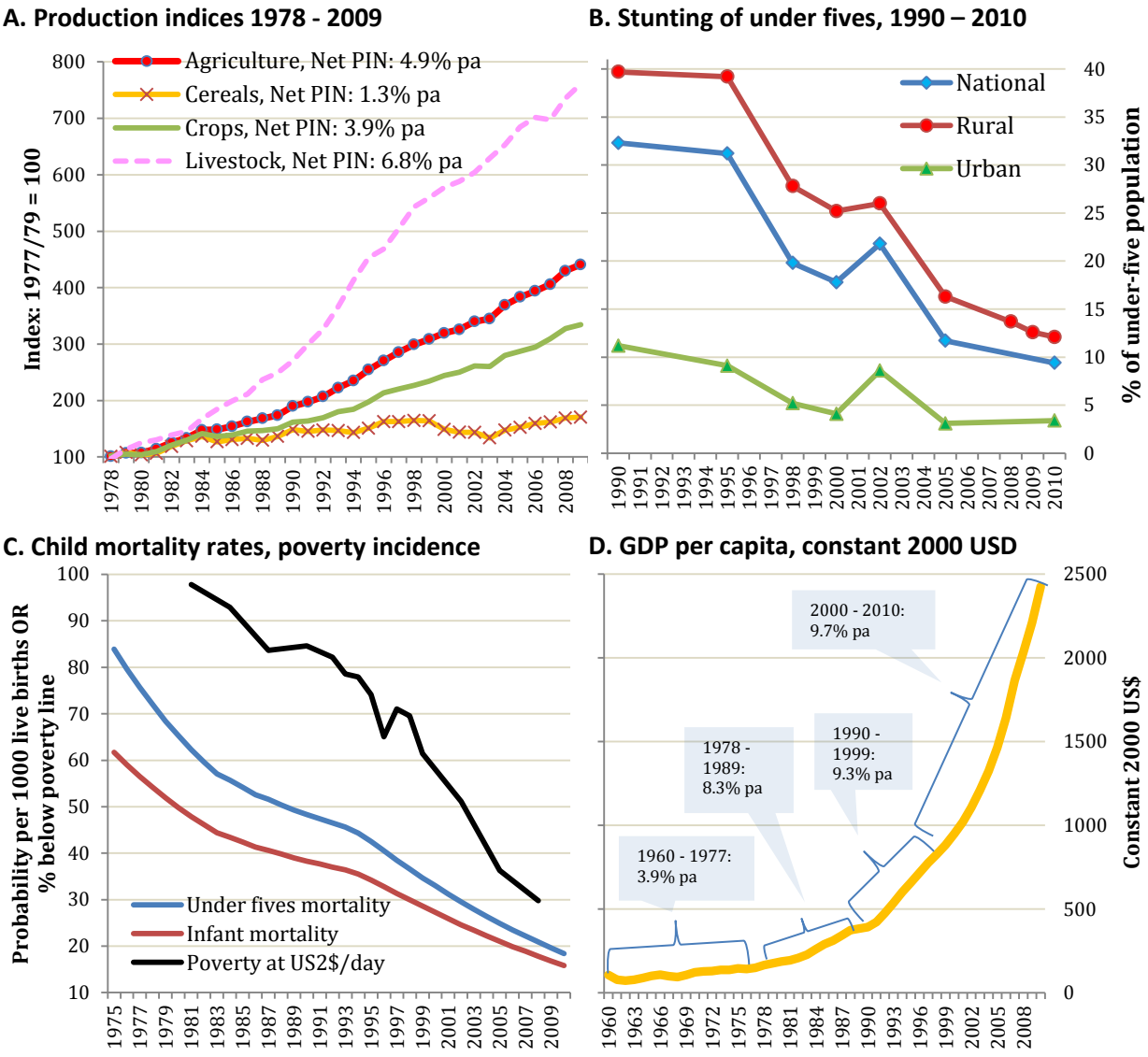
1. Introduction

1.1 Background

The remarkable economic growth of China in the last 30 years

Since the reforms that began in 1978, China has seen rapid economic growth, backed up by similarly remarkable growth of farm output. This has coincided with exceptional progress in reducing poverty and malnutrition, see indicators in Figure 1.1.

Figure 1.1 Indicators of progress in China



Sources: From FAOSTAT data for A; WHO data for B; WDI data for C, D. **Note**: GDP per capita growth rates are shown in blue boxes.

Rural stunting came down from almost 40% of children under five to just over 12% in 2010[1]. National levels were in 2010 below 10%, down from more than 30% in 1990.

China's GDP per capita in PPP terms increased dramatically from 1978 at the beginning of the reform period, when its per capita GDP was 22% of the world average, to 67% of the world average in 2010 (Maddison, 2007). In 2010 this was 24% of the EU's, 23% of Japan's, 26% of South Korea's, and 16% of the US levels (WDI data).

Staple foods

China's policy-makers have long been concerned that the supply of staple foods is sufficient to meet domestic needs; and that there be enough kept in reserve to make for any unforeseen harvest failures. China has been reluctant to import cereals off the world market, presumably since the risks of not being able to procure or having to pay a very high price are too great.[2]

Before 1978 cereals production was planned in a command economy: the rural communes and their production teams were given quotas for delivery to state agencies. After reforms that began in that year, production decisions have increasingly been left to individual farm households, who plant crops according to their needs and the returns available both from prices offered by state agencies and from the market. Liberalisation has been supported by public investments in roads, research, extension, to help farmers raise their productivity and earnings.

By the late 1990s these measures had been sufficiently successful that the country was both holding very large grain stocks — at around 70% of annual consumption — as well as exporting maize in some years. These stocks are believed to be primarily reserves against bad harvests, but stocks may be released to stabilise prices when short supply threatens to raise them.

For some time, those analysing world cereals markets have been able to remove China from their considerations. China has not been expected to enter the market either for imported grain or to offload its large stocks on the world market. Within China, it has been expected that domestic prices would not necessarily vary closely with world prices. Indeed, during the world price spike of 2007/08, rice prices rose by no more than 10% in China, effectively insulated from the tripling of the rice price that took place on international markets in early 2008.

But in 2011, two things seemed to contradict this understanding of China's grain policies:

- Prices of some types of rice have risen by 30% since mid-2010; ; and,

[1] These rates were likely helped by a) growing urbanisation (urban children tend to be better off and are less likely to be stunted) and b) China having gone through the demographic transition meaning absolute numbers of children under five fell by about a third from 1990 to 2010. The achievements remain impressive.

[2] Policy-makers have been less concerned about self-sufficiency in complementary and higher value foods. As China urbanises and incomes rise, diets have changed: from rice or noodles accompanied by vegetables and occasionally some fish, chicken or pork, to diets where rice is being replaced by more frequent consumption of meat, fish, eggs with increased use of cooking oil. Consequently, China has increasingly bought in soybeans, palm and other vegetable oils off the world market. Soybeans have also partly been imported to feed the increasingly large Chinese pig herds that underpin strong growth in meat consumption.

- China plans to import 2M tonnes of maize from the world market during the July 2011 to June 2012 marketing year, mainly feedgrain for livestock. Some believe that this could rise to 5M tonnes. This would constitute a major intervention into the world market for a grain that is already under pressure from demand for maize for ethanol distillation in the United States.

1.2 Questions raised

Do these observations mean that China can no longer be discounted as a player on world cereal markets? Has the government ceased to try and hold down rice prices at almost any cost? Or are they isolated events, the product of unusual circumstances that do not indicate changes to the patterns seen before?

To help answer these questions, three sets of questions arise:

1. What has been the evolution of grain, especially feedgrain, production, consumption, trade and stocks since 1990? Are there signs that domestic demand may be outstripping the capacity of Chinese agriculture, and what may be the future patterns of grain production and use in China?
2. What prices are paid to farmers, what do consumers pay for rice and other grain staples? What are the typical costs of production for maize, rice and wheat in China and how do they compare to an import parity price?
3. What has been policy, both officially declared and implicit, for grains production, trade, stocks and prices since 1990? What changes have been announced or seem to have been implemented since 2000 and particularly since 2007?

The following sections look at each of these questions in turn. A discussion then follows that interprets findings in terms of broader implications of China's shifting role in global cereal markets.

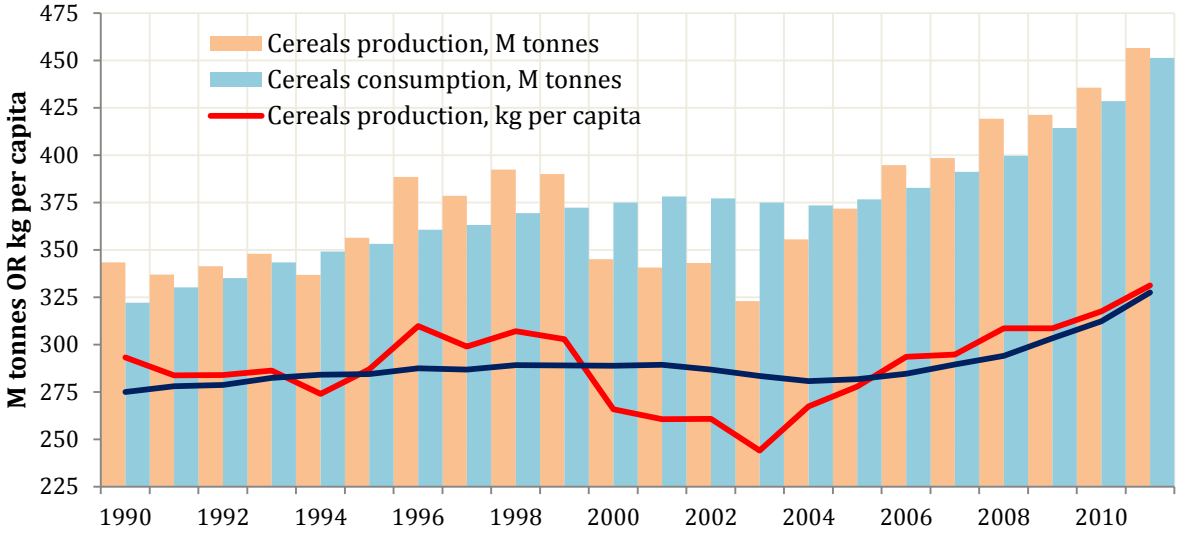
2. Evolution of cereals markets – production, consumption, trade & stocks

2.1 Cereals production

Cereal production and consumption in absolute and per capita terms from 1990/91 to 2011/12 are shown in Figure 2.1. Production of cereals has grown over 100M tonnes from 1990/91 to 2011/12, following a slight downturn in the early 2000s[3]. Per capita, cereals production rose by about 40kg a head over the same period.

[3] As grain stocks reached historical highs and prices fell in the late 1990s, farmers started to shift land under cereals to cash crops. This was also supported by government crop structure adjustment policy (jieguotiaozheng) to increase farmers' income and reduce the burden of huge grain stocks in the future. Despite the fall in grain production in between 1999 and 2003, consumption did not decrease because of a large (and planned) draw-down of stock to what was considered a more appropriate level.

Figure 2.1 Cereal production and consumption in China from 1990/91 to 2011/12 projection



Source: Constructed with data from USDA FAS and FAOSTAT for population estimates.
Note: Rice is expressed on a milled basis. See equivalent figures for maize, rice, and wheat individually in Annex figures A.1 – A.5

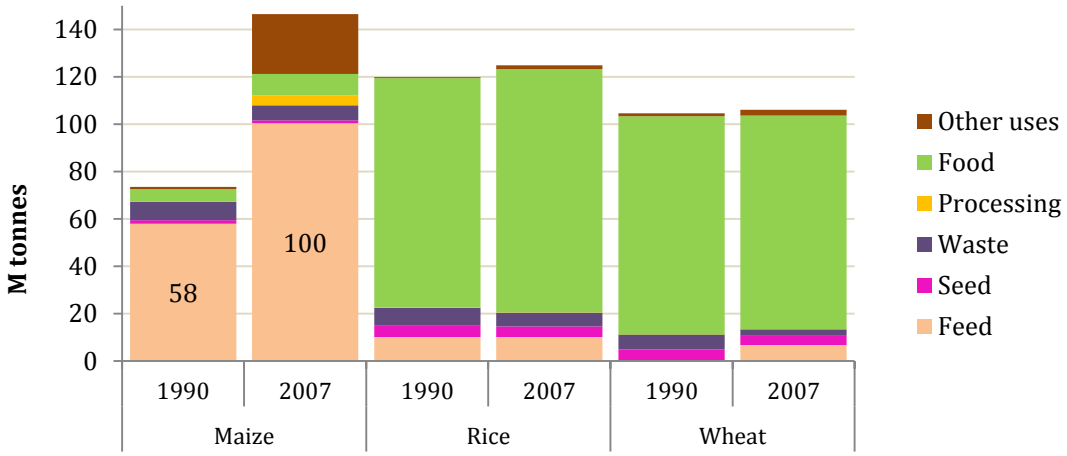
2.2 Cereals consumption

Breakdown by cereal and type of use

Cereals consumption grew at a rate of 1.5% a year from 1990 to 2000. After a period of apparent stagnation, corresponding with lower production over the first half of the 2000s, consumption grew from 2005 to 2011 at a rate of 2.9% a year.

Most of the increase in cereals consumption since 1990 comes from maize used for feed and other uses — most likely to be industrial: this grew by almost 50M tonnes from 1990 to 2007, while food use actually fell by about 3M tonnes. Figure 2.2 shows how maize, rice, and wheat were used in 1990 and 2007, while Figure 2.3 shows the change in each type of use over this period.

Figure 2.2 Maize, rice and wheat uses in China in 1990 & 2007

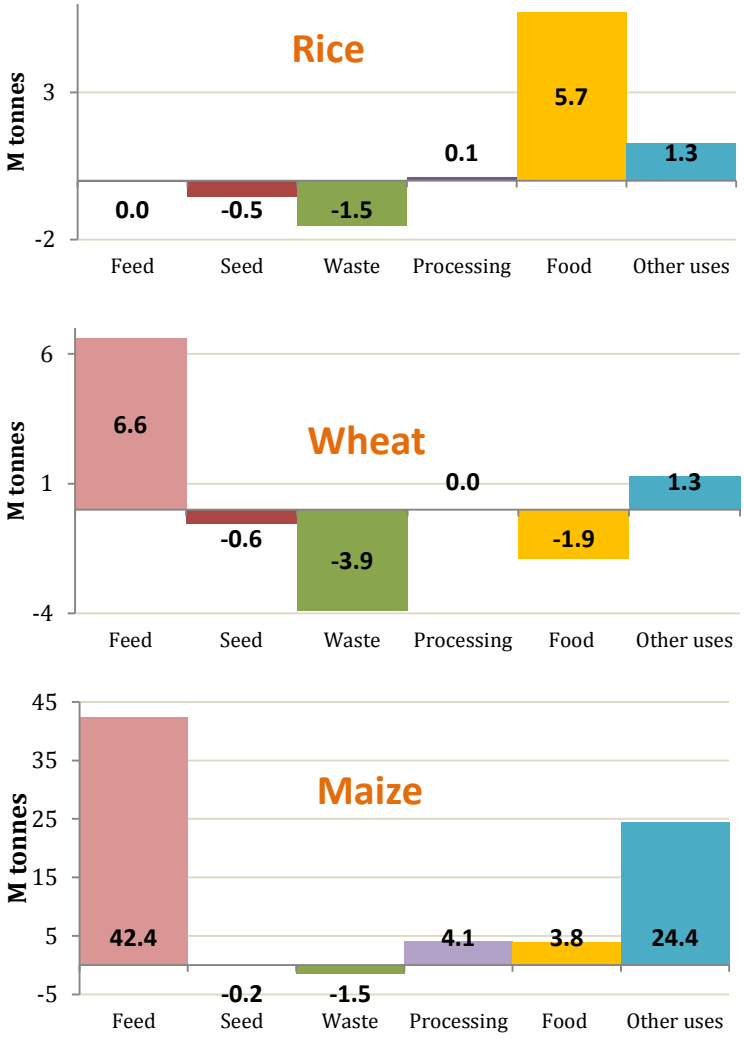


Source: From FAOSTAT data. **Notes**: Rice is expressed in milled equivalent. **Other uses** are 'quantities of commodities used for non-food purposes, e.g. oil for soap. In order not to distort the picture of the national food pattern quantities of the commodity in question consumed mainly by tourists are included here... In addition, this variable covers pet food.' (FAO)

For rice, the most notable change in use from 1990 to 2007 is the small increase in food consumption. For wheat, feed use represents the largest increase, though the change is relatively small.

Maize use from 1990 to 2007 increased dramatically for feed, followed by 'other uses', which includes industrially processed maize not destined for food.

Figure 2.3 Change in China's rice, wheat, and maize use from 1990 to 2007

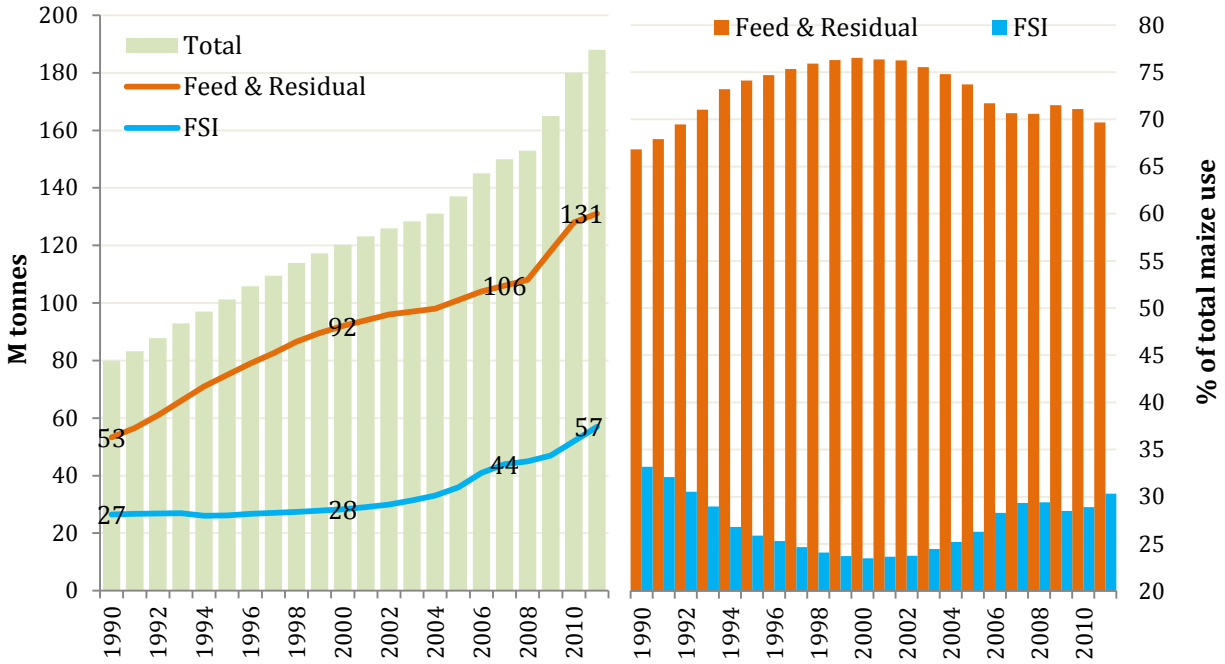


Source: Constructed from FAOSTAT data

Maize use statistics are not available beyond 2007 from FAO, but USDA does have estimates for 2007 to 2011, see Figure 2.4. They show large increases in maize use from 2007 to 2011.

USDA disaggregates use into 'feed and residual', and 'food, seeds, industrial' (FSI). The former is comparable to FAO data for feed and waste, while FSI compares to an aggregate of food, seeds, processing, and other uses, as recorded by FAO. USDA statistics estimate slightly more growth in feed and residual use from 1990 to 2007 than FAOSTAT because they began with lower estimates in 1990.[4] Subsequently there have been further increases in feed and residual use of maize, from 106Mt in 2007 to 131Mt in 2011.

Figure 2.4 Maize use in China, 1990/91 – 2011, absolute levels and proportions



Source: From USDA FAS data

While FSI uses were declining in proportion to feed uses for the 1990s, they began to increase at the turn of the century. Proportionally, these increases began to level off after 2008/09. There are however differing views on recent trends in use of maize.

While USDA data indicate feed use accelerating since 2007[5], other specialists, including those at leading Chinese research institutes, believe that the growth rate of feed demand was fairly steady during the 2000s; a suspicion supported by the fact that the growth rate of livestock production did not accelerate over this period, but fell a little in the second half of the 2000s. Moreover, production, particularly for hogs, moved to larger-scale farms which might have improved the feed conversion ratio and thereby further slowed increasing demand for feed.[6]

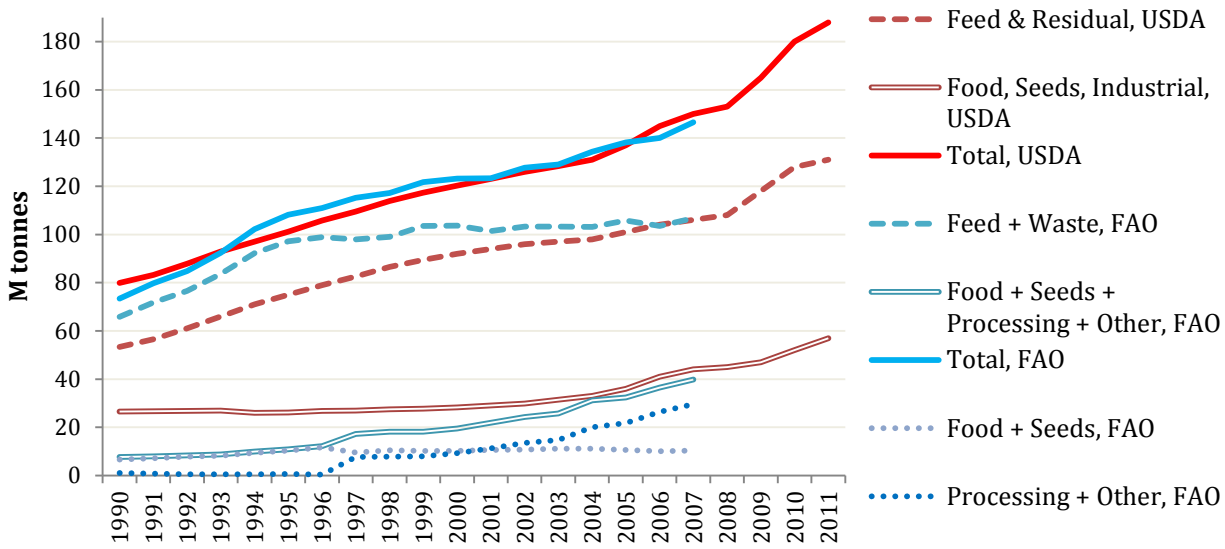
[4] USDA maize use for 'feed & residual' went from 53M tonnes in 1990 to 106M tonnes in 2007, compared to FAOSTAT figures for feed and waste combined which went from 66Mt in 1990 to 107Mt in 2007

[5] USDA data for Feed & Residual use accelerates sharply from the first to the second half of the 2000s, see Figure 2.5

[6] USDA's disputed estimates for cereals used for feed went from an estimated 85kg to 110 kg a head between 2007 and 2011. In contrast, the previous 25kg per capita increment of feed cereal use took 14 years from 1993 to 2007.

Maize use recorded by FAO for processing, other uses, food and seed, which ought to be comparable with USDA's FSI category, increased by about 32M tonnes from 1990 to 2007, growing from 8Mt in 1990 to 40Mt in 2007. Yet USDA statistics on FSI use increased only 18M tonnes over this same period. They started, however, from a much higher level, going from about 27M tonnes to 44M tonnes. The estimates for USDA and FAO are much closer around the mid 2000s than they were in the 1990s, see Figure 2.5

Figure 2.5 Maize use statistics for China, 1990 – 2011, FAO and USDA compared



Source: With data from FAOSTAT & USDA FAS

FAO figures which stop at 2007 do not capture the current high levels of cereals used for processing. Specialists also believe that USDA underestimates industrial use of cereals in China, partly by ascribing too much growth to animal feed use in the last 3 to 4 years that would be more accurately recorded as growth in processing uses.[7].

Analysts such as Wang (2007) predicted that industrial uses of maize would continue to increase at a rapid pace, largely driven by starch[8], so that by 2015, almost 40M tonnes would be processed to starch, with another 10M tonnes going to ethanol distilleries.[9]

[7] For instance, if as specialists believe, maize for industrial uses accounted for at least 30% of maize use in 2011, USDA figures for 2011 which show maize used for FSI uses at 57M tonnes would be an underestimate. If food use is assumed to be about 6.7kg/capita (similar to 2007 levels as recorded by FAO) and seed use is about 9% of total use (similar to the ratio of seed to total supply as recorded by FAO in 2007), this leaves a rough estimate of about 31M tonnes of maize for industrial use, which is about 16% of total maize use as estimated by USDA for 2011.

USDA's maize feed use estimates increased by 2Mt a year from 2006 to 2008, but by 10Mt a year from 2008 to 2009, by 6Mt from 2009 to 2010, and by 10M tonnes from 2010 to 2011. If feed use estimates for the second half of the 2000s had increased at the earlier rate, by 2011 feed use would be estimated at around 114M tonnes, leaving another 20M tonnes for industrial uses which would then add to about 26% of total uses.

[8] Overall, China's starch output was predicted to grow 10% a year from 2007 to2015, though the share of Maize starch in total starch was expected to fall from 92% in 2005 to 85% in 2015 owing to constrained maize supplies and increasing starch production using cassava and tubers (Wang, 2007).

Maize for biofuel

China once had ambitious plans for biofuels distilled from grains. China invested in four large-scale ethanol plants in the early 2000s, so that by 2007 it was the third largest ethanol producer in the world. Plans for further expansion were however put on hold as cereals prices rose:

> 'In 2007, the Chinese government announced that the four existing ethanol plants were prohibited from expanding and no more cereals would be allowed for use as ethanol feedstocks beyond those currently allocated' (Huang et al., 2009).

Any further expansion of biofuels would henceforth have to come from alternative crops grown on marginal lands (Huang et al., 2008). Were sufficient investment made in marginal lands to grow alternative feedstock, 5M tonnes of ethanol could be produced by 2012 and 12M tonnes by 2020, thereby meeting bioethanol targets set before 2007(Huang et al., 2008).[10]

In sum, while there is scope for debate about just how much of additional maize consumption is going for animal feed as opposed to industrial use, there is little doubt about the overall point: maize consumption is increasing quite rapidly, driven by uses other than human food.

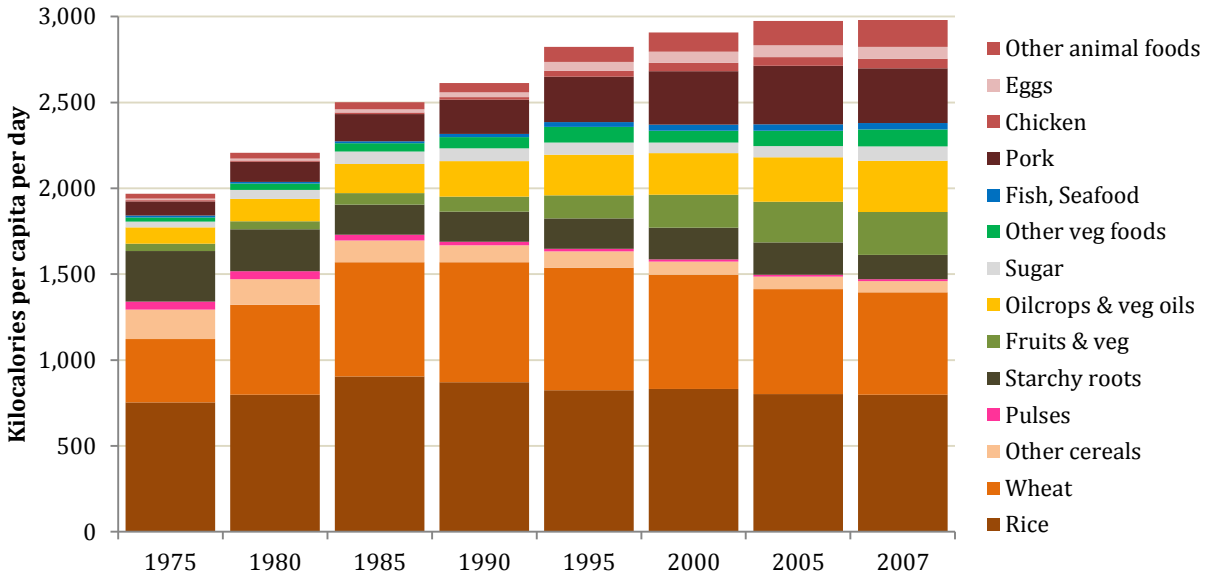
Human consumption and changing diets

Diets have improved in quantity and quality since the 1970s, see Figure 2.6. Between 1975 and 1995, average energy consumption rose by almost 50%, since when only small increases in energy have been seen. The composition has changed as well: in 1975, more than 80% of dietary energy came from cereals and starchy roots; by 2007 they made up just 54% of diets. Fruit and vegetables, oils and animal products have correspondingly markedly increased their energy share of diets.

Figure 2.6 Contribution of foods to calories supplied per capita, 1975 to 2007

[9] Figure A.7 in the Annex shows how starch and alcohol/ethanol uses are projected to grow to 2015

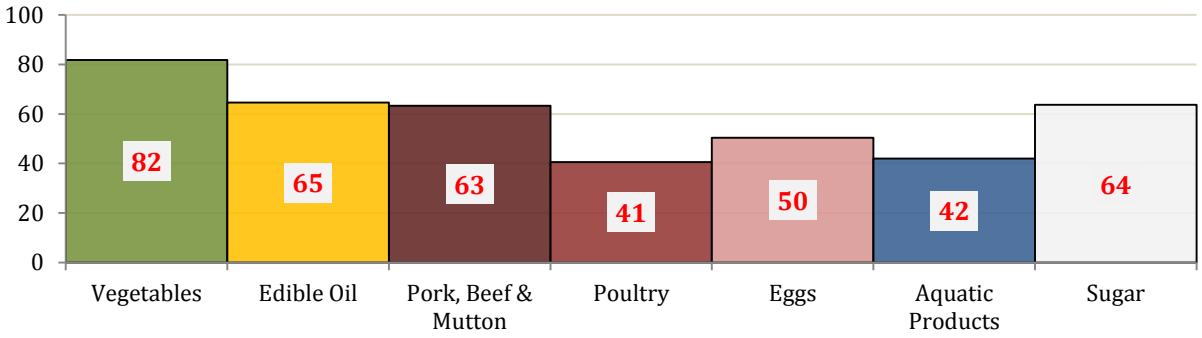
[10] 'From 2005 to 2007 Chinese legislation emphasized the nation's long-term renewable energy intentions. The "Renewable Energy Law" and its "Middle and Long Term Development Plan" targeted China's bioethanol and biodiesel production at 10 and 2 million tons by 2020, respectively.' Huang et al. (2008)



Source: From FAOSTAT data

Progress has been better for urban dwellers than rural people. In 2009, the average rural household consumed about 190 kg of grain[11] per capita, compared to about 80kg per capita for urban households [National Bureau of Statistics of China (NBSC)] Rural consumers typically eat between 40% and 80% of the amounts of higher value foods that urban people eat, see Figure 2.7.

Figure 2.7 Rural consumption of higher value food products as share of urban consumption, 2009



Source: From NBSC.

Note: Percentages calculated by consumption in kg per capita of average rural compared to average urban households. Statistics exclude food consumed outside households and likely overestimates how much rural dwellers eat compared to urban dwellers, given that urban people tend to consume a more significant share outside the house.

[11] Grain in China includes cereals such as rice, wheat, maize, other cereals; as well as pulses and starchy roots, thereby including soybean and other beans, potato, and sweet potato.

That said, there are questions about just how much meat China consumes. Some analysts believe the statistics are exaggerated. China's per capita pork consumption in 2006 was stated at 39.6kg, [12]which seems surprisingly high, given feed available, to some observers such as Aubert (2008):

> In our opinion, this figure [China's pork consumption] is simply false… it seems doubtful that China, with a rural population of 737 million (56% of the total population) known for its low meat consumption, could rival … Taiwan in this respect.
>
> Not only would the official meat output figure (81 million tonnes, out of which 52 million tonnes is pork) translate into an incredibly high per capita availability for China's level of economic development and urbanisation, but it would be a miraculous achievement based on the feed resources available in China.

He concludes:

> In short, there is no "meat miracle" in China, but an overestimation in which actual output could be as low as 70 percent of the claimed figure. (ibid)

Even if the statistics exaggerate meat consumption, there are no disputes about the direction of change: China is eating more meat than before, from animals largely fed on grains.

2.3 Trade & Stocks

Trade in cereals

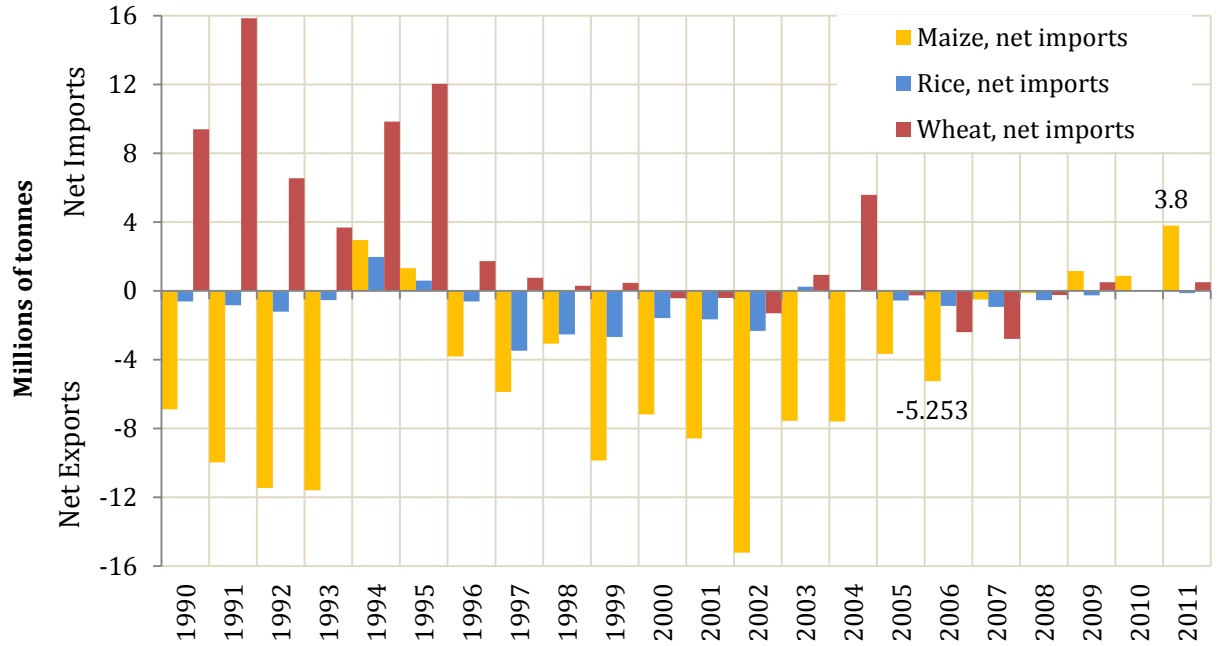
China's trade in cereals with the outside world has for long been a small share of domestic production: since 1990, for example, the volume of gross trade in cereals has rarely exceeded 6% of the volume of domestic production, and often less than that. Trade has thus played only a minor role in adjusting quantities of cereals available domestically.

Since 1990, for most years China has been a net exporter of cereals, see Figure 2.8. In the early 1990s there were substantial imports of wheat, plus imports of maize and rice in 1994 and 1995 when harvests were poor. Since 2009, however, China has imported maize, mostly for animal feed[13].

Figure 2.8 Maize, rice, and wheat net imports, 1990 - 2011

[12] It would also make China the 16th country ranked by per capita consumption of pigmeat, consuming considerably more than several OECD countries — including, for example, Switzerland — where incomes are much higher.

[13] On top of this, China is also now a large importer of US maize-based distillers dried grains with solubles (DDGS), a byproduct of ethanol processing. China imported around 3.1Mt of DDGS in 2010, and 1.5Mt in 2011 (Reuters, 2011). Hoffman & Baker, 2011, found: 'in aggregate (including major types of livestock/poultry), a metric ton of DDGS can replace, on average, 1.22 metric tons of feed consisting of corn and soybean meal in the United States.'



Source: From USDA FAS data.

Note: Rice in milled equivalent. Years represent marketing year beginnings. The unusually large sale of maize in 2002/03 contributed to mitigate a price rise in international markets.

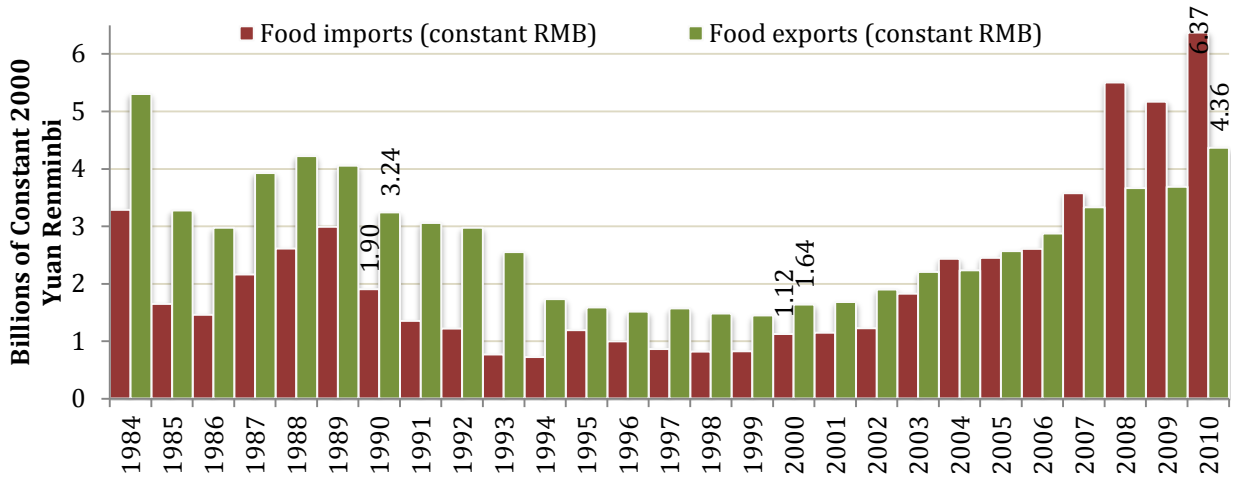
Some of the grain imports in recent years may be contributing to building stocks.[14]

Comparison to other major traded foods

China has shifted in recent years from net food exporter to net food importer, with value of food imports exceeding food exports consistently since 2007. In 2010, the value of exports exceeded those of imports by 2 billion RMB (in constant 2000 terms): in 1990 the equivalent figure was an export surplus of 1.3 billion RMB (constant 2000), see Figure 2.9.

[14] In soybeans large imports may be stock rebuilding, with USDA data showing soybean stock-to-use ratios in China of about 29% in 2010/11, up from about 18% in 2005/06

Figure 2.9 Overall value of food imports and food exports in constant 2000 RMB, 1984 to 2010



Source: Constructed with data from World Bank WDI.

Note: Food imports/exports given as a % of merchandise imports/exports, converted to absolute amounts using merchandise data in US$, converted to LCU and deflated by China's GDP deflator

Oilseeds dominate imports. In 2009, the latest year for which trade data are available, 52% of the value of food imports was from oilseeds (47% from soybeans)[15]; 18% was from vegetable oil (10% from palm oil); 9% from fruits and vegetables, 9% from cereals and cereal preparations[16]; and 6% from meat and meat preparations [FAOSTAT statistics]. By quantity, the increasing volumes of soybean and other animal feed, such as cassava[17], can be clearly seen, see Figure 2.10.

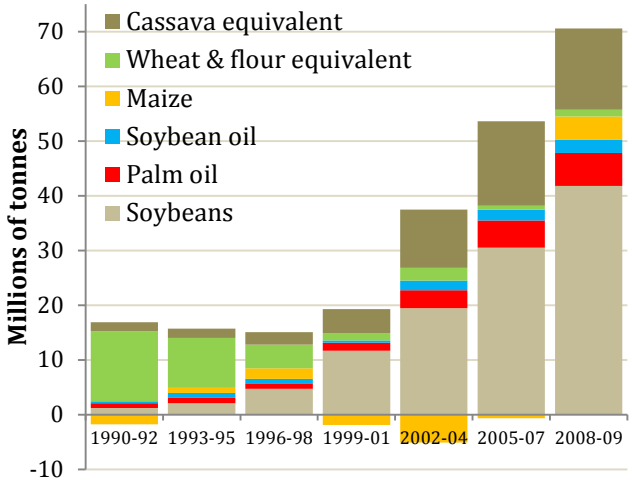
[15]This compares to 30% of food import value attributable to soybeans in 2000, and 8% in 1990

[16]The compares to 52% of food import value attributable to cereals in 1990 and 17% in 2000.

[17] 'China has emerged as the leading cassava importer, procuring mostly feed ingredients. Presently, the country accounts for around 60 percent of the global market. China has supplanted the EU as the single most important destination for international cassava shipments.' [Prakash 2005]

Some cassava also used for biofuel: "About 4 million tons of corn were used to produce fuel ethanol in 2010. China has implemented policies to limit further expansion of grain- and oilseed-based biofuel production for transportation fuel use, and is now emphasizing the use of nongrain feedstocks such as cassava." [USDA Feb 2012]

Figure 2.10 Quantity of selected large net imports, China, 1990 - 2009



Source: Data from FAOSTAT

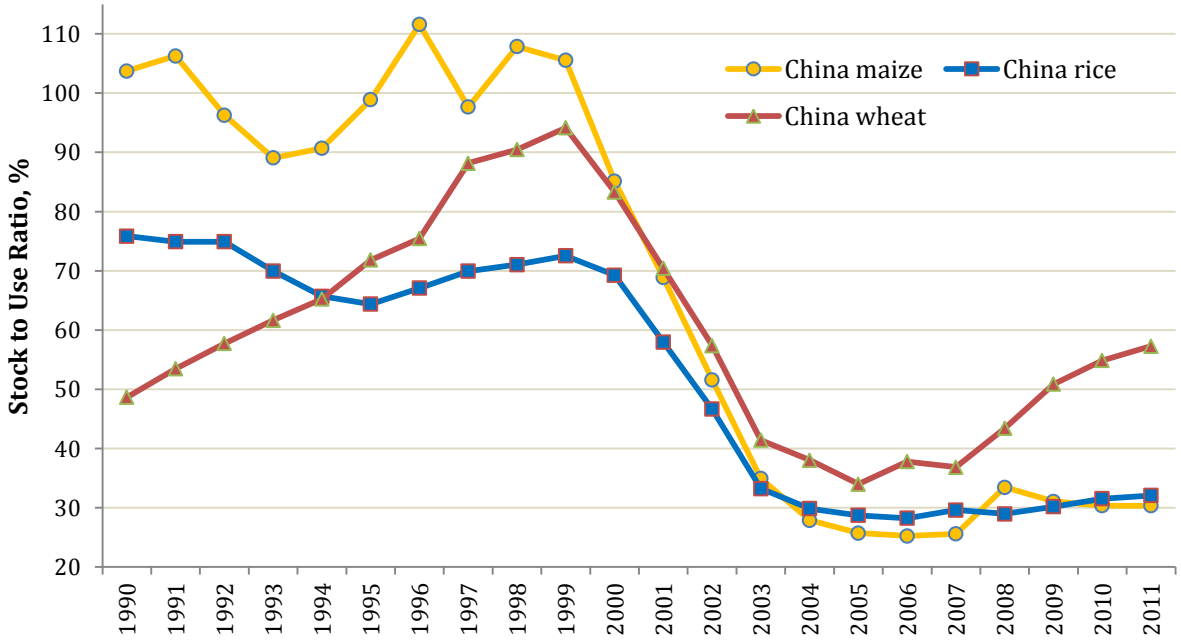
China's policy of self sufficiency has mainly focused on rice, wheat and maize, but not cassava and soybeans for several years.

Increasingly, feedgrains are being bought from the international market.

Stocks

In the 1990s, China held large stocks of cereals, with maize stocks sometimes more than 100% of use, rice stocks over two thirds of use, and wheat stocks over 50% of use — peaking in 1999/2000 at 94% of use. From 2000/01 to 2005/06, stock-to-use ratios of maize and rice dropped below 30%, while those for wheat dropped below 40%. In recent years, stocks have been increased somewhat, with wheat back above 50% for the marketing years 2009/10 to 2011/12, and maize and rice slightly over 30% for this period also, see Figure 2.11.

Figure 2.11 Stock to use ratios for China, maize, rice, & wheat: 1990/91 to 2011/12



Source: Constructed using data from USDA

Compared to stock levels for the rest of the world, these figures are high. For China, with its history of holding very large stocks and maintaining stable prices for consumers, they are quite low, especially for rice and maize.

Stocks are inferred from reported levels of production, trade and consumption. Since the data on these variables are subject to error, then estimates of stocks as residuals must be subject to wide confidence limits.

> "We don't know how much China has, it could easily be 50m–300m tonnes of grain", (Shenggen Fan, Director of IFPRI, quoted by Lucas & Fontanella-Khan, 2012).

Trends may thus be more reliable than actual levels. This is more than an academic point: at the turn of the century inferred Chinese stocks were revised upwards by 70M tonnes when it became clear that previous estimates had been too low (Hsu & Gale, 2001).

2.4 Is domestic demand outstripping domestic production capacity?

In 1995, following China's last significant recourse to international markets for cereals, Lester Brown (1995) predicted that to feed a growing population with growing incomes, China's need to import grain would trigger unprecedented rises in world food prices. Contrary to other projections at the time, see Box A, Brown supposed China's capacity to produce would fall. His dire predictions have proved unduly pessimistic.

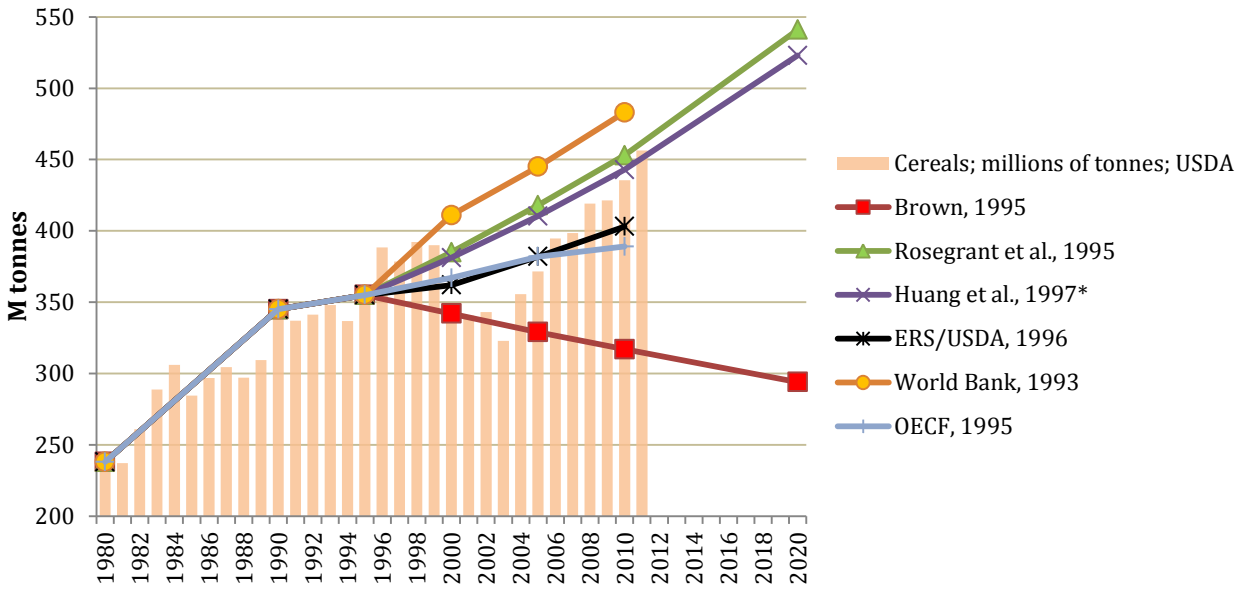
Though world cereals prices spiked in 2007/2008, China had little to do with this: there were few imports of cereals to China at the time, see Figure 2.8. From 1995 to 2008, China managed to remain largely self-sufficient in rice, wheat, and maize. During this period, the official goal of 95% self-sufficiency in grain was achieved every year but 2003 (Aubert, 2008).

BOX A: FOOD PRODUCTION PROJECTIONS FOR CHINA, 15 YEARS AGO

In 1997, an IFPRI study compared cereal production projections for China from six different sources, among them Brown's 'Who will feed China?' (Fan & Agcaoili-Sombilla, 1997).

Figure A1 below shows these projections to 2020, against annual USDA production figures:

Figure A1 Projections of China's cereal production from 2000 on, and USDA annual estimates



Source: Constructed with data from Table 1 in Fan & Agcaoili-Sombilla (1997) with Huang et al. (1997) figure adjusted to remove non-cereals from the estimate to make it comparable with USDA cereal production data (using the definition of grain in China, the Huang et al. unadjusted estimate had included potatoes and legumes). Original sources are listed in the references. The World Bank figure is from Mitchell & Ingco.

Brown's predictions were unusual amongst this set in expecting declining production. They have also proved wildly inaccurate. So far, the projections of Huang *et al*. (1997), Rosegrant *et al*. (1995), and the USDA (1996) are the closest to actual production estimates, while those of the World Bank (2003) were slightly optimistic.

Demand for staples is growing slowly in China, even if that for higher value products grows with income. (Gale & Huang, 2007) For instance, the wealthiest urban households in China seem to have reached capacity in terms of amount of food consumed, so that most demand growth comes from lower income households, who make up 60% of rural and 20% of urban households. The incomes of these groups, however, have only grown at about half the rate of China's GDP growth[18], so that their spending on food has grown slowly (Gale & Huang, 2007). If their incomes were to rise faster, then so would demand for food:

> These food consumption and income growth patterns may explain how China has been able to remain self-sufficient in most food items. A large proportion of China's income growth has been devoted to greater value added in food processing and marketing rather than increased quantity. (Gale & Huang, 2007)

[18] See panel D of Figure 1.1 for China's per capita GDP growth in constant USD terms

How much more demand may there be for meat? Current meat consumption may be overstated, perhaps two-thirds to three-quarters of reported levels (Aubert 2008)[19]. If this were the case, China may see large increases in meat consumption in the future.

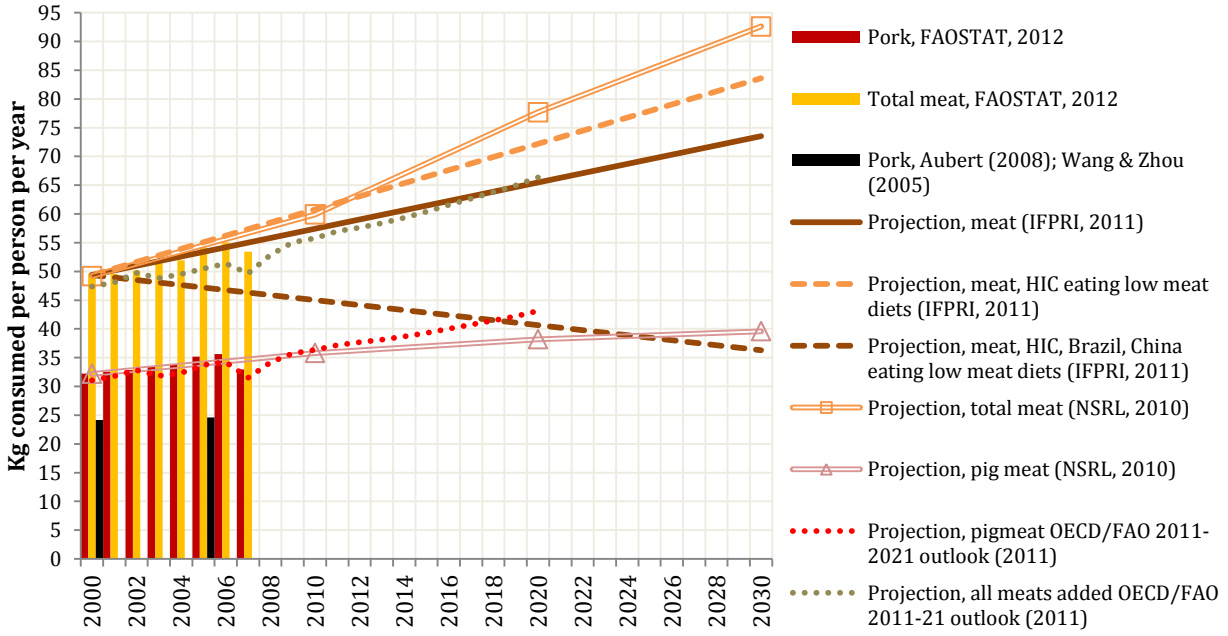
2.5 Projections of meat consumption & cereal imports

Projections of meat consumption vary, see Figure 2.12 that shows those made by OECD/FAO (2011) for pigmeat, Masuda & Goldsmith of NRSL— National Soybean Research Laboratory (2010) for pigmeat and all meat, and Msangi & Rosegrant of IFPRI (2011) for all meat.

IFPRI, using its IMPACT model, makes three estimates: current trends continue; High Income Countries (HIC) eat less meat — in which China consumes more meat than the baseline predicts; and, HICs and Brazil and China eat less meat.

By 2030, it seems Chinese consumers will be eating between 73 and 93 kg of meat a year— unless diets switch to lower meat intakes. With current levels of consumption estimated at just over 50 kg a head a year, then this means very large increases in meat consumption over the next two decades.

Figure 2.12 Comparison of different projections of pork and total meat consumption in China



Sources: FAOSTAT, Aubert 2008, Wang & Zhou 2005, Msangi & Rosegrant 2011 (for IFPRI estimates), OECD/FAO 2011, Masuda & Goldsmith 2010 (for NSRL estimates).

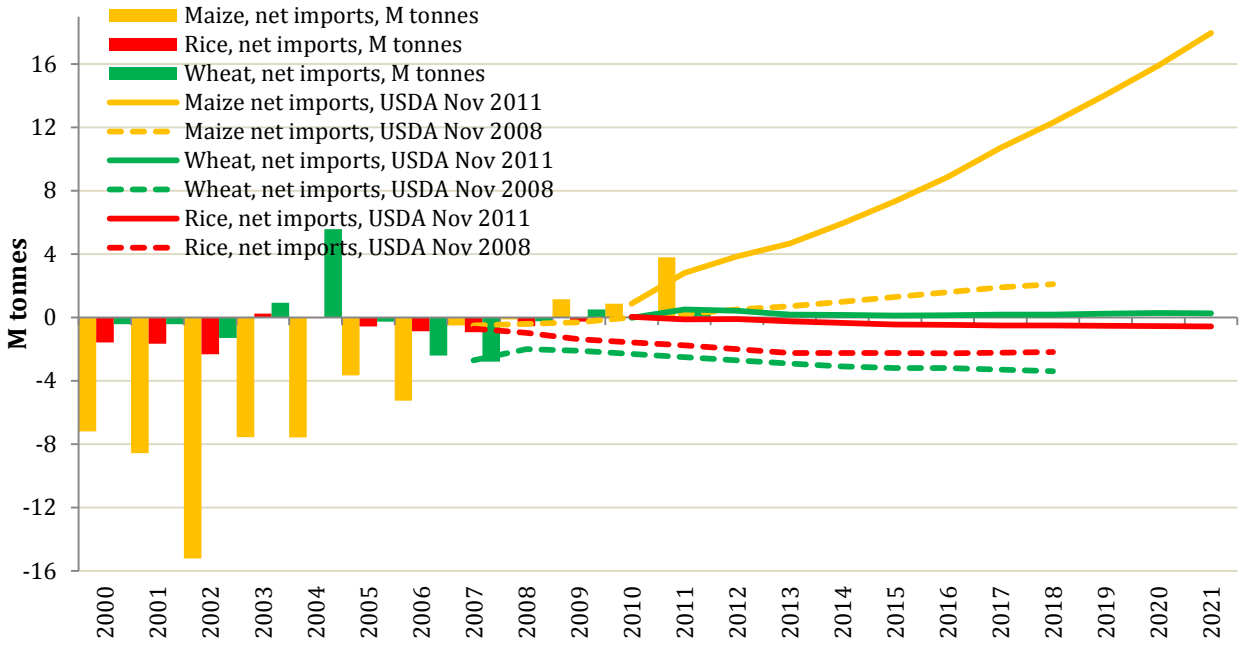
Notes: The columns represent data from FAO on per capita consumption of meat (yellow) and pork (blue) – and adjusted estimates for pork consumption from Aubert for 2005 and Wang & Zhou for 2000 in black.

[19] From Aubert (2008): '… Wang and Zhou 2005… present very original and interesting estimates of meat consumption. After making the same observation that we did regarding official consumption being much lower than output, they try to reconcile the official meat output with real data for consumption. To that end they use a sample survey of their own made in 1998, in which they observed rural and urban consumption, including processed meat and out-of-door consumption. On this basis, taking pork as an example, they arrive at a ration of 24kg per capita in 2000, against the official gross availability figure of 32kg. The difference is attributed to a high carcass loss rate of 24%'

Since China has limited good quality grazing, most of the increased herd would need to be fed on grains. This then may cause large-scale imports of maize, cassava and soybeans as feed.

Only a few years ago, analysts were predicting China would be a relatively small importer of maize in coming years: this has shot up dramatically in the most recent USDA projections. In November 2008, USDA projected maize imports in 2015 to be 1.3Mt: by November 2011 this had been revised to 7.3Mt — and increasing to almost 18Mt by 2021, see Figure 2.13.

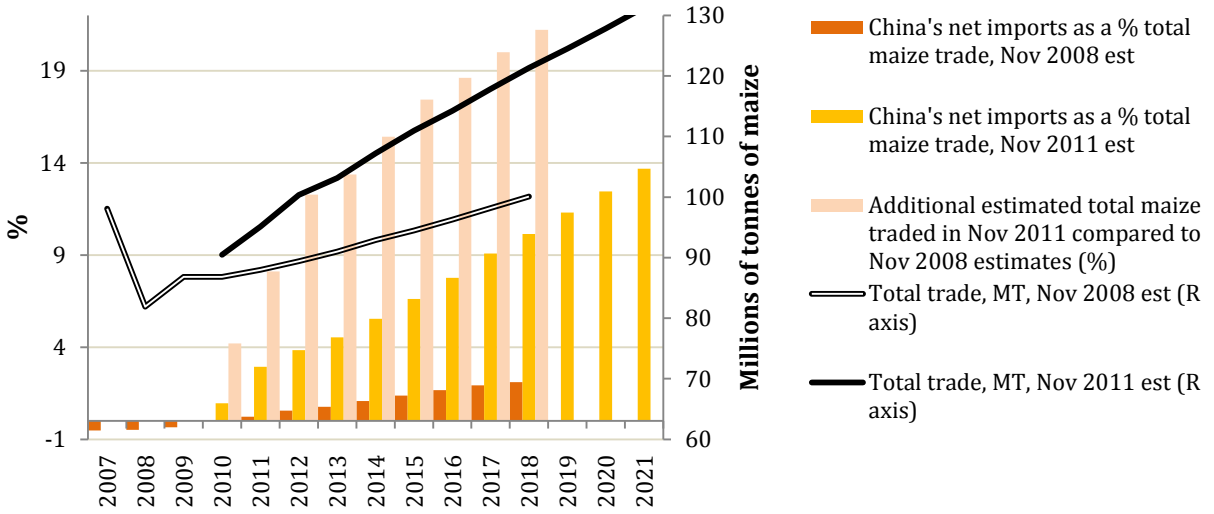
Figure 2.13 Net imports and projected net imports from 2008 and 2011, China, 2000 to 2018 & 2021



Source: USDA Agricultural Projections 2009 and 2011 (running to 2018 and 2021), and USDA FAS data

USDA expects that these increases in maize imports will make up a substantial share of the increase in maize traded on world markets, see Figure 2.14.

Figure 2.14 China's projected maize imports compared to world trade:

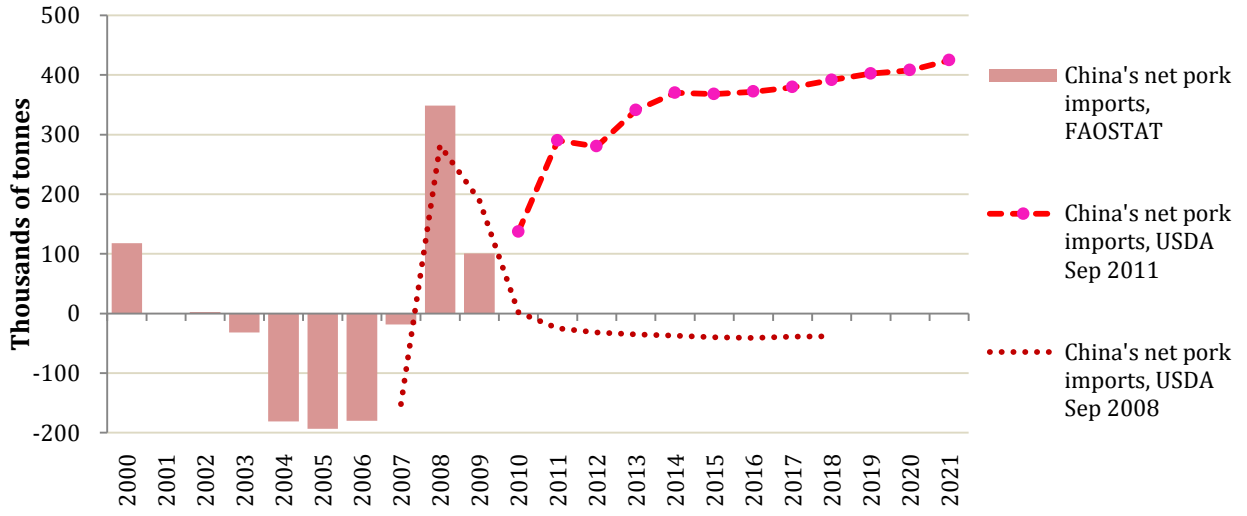


Source: Compiled with data from USDA 2009, 2012

> China's net imports of corn are projected to reach 18 million tons by the end of the projection period as imports grow steadily while exports remain small. China's strengthening domestic demand for corn is driven by its expanding livestock and industrial sectors. The increase in China's imports accounts for 45 percent of the 2012/13 to 2021/22 growth in world corn trade. [USDA, Feb 2012]

Pork imports too are projected to rise beyond levels expected in 2008, from exports of up to 40,000 tonnes, to imports of almost 400,000 tonnes, see Figure 2.15

Figure 2.15 Pork imports projected late 2008 compared to late 2011



Source: With data from USDA 2009, 2012

This follows a recent trend of increased pork imports. In 2010 China imported 0.6Mt of pork for large cities (Zhu, 2011). In a virtual grain equivalent this could be as much as 3.5Mt[20].

[20] In the US, it takes 5.9kg of grain to produce 1kg of pork (Table 3 in Pimentel & Pimentel, 2003)

Soybean imports are increasing too.

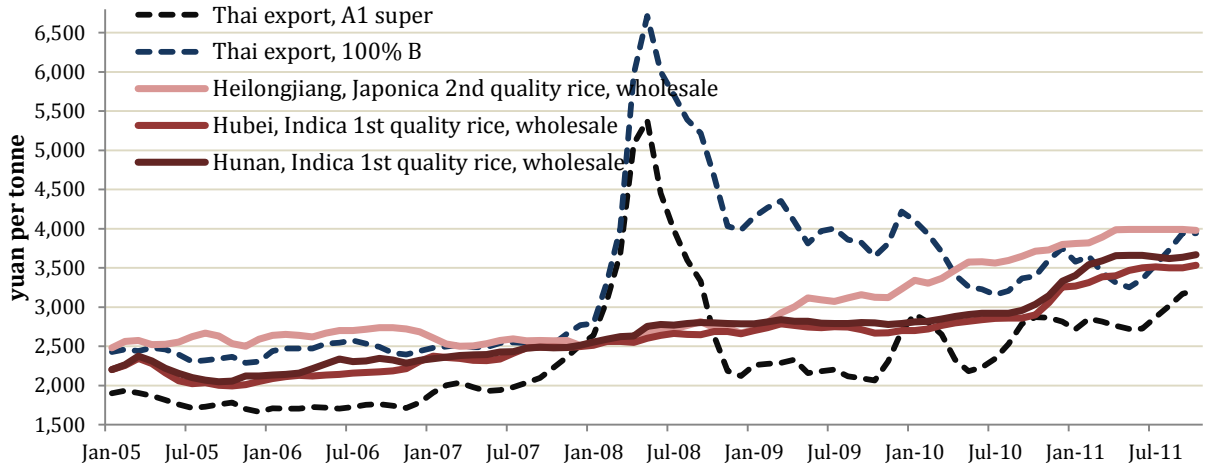
In sum, while domestic production of cereals will be able to meet human demand, it is likely that demand from livestock will exceed growth of domestic production so that increasing amounts of cereals and soy are likely to be imported. Much depends, however, on the way in which Chinese diets develop: will meat and dairy consumption a head rise towards levels seen in Europe and the Americas, or might it level off at a lower quantity? Given the dangers of rising incidence of obesity, diabetes and other diseases encouraged by diets high in animal produce, and the cost of imported feed, China may consider policy to influence future diets to have less animal produce with more pulses, fruit and vegetables instead.

3. Food prices and production costs in China

3.1 Consumer prices

Figure 3.1 shows how rice prices from major rice areas evolved in China since 2005, compared to international Thai export prices.

Figure 3.1 Nominal rice prices in China compared to Thai export prices, in Chinese currency, Jan 2005 – Oct 2011



Source: Constructed with data from FAO GIEWS. Thai prices in US$ converted to yuan at official exchange rate

From 2005 to 2009, rice prices in China were remarkably stable compared to world prices.

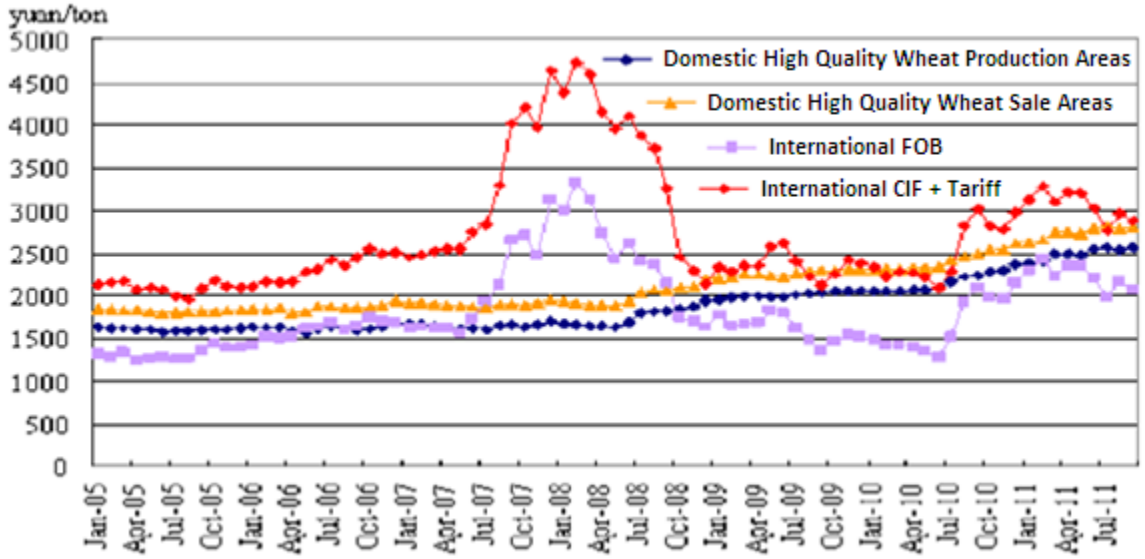
From December 2007 to May 2008, when Thai export prices more than doubled, Chinese rice prices shown in Figure 3.1 rose between 4 and 10%. Japonica prices accelerated since December 2008, followed in mid-2010 by Indica rice prices. From December 2008 to October 2011, Japonica prices in China rose 49% and Indica prices 32%. Over the same period, Thai A1 super prices rose 51%.

The Chinese rice prices in Figure 3.1 are however for relatively high quality varieties, which may have risen by more than the prices of varieties consumed by poor consumers. Taking this into account, it seems that rice prices probably rose on average by about 15% over the 2007/08 period, and by about 20% over the 2010/11 period.

Wheat prices show similar stability over the international price crisis of 2007/08, increasing by around 6% from mid-2007 to the height of the international spike. From early 2010 to the second half of 2011 they also accelerated, rising about 20% to 30%, see Figure 3.2.

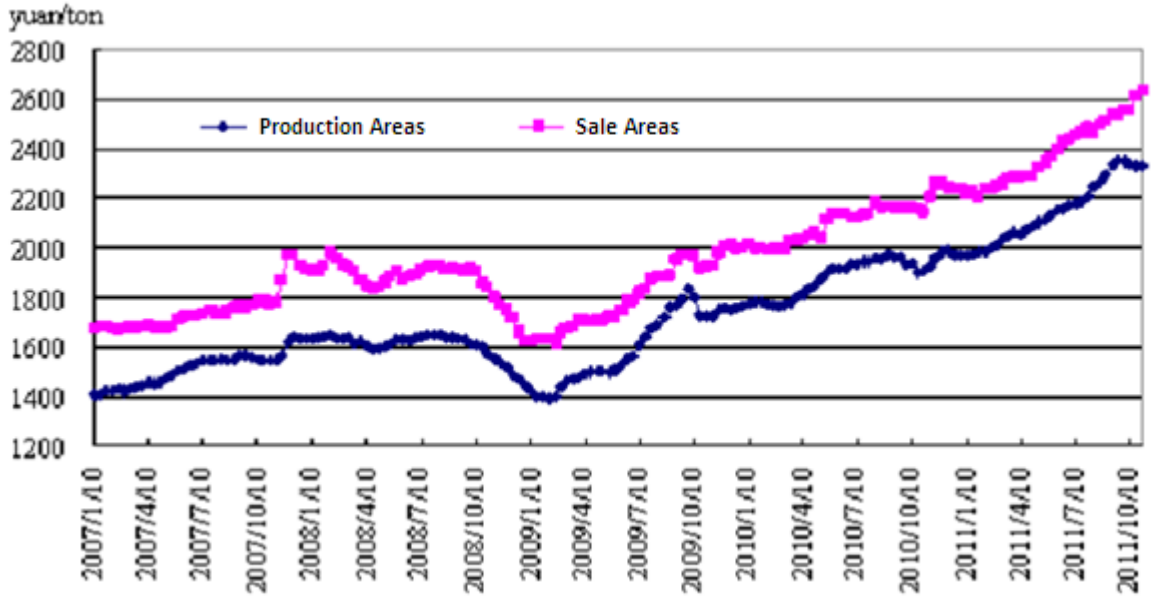
Maize prices moved up more over the food crisis than rice or wheat prices. From Jan 2007 to the first quarter of 2008 they increased around 18%, see Figure 3.3. From early 2010 to October 2011, maize prices increased about 30%.

Figure 3.2 Nominal wheat prices in China compared to international import & export parity, 2005 - 2011



Source: Zhu, 2011

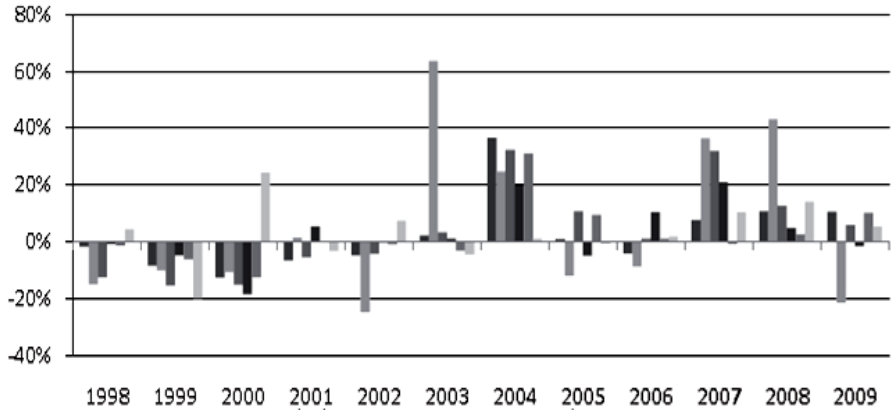
Figure 3.3 Nominal maize prices in China from Jan 2007 to Oct 2011



Source: Zhu, 2011

The recent rises in prices are not, however, unprecedented. From 1993 to 1996, for example, retail grain prices tripled and meat prices more than doubled (Gale et al., 2005). In more recent times there were sharp rises of 20% or more for most grains in 2004, see Figure 3.4.

Figure 3.4 Change in grain prices in China year-on-year, 1998 to 2009



Source: Wang et al., 2010

Lohmar and Gale (2007) wrote:

> Food prices in China began rising in 2006, and China's government made controlling the inflationary impact of food prices a top policy concern in 2007. ...
>
> Prices are rising partly due to increasing world commodity prices, but also because of China's inability to boost domestic production.

Previous rises in staples prices for consumers have coincided with spikes in national poverty levels (1997)[21] and stunting of pre-schoolers (2002)[22]: see panels B and C in Figure 1.1.

3.2 Farmer prices

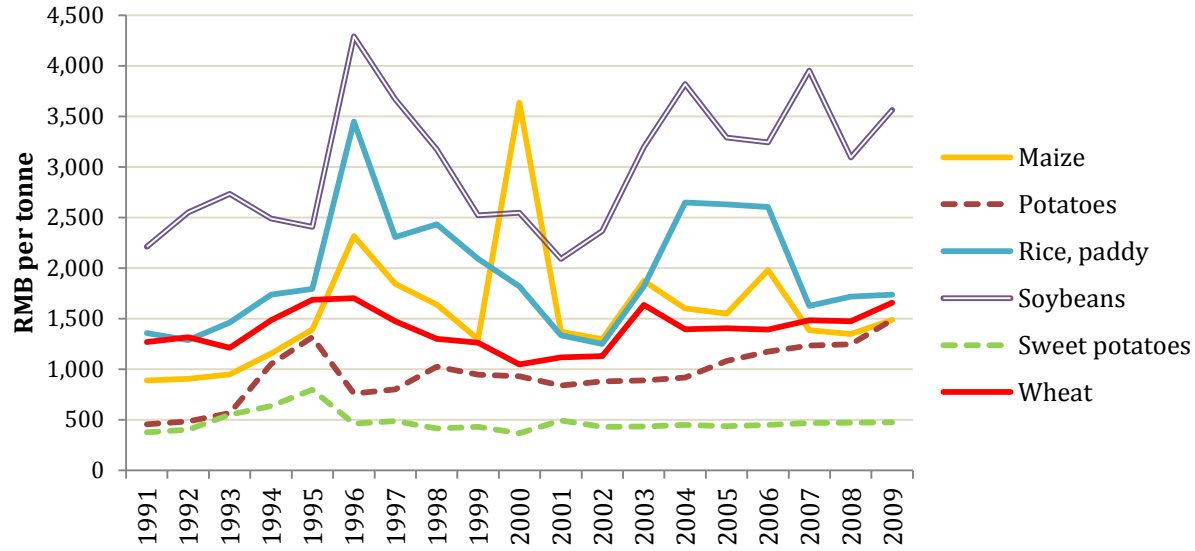
Figure 3.5 shows average annual producer prices across China for key staples. These have varied more than consumer prices. Paddy prices rose 100% from 1995 to 1996 and 51% from 2003 to 2004. From 2006 to 2009 they fell 27%. Maize prices rose 180% from 1999 to 2000 and then returned almost to 1999 levels for 2001. Wheat prices look to have been more stable than maize and rice prices.

[21] Rural poverty reduction slowed down significantly in the 1990s and showed signs of reversal (Zhang & Wan, 2006)

[22] The spike in stunting from 2000 to 2002 is especially evident for urban children, though they start from a lower baseline. In addition, Xin (2004) found that nutrition intake for poor urban dwellers declined in the 1990s, writing:

> 'The main reason for the reduction in calorie consumption for the low income group in the early 1990s was a sharp increase in food price. In addition, in the mid to late 1990s large scale social welfare reform increased households' need to pay for education, medical, housing expenses and the need to save for future consumption and income uncertainty. These factors seem to have played an important role in suppressing nutrition consumption of the low income group during this period.'

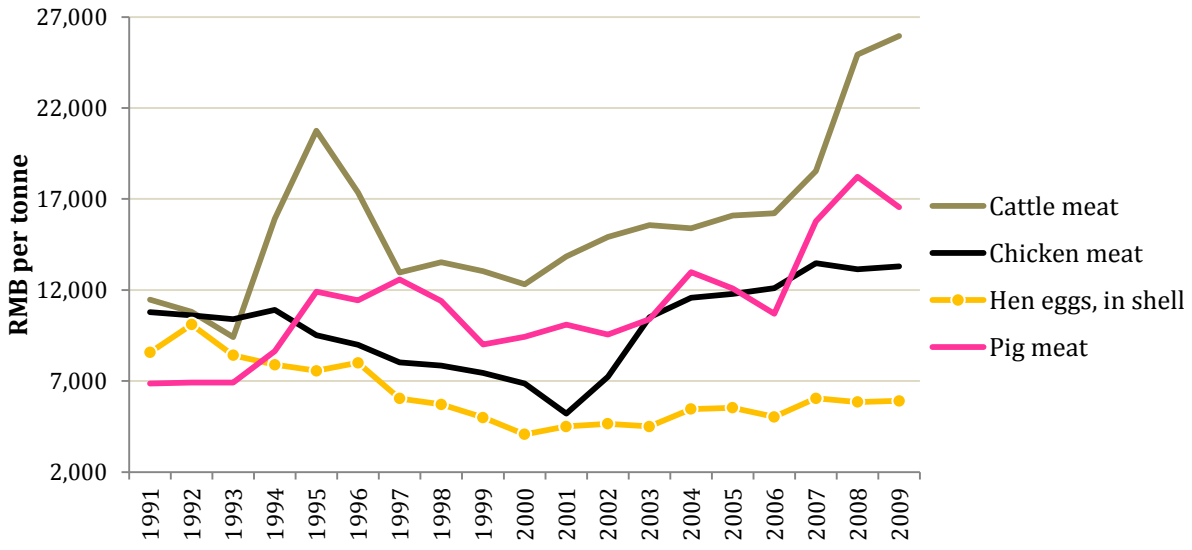
Figure 3.5 Producer prices for some main staples, LCU per tonne, constant 2005 RMB



Source: Constructed with data from FAOSTAT, deflated by China's CPI from WDI

Farm prices for animal products also show spikes in the mid-1990s, and in 2008 for pig meat, which had prices 89% higher than in 2006.

Figure 3.6 Producer prices for some animal products, LCU per tonne, constant 2005 RMB

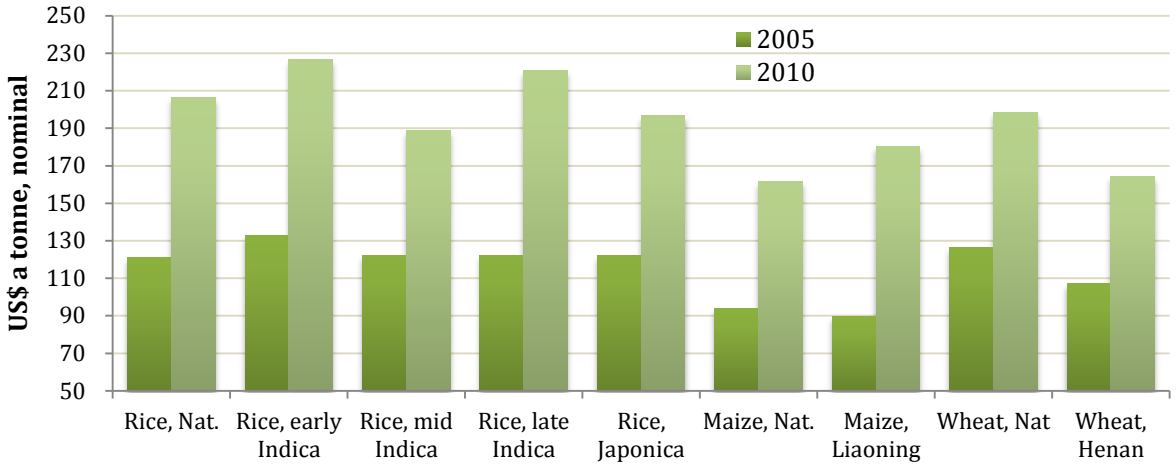


Source: Constructed with data from FAOSTAT, deflated by China's CPI from WDI

3.3 Production costs

Costs of production for cereals have risen in real terms since 2005, see Figure 3.7.

Figure 3.7 Variable costs of production for maize, rice, and wheat in China in 2005 and 2010



Source: Production costs from Prof Huang, converted at official exchange rates to US$. Costs are shown as national averages, but also for the main centres of production of the three cereals. Indica rice is grown in Southern China, while Japonica rice is grown in northern China, particularly in Northeast China.

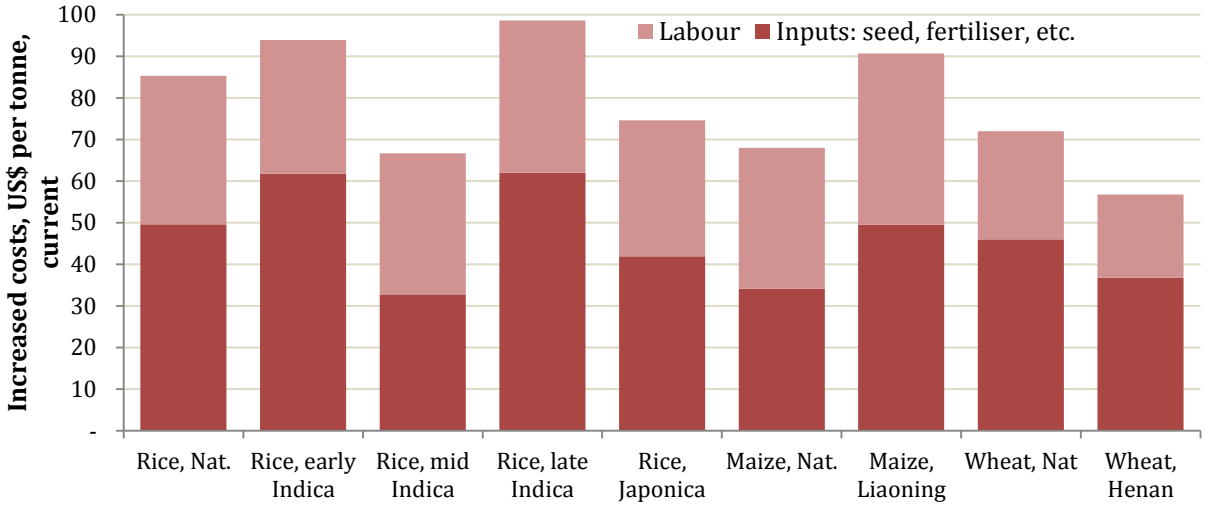
Two things are clear from these statistics. One is that in 2005 costs of production in China were comparable to some of the lowest cost producers in the world for these three cereals. World prices at the time were well above these costs: in mid-2005, maize cost US$98, rice US$287[23] and wheat US$142 a tonne.

The other striking point is the remarkable rise in costs between 2005 and 2010, with increases typically in the range 50–70%. For rice, even with these increases, costs were still well below ruling world prices; but for maize and wheat variable costs were close to world market prices.

Costs rose for both labour as well as seed, fertiliser and other physical inputs, see Figure 3.8, raising costs by US$57–98 a tonne between 2005 and 2010.

[23] Rice prices are not directly comparable since these are costs for paddy, not milled rice. But even if a milling conversion is applied — around 2/3rds, Chinese costs of production remain well below the international rice price in mid 2005.

Figure 3.8: Increases in costs of production, 2005 to 2010, in US$ nominal a tonne



Source: constructed from data supplied by Prof Huang

3.4 Drivers of consumer price rises since 2005

On the demand side, prices have risen owing to:

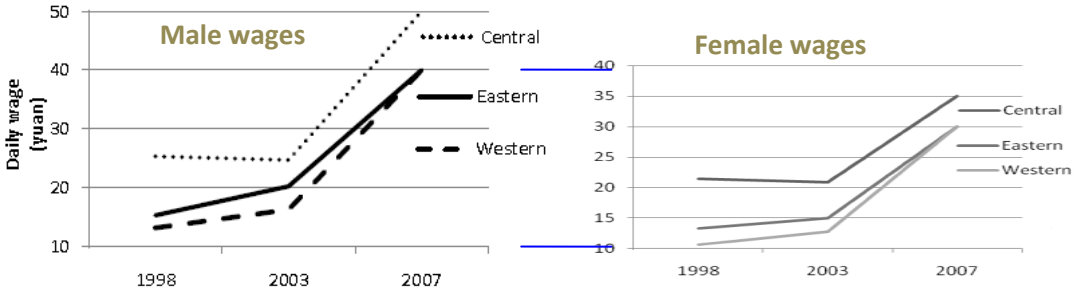
a. Increased money supply, and economic growth which put pressure on all prices including factors of farm production. Inflation in China's wider economy is increasing partly because of loosening of monetary policy, owing to the government's large stimulus package following the financial/food crisis (Zhu, 2011); and

b. Growth of income and changing diets which lead to increased demand for livestock and hence increased demand for feed. Although demand for foodgrain may be declining, increased demand for feedgrain and industrial uses has been dramatic, with total maize use increasing from 2005 to 2011 by 54M tonnes, or 39%. Some analysts credit the rising pork price with pushing up maize prices. Demand for pork and other high value products which require large inputs of basic grains to be produced are rising as people become wealthier.

On the supply side, costs of production have been ratcheted up — see previous section. Higher oil prices feed through to transport and fertilizer costs. During the global food crisis in 2008, China tried to limit fertiliser exports to stabilize fertiliser prices in China, though this only lasted for a few months (Yang et al., 2008). Other input prices such as machinery costs are also rising, along with rising machinery input (Zhu, 2011)

Wages too are increasing. In the five years to 2011, cost of labour for producing cereals increased 20% according to (Zhu, 2011), although going by production costs data this looks an underestimate. Rural China went from having an excess supply of labour to having a labour shortage after 2003, according to Zhang et al., 2010, when wages in peak and slack seasons began to rise substantially, doubling over the next four years, see Figure 3.9.

Figure 3.9 Daily wage rates, constant 2006 for men and women in three areas of China: 1998 to 2007



Source Zhang et al, 2010. **Note**: The authors used real wages in constant 2006 yuan, deflated by provincial rural consumer price indices

Farmers are, moreover, increasingly expected to make additional investments for environmental reasons. Water conservancy has been made a key priority, with the release of China's Central Committee of the Communist Party and the State Council's annual 'Number 1 Document' in Jan 2011, outlining 'the Central Government's plan to accelerate water conservancy reform and development, and achieve sustainable use of water resources in the next 10 years' (Lagos & Junyang, 2011). See Box B for some more discussion of environmental issues.

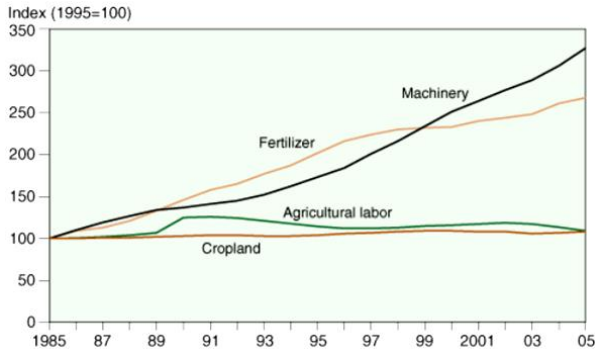
Finally, food safety[24] is increasingly important, as recent incidents such as the melamine in milk scandal illustrate: producing safe food is likely to be more costly.

[24] Gale & Huang, 2007 wrote: 'There is a growing segmentation of the China market linked to the emerging demand for food quality. Chinese food retailers offer a wide range of food products appealing to demands for safety, quality, and health attributes demanded by high-income urban consumers. However, the majority of Chinese consumers—those with less discretionary income—consume less expensive generic food items.'

BOX B: ENVIRONMENTAL CHALLENGES FOR CHINA'S AGRICULTURE

China has increased production in the last decades largely by intensifying land use.

Figure B1 Indices of fertilizer, machinery, labour, and land use in China; 1985 - 2005



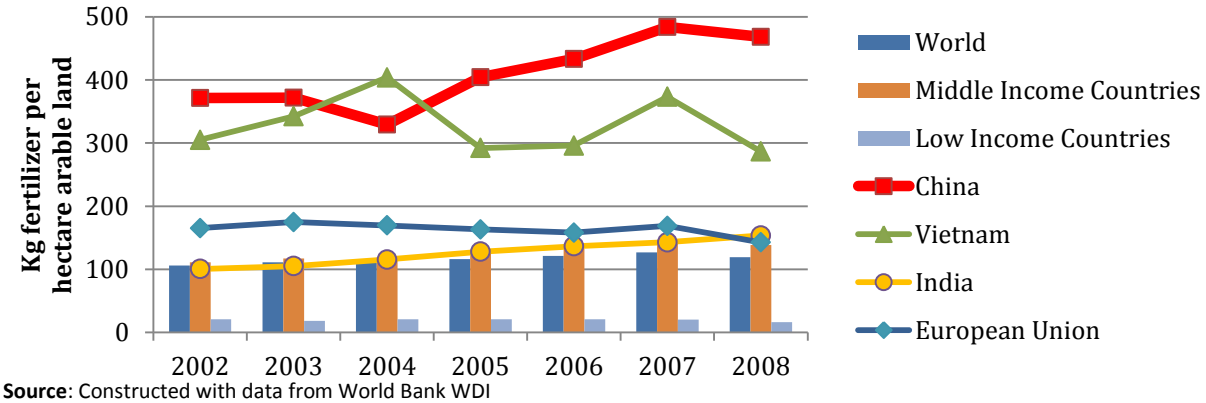
Source: Lohmar & Gale 2007

In the process there are dangers of runoff of chemicals into aquifers and watercourses:

> In the past, China had boosted food production by increasing the amount of land being used for agriculture. In recent years, however, the area of cultivated land has been decreasing, and the focus has been on using more fertiliser, pesticides and mechanical inputs to increase productivity. But this more intensive chemical-use system of farming is creating its own problems. China's use of fertilisers... is one of the highest in the world (OECD, 2005)

China used almost four times as much fertilizer per hectare of arable land than the world average in 2008, see Figure B2

Figure B2 Fertilizer use, kg per hectare of arable land, China compared to elsewhere



Source: Constructed with data from World Bank WDI

In some areas pressure on scarce land has led to cultivation of marginal lands where the risks of erosion are greater.

> Land and water are key inputs to agriculture and are the main constraints to China's continued production growth. Chinese farmers farm not only the most productive land in plains and valleys in the eastern third of the country but also steep hillsides, arid grasslands, drained lakes, and dry riverbeds that are generally not cultivated in more land-abundant regions like North America or Australia (Lohmar & Gale, 2007)

Water is becoming increasingly scarce, above all on the North China Plain. Yet this region produces a large share of China's wheat, maize, cotton, and other crops that rely heavily on irrigation (Lohmar & Gale, 2007)

4. Policies for cereals production, prices and storage since 1990

In 2010, the Chinese government allocated 133.5 billion yuan (US$19.55 billion) to subsidize agricultural production; an increase of 6.04 billion yuan (US$879 million) on the previous year. (GIEWS, March 16, 2010)

Policies for cereals have been geared towards four main goals: stimulating production; raising farm incomes; stabilizing quantities in markets and thereby prices; and, when prices rise, ensuring poor and vulnerable people get access to staples see Table 4.1.

Table 4.1 Framework of polices affecting cereals production, prices, and storage in China

Stimulate production	Raise farm incomes	Stabilise quantities & prices	Smooth impacts on the vulnerable
• Provide public goods • Subsidise inputs • Raise prices to provide incentives to farmers • Impose quota deliveries & mandatory planted areas	• Production stimulus as on left • Direct payments • Less tax	• Trade • Storage	• Transfer food or cash • Other social protection

4.1 Policies to stimulate production & raise farm incomes

The first two goals are dealt with together because they share many policy instruments. These include providing public goods, subsidising inputs, raising prices to provide farmers with incentives, and imposing mandatory quota deliveries and planted areas. But first, some recent history of cereal policy helps understand current policy making.

Broad evolution of cereal policies since the late 1970s

Before reforms began in 1978, cereals were produced by production teams on rural communes, responding largely to commands to plant cereals and deliver harvests to state agencies. The reforms saw two key changes. One, the production teams were replaced by the Household Responsibility System, whereby land, draft animals, tools were allocated to households who were able to make their own decisions on what to produce and how. Initials leases of land were reinforced by further reforms in 1984 that extended leases to 15 years, and allowed some renting out of land and hiring of labour.

Two, increasingly farmers were permitted to produce for the open market as quotas for deliveries to the state were reduced. In addition, official procurement prices were raised and bonuses were paid for over-quota deliveries. Substantial liberalisation of state procurement and distribution systems meant agricultural commodities sold through markets increased from 6% in 1978 to 40% in 1985, 79% in 1995, and 83% in 1999 (Orden et al., 2007). With these and other measures, the Chinese rural economy moved from being largely planned to one where markets became increasingly important. (Cabral et al. 2006)

But the process has not been even. The broad pattern shows that when staples production has grown, the state has retreated and allowed farmers more freedom to respond to market forces: conversely, when cereal production has stuttered, the state has tended to intervene to try and raise production — initially by administrative order, subsequently by incentives.

For example, following a bumper crop in 1984, the government replaced mandatory procurement with voluntary contracts between farmers and the government (Orden et al., 2007). On the other hand in 1994 when the harvest was low, leading to rising prices, the government reinstated compulsory grain procurement.

Policies for cereals in the 1990s and 2000s

Cereals production since 1990 has varied. Growth in the first half of the 1990s was low, leading not only to the compulsory purchases mentioned after 1994, but also to guaranteed prices in 1997. A notable increase in production in the second half of the decade led to the part removal of these prices so that by 2003 they only remained for cereals in important production areas. By 2004 most of these were eliminated so that cereal prices were largely set in open markets, with government procurement prices following market prices (Orden et al., 2007).

Cereal procurement and marketing in the 1990s led to large inefficiencies, with estimates of cereal marketing losses, including those from price interventions and deficits of business operations, at between 300 to 600 billion yuan[25] (Sonntag et al., 2005). Very little of the funding went to farmers, but rather to cover 'bad loans in the Agricultural Development Bank' and to build large grain inventories — that some think may have hampered efficient private sector storage development (ibid).

Cereals production again fell in the early 2000s, leading to further stimulus from 2004.

In response to the latest price rises the government has once again raised the minimum procurement prices for rice and wheat (Zhu, 2011). For instance, in late February 2010 the minimum purchase prices for white and red wheat were increased by 3.3% and 3.6% respectively from their levels in 2009 (GIEWS, Feb 26, 2010); the white wheat price was further raised by 5.5% to an equivalent of about US$285/tonne (GIEWS, Oct 12, 2010). Minimum purchase prices for short grain rice were also increased in late February 2010, to 10.5% higher than their 2009 levels, while minimum purchase prices of Indica rice varieties were increased 3.3 and 5.4% on 2009 levels (GIEWS, Feb 22, 2010).

Another major shift[26] in cereal policy came in 2004 with national rollout of direct subsidies to grain farmers,[27] costing RMB 11.6 billion (US$1.4 billion) according to China's Finance Ministry (Orden et al., 2007).

[25] Losses arise from for instance: misappropriation or illegal diversion of budgetary allocations to other uses, payment of interest, reserve management and asset depreciation in China's large grain reserves.

[26] The shift is significant from policy of the past two decades, where China gave few agricultural subsidies, having low levels of aggregate measures of support: between 0% and 2% of agricultural GDP (Sonntag et al., 2005). China has apparently been reluctant to use direct subsidies in the past owing to their cost (which tends to rise as farmers begin to feel entitled to continually increasing levels of support) and the difficulty of reducing them without social or political upheaval (ibid)

[27] These were initially put in place in 2002 in selected major grain-producing provinces of Anhui, Henan, Hubei, and Jilin

The direct subsidies were introduced concomitantly with agricultural tax reductions. From 1990 to 2003, farmers were required to pay agricultural taxes in cash or in kind, as well as paying various fees to local governments and collectives, and providing 'labour accumulation' for communal construction projects (Orden et al., 2007). Reform of agricultural tax[28] was begun in 2000 and extended across rural China in 2004, with the schedule to be eliminated in five years at a total annual estimated cost of US$5–7 billion (ibid).

These policies reflect China's new view of agriculture as a sector needing a helping hand (Gale et al., Feb 2005). Table 4.2 summarises the new policies of 2004 and their probable effects.

Table 4.2 Summary of China's new agricultural policies in 2004

Policy ***Estimated cost***[1]	Description	Probable effects
Grain subsidies ***$1.4 billion***	Direct payments of roughly $7.33 per acre planted in grain	Modest income gains for farmers. Effect on grain production is uncertain.
Agricultural tax reduction ***$5-7 billion***	Elimination of agricultural tax within 5 years. Elimination of tax on specialty crops (except for tobacco).	Modest income gains for farmers. May encourage planting of specialty crops, somewhat offsetting effect of grain subsidy.
Seed subsidies ***$193 million***	Subsidies for high-quality grain and soybean seeds of $7-$10 per acre planted.	May encourage planting of certain crop varieties.
Machinery subsidies ***$5 million***	Subsidies for purchase of machinery in targeted areas.	Increased mechanization but little effect on output Frees labor for off-farm work.
Rural infrastructure spending ***$18 billion***	Improvement of irrigation facilities electricity generation, roads, testing. facilities, other rural infrastructure.	Improve productivity and marketing efficiency

Source: Gale et al., Feb 2005, from various news reports

Note 1. Dollar values calculated using the official exchange rate, currently fixed at RMB 8.28 = U.S.$1.

It seems these measures have had the desired effect, see Box C: areas planted to cereals have grown, yields have increased thanks to more use of inputs, and cereal harvests have risen considerably.

In 2004, China resumed futures trading of corn, which had been suspended in the late 1990s (Orden et al., 2007).

Increasing grain production is firmly on the agenda for the current five year plan (2011–2016)[29]. The goal is to maintain area planted to grains and improve variety, quality, and yield to establish a grain production capacity over 540M tonnes (Lagos & Zhang, 2011) — compared to recent harvests

[28] Taxes to be eliminated included: assessment on normal productive value of land, agricultural specialty product tax, selection of local taxes and fees to fund road construction, schools, and various other projects or services undertaken by village/town authorities.

[29] Table A.1 in the annex shows the headings and sub-headings in the agricultural 5 year plan.

of almost 490M tonnes.[30] To add 50M tonnes of cereals to existing production by 2016 would require growing output at about 1.6% per year, a rate that appears to be realistic given past rates of growth in cereals production; see Figure A.10 in the annex[31]. Considering the definition of grain in China includes potatoes and legumes, the figure seems even more realistic.

Plans include: increasing investment in major grain producing areas, improving the agricultural subsidy system and continuing to provide direct subsidies to grain growers, further implementing subsidies to buy high-quality seeds and farm machinery; as well as building capacity of smaller centres of production to become more stable and high-yielding. This includes improving drought and flood-resistance measures[32] and accelerating consolidation and reclamation of rural land. Furthermore, there are plans to steadily improve the minimum purchase prices for key grain varieties (Lagos & Zhang, 2011).

Livestock are also on the agenda; with plans to increase animal outputs, including encouraging intensive systems (Lagos & Zhang, 2011) and large scale hog farms—those with annual slaughter of 5,000 pigs or more (Woolsey & Zhang, 2011)[33].

> In 2009, farms with 5,000 head or more were eligible for a one-time payment of RMB800,000 ($126,000). Farms that received the payment in 2009 will not be eligible in 2011.... In addition to minimum herd size, farms must meet certain conditions to be eligible, including a requirement that they are either new or improved. (Woolsey & Zhang, 2011)

Other policies to support production include provision of credit. Until the end of the 1990s, preferential loans from rural credit cooperatives (RCCs) were provided mostly to state marketing organizations to fund the purchase and storage of key agricultural products. In the 2000s most of these programs were discontinued, but those for grains were continued. RCCs have since increased small short-term loans to farm households.[34]

In 2002, the Agricultural Development Bank of China launched a specialized lending programme targeted at "dragon head" agricultural enterprises[35], so that lending grew to RMB 40 billion (US$4.8 billion) in 2003. The China Development Bank, the Agricultural Bank of China, and the RCCs also make preferential loans to these enterprises. (Orden et al., 2007)

[30] USDA has cereals production marked at 450M tonnes in 2011/12, however it reports rice on a milled basis. China's definition of grains includes rice, wheat, maize, other cereals, soybean and other beans, potato, and sweetpotato.

[31] From 2003 to 2010, China's cereal production grew at 3.7% per year. From 2000 to 2010, it grew at 2.5% per year. From 1990 to 2010 however it grew at only 0.7% per year on average (Calculated from FAOSTAT).

[32] For instance, new irrigation areas are being established to help implement the plan to increase grain production capacity by 50M tonnes across China (Lagos & Junyang, 2011)

[33] This is an increase on the farm size eligible for a similar subsidy in 2009, which were those farms slaughtering at least 500 pigs a year (Woolsey & Zhang, 2011). Payments were suspended in 2010 under this scheme because of hog oversupply (ibid).

[34] For input purchases and modest investments like well-digging, buying livestock, planting orchards, and building greenhouses (Orden et al., 1997)

[35] Companies meeting certain size, management, facilities or technological criteria set by national or provincial governments.

China has subsidised transport[36] — for example from 2002 to 2005, rail shipments of grains and soybeans were exempt from paying a railway construction fee. In response to the latest price rises, the government introduced an exemption of tolls on food transportation (Zhu, 2011). Subsidies have long been offered on agricultural inputs, including fertilizers, pesticides, electricity, and water[37](Orden et al., 2007). Since 2002, China has also provided small subsidies for farmers to buy improved-quality seeds and machinery (ibid).

Farm incomes

In the late 1990s and early 2000s, with oversupply emerging on most agricultural markets causing grain prices to fall, the main policy objective shifted to raising farmers' incomes (OECD, 2005).

> The Chinese Government has dual, often conflicting, rural/agricultural policy goals. Policies originally intended to raise rural incomes were given a secondary goal of promoting grain production when Chinese authorities became alarmed by rapid increases in grain prices following the fall 2003 grain harvest, the smallest since 1989. The government is trying to raise rural incomes while also trying to encourage grain production. Grain typically provides relatively low returns to Chinese farmers. [Gale et al., Feb 2005]

36 The cost of shipping goods across China is however thought to be very competitive, with costs of shipping grain comparable to US Mississippi River freight charges (Sonntag et al., 2005).

37 Charges for electricity and water for farmers are generally lower than for other users. Domestic fertilizer producers have also been able to access lower-price inputs in order to keep fertilizer prices down. (Orden et al., 2007)

BOX C: WHAT IMPACT RECENT DIRECT SUBSIDY, TAX CUT PROGRAMMES FOR CHINESE CEREALS?

Huang et al., 2011, used producer-level data to see the effect of the 2004 policy shift and found:

> '...the subsidy programme in China...is very popular in the countryside, and, therefore, it is likely to be a fixture of China's agriculture for a while. However, this programme, so far, is mainly an income transfer programme. And, so far, it is being accomplished with few distortions to grain sown area or input use.'

Yields of maize, rice, and wheat from 1975 to 2010 are shown in Figure C1. Growth rates in yields are illustrated in adjacent figure C2. Though stagnant or declining slightly from 2000 to 2003, these have picked up since 2004, though they have not returned to the average rates seen from 1975 into the mid-1990s.

Figure C1 Yields of key cereals, 1975–2010

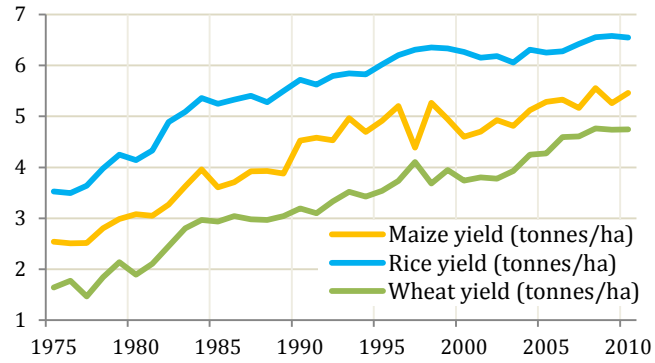
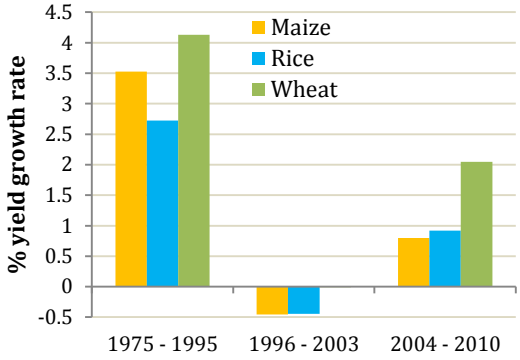


Figure C2 Yield growth rates



Source: Constructed with data from FAOSTAT

The official statistics show more land under cereals between 2003 and 2010: up from 77M ha in 2003 to 89M ha in 2009, see Table C1. The share of arable and permanent crop land devoted to cereals went from 59% to 71% over the same period (FAOSTAT).

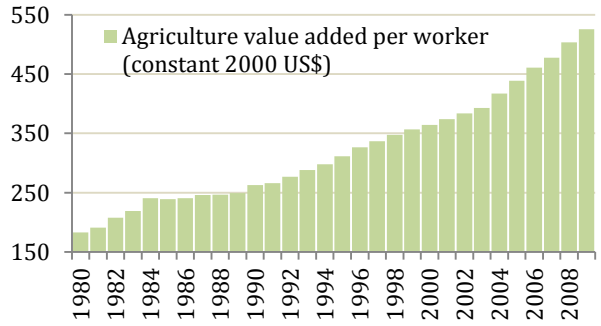
Table C1 Change in area under maize, rice, and wheat in China, 2003–2010

	2003 (M ha)	2010 (M ha)	% change
Maize area	24	33	+35%
Rice area	27	30	+12%
Wheat area	22	24	+10%

Source: With data from FAOSTAT

The value added per worker in agriculture also shows an acceleration; see figure C4 below:

Figure C3 Agriculture value added per worker



The annual growth rate in agriculture value added per worker from 1980 to 2003 was 3.1%, and from 2004 to 2009 it was 4.6%. Most likely intensification of inputs such as fertilizer raised the return to labour. From 2003 to 2007, because of policies abolishing agricultural taxes and subsidizing grain production, farmers increased their use of agricultural inputs (Chen et al., 2011).

Source: World Bank WDI

4.2 Policies to stabilise food prices

Storage

The key policy to stabilise supply and prices has been grain stores: larger amounts of grain have moved in and out of stocks at the end of seasons than have been traded internationally. China is believed to have held grain stocks of around 70% of use for much of the 1990s, and while these levels fell in the early 2000s as harvests faltered, cereals stocks have been rebuilt in every year since 2007, particularly for wheat and rice — which now reach ratios of 60% and 50%, see Figure 4.1a

OECD/FAO Outlook projections however predict little change in China's stock-to-use ratios to 2020, see Figure 4.1b

Figure 4.1a Cereal stock estimates, 2006–2011 and projections, to 2020

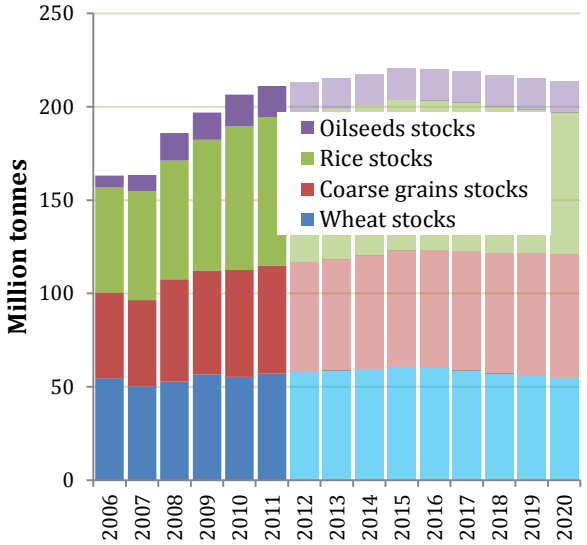
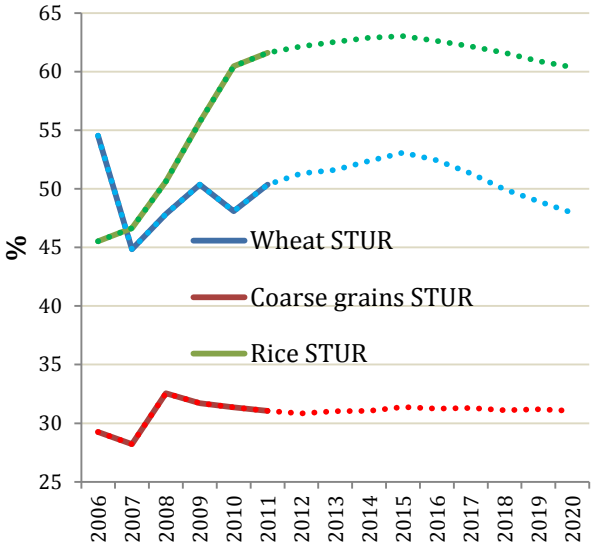


Figure 4.1b Cereal stock-to-use ratio estimates, 2006–2011 & projections to 2020



Source: With data from OECD/FAO Outlook 2011-2020

The government's latest five-year plan on the other hand suggested they would enhance capacity-building in 'food logistics, reserve, and emergency support' (Lagos & Zhang, 2011).

Government policies surrounding stocks in China are however somewhat opaque, because it is impossible to assess what is held by millions of farmers and thousands of even moderate sized traders[38]; on top of which the levels held by government are unpublished.

Some also consider that rises in China's domestic prices seen around the mid-2000s could have been avoided if China's government had managed stocks in a more transparent and open manner (ibid)[39].

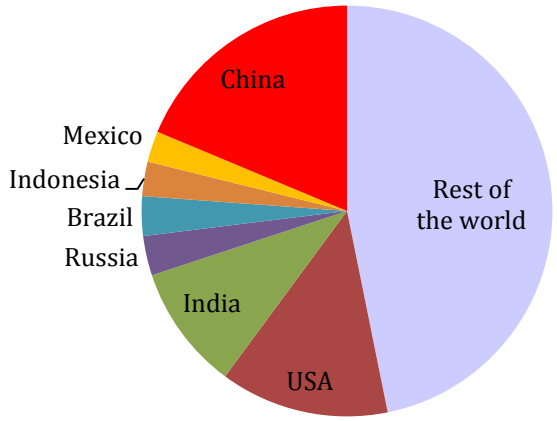
[38] Sonntag et al., (2005) wrote: 'Thousands of wholesale and retail trading companies currently trade into and out of all major metropolitan markets, a fact that makes competition in China's grain markets much more intense than in most developed countries where typically a handful of firms dominate national grain trade (e.g. in the US, the market share of the top five grain-trading firms is more than 80%; in China, the market share of the top five trading firms is certainly less than 5%).'

[39] They wrote: 'The lack of transparency in reserve quantity, throughput and operation misleads producers, consumers and grain traders and thus hinders the prediction of short and long-term grain price. As long as the government manages its stocks in this way, it will never get help from the private sector in holding and managing a large share of grain stocks for the nation.

BOX D: CHINA — THE LARGE COUNTRY'S STOCKHOLDING DILEMMA

China is the world's largest country and consumes the largest share of cereals – about 19% in 2007.

Figure D1 Domestic cereal supply, 2007, China compared to the rest of the world



Source: Data from FAOSTAT

China's strategy of using food stocks to smooth prices has high costs, and at times fails to deliver its objective owing to excessive amounts of grain held in reserve; grain held in consumption regions rather than the more efficient alternative of production regions; and lack of clear rules and regulations to manage procurement release and pricing (Sonntag et al., 2005)

Some recommend that China should use grain stocks only to smooth short term fluctuations in market supply rather than covering long-term shortfalls, and that instead China should rely on a combination of financial reserves to import cereals when needed. Funds saved should be invested to increase productivity and efficiency of domestic production. (Sonntag et al., 2005).

However events on global markets in 2007/08 weaken these conclusions. It is not clear that the international market can be relied upon, particularly if a large country like China were to import to cover domestic shortfalls. Bruins & Bu (2006) set out the dangers if there were either a severe multi-annual drought, or reduced chemical fertilizer manufacturing, leading to a one third loss of harvest:

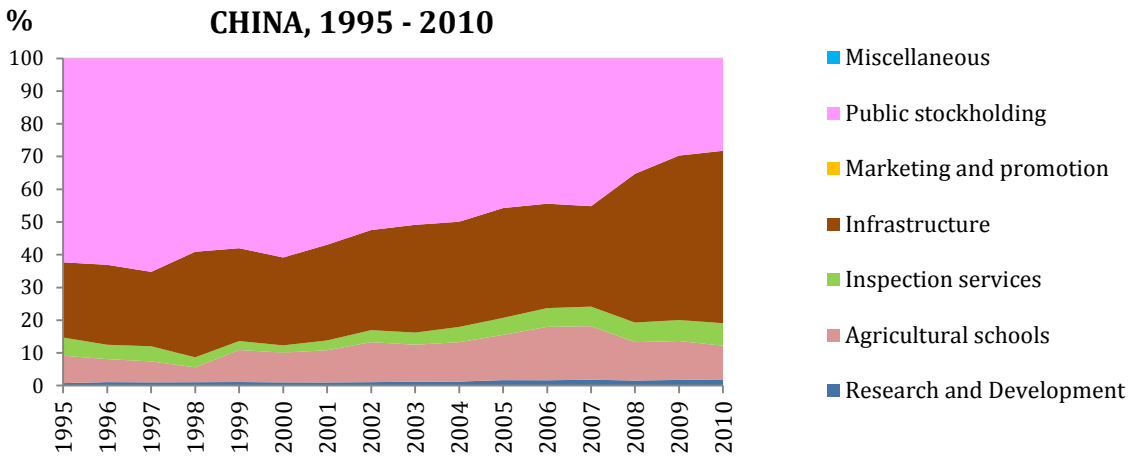
> A shortage of ca 150 million tons of food grains cannot easily be buffered by the volume of food grains annually traded on the world market, ca 240 million tons. Much of this amount tends to be committed already to traditional buyers, as most countries in the world have to import food grains. Cash reserves, therefore, may not guarantee food purchases, because global grain reserves are limited and declining. The formation and maintenance of large internal food grain reserves in China, common in its tradition and ancient history, seem the only realistic contingency planning strategy to avert famine in case of a severe decline in its food production in future crisis years. [Bruins & Bu, 2006]

Stocks therefore present a dilemma: costly they may be, especially in terms of foregone opportunities to invest in production and transport. But reducing stocks is dangerous, as Bruins & Bu argue: if a very bad harvest or run of poor harvests occurred, there could be hell to pay. So what price insuring against this? Policy-makers then face the difficult question of whether it is worth taxing the public to have both the stocks and the infrastructure, and what may be lost by doing so.

Price stability still matters, even for the increasingly affluent urban population. Many urbanites are reportedly dissatisfied with food price rises. One survey of 2000 people found more than 40% of Beijing, Shanghai, and Guangzhou residents were dissatisfied with measures the government had taken to control prices in recent years, and only 21% said they were satisfied with them (China Daily, Jan 2012). Price increases in 2011 left 64% of residents surveyed dissatisfied, while 56% thought prices would continue to rise in 2012 (ibid).

Until recently, China has been cutting back on costs of public stocks to spend more on physical infrastructure: irrigation, rural roads, methane production, rural hydroelectric plants, pasture enclosures, research, and agricultural high-technology parks (Orden et al., 2007), see Figures 4.2 and 4.3.

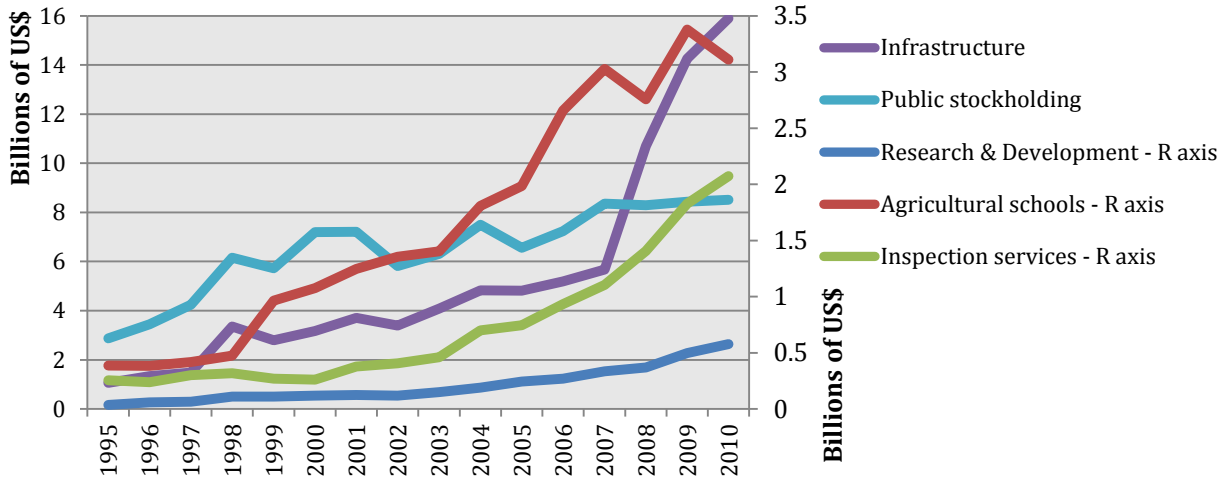
Figure 4.2 Composition of Agricultural General Services Support Estimate



Source: Constructed with data from OECD.

Note: Figure A.11 in the Annex provides a comparison to other countries.

Figure 4.3 Agricultural General Services Support Estimate for China in nominal US dollars



Source: Constructed with data from OECD

Stocks are being used to try to limit price rises. In early 2010 it was reported that nearly 80% of about 1M tonnes of state maize reserves were sold at prices between US$228 and US$297 per tonne to reduce rising domestic prices. (GIEWS, 13 April, 2010) In December 2010 25M tonnes of grain and oil were released from reserves, to ensure market supplies and stabilize prices. (GIEWS Dec 3rd, 2010) In February 2011, major state-linked grain buyers stopped buying to slow inflation in the grain market (GIEWS, Feb 28, 2011) In March 2011, owing to strong demand from flour mills, the government released 1.1MT of wheat from their reserves (GIEWS, March 2, 2011)

Stocks also apply to pork: China had built a 1M tonne pork reserve, and imported 0.6 M tonnes of pork, destined for large cities, in 2010.

Trade

Trade has played a minor role in stabilising grain supplies.

Import restrictions are being lowered. In 1991, China's average import tariff rate was one of the highest in the world at 47.2% (Orden et al., 2007). This was subsequently reduced during the 1990s, with a large drop in 1996 when the simple average tariff rate was lowered from 35.9% to 23% (ibid). Agricultural tariffs were reduced, but at a slower pace, so that in 2000, China's average agricultural import tariff rates were as follows (ibid):

- For all agricultural commodities, 31%
- For live animals and animal products, 21%
- For grains, 7%
- For fats and oils, 17%, and
- For processed foods, beverages, and tobacco, 29%

By 2004, the average tariff rate for all agricultural commodities was 17% (ibid).

China also used quotas to guide imports, with in-quota tariff rates of 1% for grains and 9% for vegetable oils. Quota volumes were scheduled to increased each year, however over-quota tariffs remained very high, at 65% for most commodities in 2004 (ibid)

When domestic supplies have been buoyant, export subsidies have been used. Since the early 1990s, China has taken measures to reduce these subsidies, initially fixing its export subsidization for the 1988 to 1990 period at about 4% of the total export value in 1987 (Orden et al., 2007). China still subsidized exports for some commodities including maize and rice in the late 1990s, as a means of bolstering domestic prices when faced by large production surpluses. Maize exports were subsidized an estimated 10% in 2001 (Orden et al., 2007)

Recent examples of trade policy changes include:

- Signing an agreement with Cambodia in late 2010 to increase rice imports from there (GIEWS, Oct 26, 2010);
- Removing export tax rebates on 406 products, including fertilizers and corn flour (GIEWS, 15 July, 2010); and
- Extending (until at least 31 May 2010) wheat import tariff reduction of 50%; maize flour tariff exemption (GIEWS, 23 Feb 2010).

4.3 Policies to protect the vulnerable

Over the last decade there has been increasing concern over rising levels of inequality and the gaps in social provision for the poor in China. Consequently, since 2002 government has brought many more people within social insurance, rising from 282M in 2003 to more than 1,000M in 2010. (Huang Zuhui 2010) Increasing social provision may have helped moderate some of the political imperative of dampening price rises.

In 2011, China launched a new programme for rural poverty reduction scheduled to run to 2020. They extended the social protection system from urban to rural people, including the medical cooperative system, the pension system, and the minimum living standard guarantee system (Zhu, 2011). It includes providing food to college students in cafeterias.

They raised the poverty line in rural areas to 2,300 Yuan per capita annual net income[40] (US$1.8 constant 2005 in purchasing power parity per day) and increased investment in hard core poor areas (Zhu, 2011). People who are classified as below the poverty line are entitled to government help including subsidies, job training, discounted loans, and employment opportunities at government-funded rural infrastructure projects (AFP, 2011).

5. Conclusions

Recapping

Six things are clear from this review.

One, ***production of cereals in China has been growing sufficiently in the last twenty years to match increases in demand for human consumption***, in part since the latter demand is growing slowly. Growth was strong enough in the 1990s to allow very large public stocks to be built up.

Two, ***demand for feedgrain, on the other hand, has grown rapidly, since meat consumption is rising.*** Most of the additional meat has come from animals fed with grains, given the limited amount of good grazing available. . Animal feed requirements have led to large imports of soybeans for their protein, while energy comes mainly from maize. From 1990 to 2007, feed use of cereals increased by 48M tonnes, while food use decreased by 3M tonnes. Growing demand for feedgrain has recently started to outstrip domestic production. China may well see increased feedgrain imports from this year into the future since most projections forecast meat consumption rising from their current levels of around 50 kg a head a year, to 70 or even 90 kg a head as and when incomes rise to levels seen in neighbouring Korea and Japan.

Three, ***demand for industrial use of some cereals, above all maize, is also growing quickly***.

Four, given rising demand for cereals for feed and industrial processing, , ***cereals imports are rising***. As recently as 2006, China was a net exporter of over 5Mt of maize, but in 2011 it was a net importer of about 4Mt. This swing of 9Mt in 5 years is about 10% of the 91Mt of maize that was traded on world markets in 2010/2011 (USDA).

Five, ***consumer prices for rice and other cereals have risen surprisingly since early 2010***. Part of this reflects growing demand for feedgrain, but more important has been a large increase in costs of domestic production, owing to rises in prices of inputs such as fertiliser and labour. Costs of production rose in current US dollars by 50–70% from 2005 to 2010.

[40] This is an 80.5% increase from 2010, which researchers contend would raise the official number of rural poor in China from 27M to 100M (AFP, Nov 29, 2011). Official data says China had 94M rural poor in 2000 when the poverty line was set at 865 yuan (ibid).

Despite this sharp rise in costs, China remains a relatively low cost producer of rice: domestic costs remain well below import parity prices.

Six, although policy for cereals production was liberalised from 1978 onwards, ***the state intervenes actively when it seems that production is faltering or that public stocks may be drawn down too far.*** In the 2000s, the state has fostered production by investment in rural investment, research, extension, and by offering farmers attractive prices. Government is also trying to boost farm incomes, partly through direct payments, to reduce the gaps between urban and rural markets. It seems that social protection may be used as a way to cushion the impacts of rising domestic prices for staples on poor and vulnerable consumers.

Answering the questions posed

Can China no longer be discounted as a player on world cereal markets?

For rice it seems likely that China will continue to rely predominantly on local production, remaining a small net exporter. Demand for rice grows slowly, stocks are high.

For maize and wheat, the story is different, since these can be used as feedgrain. Given the rapid growth in demand for meat, it seems likely the country will turn increasingly to international markets for feedgrains — mostly maize. USDA's projections from November 2011 estimate China's net maize imports in 2015 at 7.3M tonnes, or 7% of world trade: up from 1.3M tonnes of net imports (1.4% of world trade) predicted for 2015 in their 2008 projections.

In wheat, China may go from being a small net exporter to a small net importer, though much depends on relative prices of maize and wheat for feed. As the price premium on wheat compared to maize has withered in recent years, China's feedlots have been using more wheat, even if marginally so:11% of China's feedgrain in 2011 was wheat, compared to 89% maize; up from 3% wheat compared to 97% maize in 2005 (USDA). While China was a major wheat importer in the 1980s and 1990s, it achieved near self-sufficiency in the latest decade. With falling wheat consumption per capita, it is expected that China will not return to heavy imports of wheat from international markets, except when feed wheat is much cheaper than feed maize, and substitutes for it.

The great uncertainty here is how fast demand for animal products and thereby for feedgrains will grow. This in turn rests on two sets of assumptions, one being the current level of meat consumption, the other being the level at which individual demand for meat will level off. The former is contested, with some observers adamant that official statistics overstate consumption. The latter depends partly on consumer preferences, but may well be influenced by public policy: it is hard to imagine the leadership will do nothing to deter the adoption of Western diets widely considered to be less healthy than many Asian diets; especially when to do so would increase China's dependence on imported grains.

In sum, for the near and foreseeable future China is likely to become a significant importer of maize, with perhaps 5–10M tonnes a year through to 2015, and probably more after that, putting further

pressure on supplies of a grain that is already in high demand from the ethanol distilleries of the Midwest. [41]

Has the government ceased to try and hold down rice prices at almost any cost?

As costs of production rise, owing largely to pricier inputs and rising wages, prices for consumers are being permitted to rise more than in the past. Some of the price rises may also be driven by people switching from low to high quality rice. That said, China is expected to import 1M tonnes of rice in 2012, 0.5M tonnes or more than in 2011, seemingly taking advantage of cheaper rice being available from Vietnam.

On average as people become wealthier, they demand less cereal for direct consumption. Given their rapidly rising incomes, this may not be a great concern for the urban middle class. Large numbers of poor people however continue to rely heavily on staple cereals. It is not clear how far prices may be allowed to rise beyond current levels. General inflation has been pushing up prices of more than just cereals, and surveys of urban residents show dissatisfaction with rises in food prices and the government's handling of the situation.

It appears that the government may be seeking to protect poor consumers more through safety nets than by holding down staple food prices. The sharp upward adjustment of the rural poverty line in 2011 to allow more people to qualify for state assistance suggests as much. It is to be hoped that these measures will be enough to prevent the social harm that has accompanied faltering cereal production and rising prices in the past.

[41] Import of oilseeds and vegetable oils including palm oil – products little covered in this study – are also projected to rise in the near future

REFERENCES

AFP. Nov 29, 2011. **China raises poverty line for rural dwellers**. AFP http://www.google.com/hostednews/afp/article/ALeqM5gKRESFmGYoLFTJRnWLt2tkRfiY4w?docId=CNG.e39574da76c565cc5f310844b7ae501d.401

Aubert, Claude. 2008. **Food Security and Consumption Patterns in China**. China Perspectives, special feature No. 2008/2

Brown, Lester, R. 1995. **Who Will Feed China: Wake-Up Call for a Small Planet**. Worldwatch Institute.

Business Recorder, March 19, 2012. **China's rice imports from Vietnam seen tripling**. http://www.brecorder.com/world/global-business-a-economy/49999-chinas-rice-imports-from-vietnam-seen-tripling-.html

Cabral, Lídia, Colin Poulton, Steve Wiggins & Linxiu Zhang, 2006, '**Reforming Agricultural Policy: Lessons from Four Countries**', Working Paper, Future Agricultures Consortium. Brighton, Sussex: Institute of Development Studies, University of Sussex

China Daily. Jan 24, 2009. **China removes government control over fertilizer price**. http://www.chinadaily.com.cn/china/2009-01/24/content_7427971.htm

China Daily, Jan 13, 2012. **Food prices drive up CPI**. http://www.china.org.cn/business/2012-01/13/content_24396119.htm

Collins, Gabe & Andrew Erickson, March 28, 2011. **The Saudi Arabia of Corn: Reduce U.S. ethanol production and boost corn exports to China to trim the trade deficit and ensure China's food security**, China SignPost™ (洞察中国), No. 30. http://www.chinasignpost.com/2011/03/the-saudi-arabia-of-corn-reduce-u-s-ethanol-production-and-boost-corn-exports-to-china-to-trim-the-trade-deficit-and-ensure-china%E2%80%99s-food-security/

Economic Research Service/United States Department of Agriculture. 1996. **Long Term Projections for International Agriculture to 2005**. ERS Staff Paper No. 9612, August. Washington, DC.

Fan, Shenggen & Mercedita Agcaoili-Sombilla. March 1997. **Why do projections of China's future food supply and demand differ?** IFPRI EPTD Discussion Paper No. 22. http://www.ifpri.org/sites/default/files/publications/eptdp22.pdf

Gale, Fred; Bryan Lohmar & Francis Tuan. Feb 2005. **China's New Farm Subsidies**. USDA ERS. http://usda.mannlib.cornell.edu/usda/ers/WRS/2000s/2005/WRS-02-02-2005_Special_Report.pdf

Gale, Fred & Kuo Huang. Jan 2007. **Demand for Food Quantity and Quality in China**. USDA ERS Economic Research Report Number 32 http://www.ers.usda.gov/publications/err32/err32.pdf

GIEWS, 2008 to 2011. **Country Policy Monitoring: Main Food-related Policy Monitoring**. http://www.fao.org/giews/countrybrief/policy_index.jsp

Hoffman, Linwood A, & Allen Baker, Oct 2011. **Estimating the Substitution of Distillers' Grains for Corn and Soybean Meal in the U.S. Feed Complex.** USDA ERS. http://www.ers.usda.gov/Publications/FDS/2011/09Sep/FDS11I01/FDS11I01.pdf

Hook, Leslie. April 10, 2012. **Chinese grain imports hit record high**. Financial Times. http://www.ft.com/cms/s/0/9e95275c-82c9-11e1-929f-

00144feab49a.html?ftcamp=published_links/rss/markets_commodities/feed//product#axzz1sOprPfyS.

Hsu, Hsin-Hui & Fred Gale. 2001. **USDA Revision of China Grain Stock Estimates**. USDA Economic Research Service, China: Agriculture in Transition / WRS – 01-2 (53-56)

Huang Jikun, Scott Rozelle, and Mark W. Rosegrant. 1997. **China's food economy to the 21st century: Supply, demand, and trade**. 2020 Vision Discussion Paper No. 19. Washington, D.C.: International Food Policy Research Institute.

Huang, Jikun; Huanguang Qui & Yang Jun, 2008. **Biofuels & the Poor. Case Study: China**. Research project funded by the Bill & Melinda Gates Foundation. http://biofuelsandthepoor.com/case-study-china/

Huang, Jikun; Jun Yang; Siwa Msangi; Scott Rozelle; & Alfons Weersink. Oct 2009. **Global Biofuel Production and Poverty in China**. Biofuels & the Poor. Working Paper 3

Huang, Jikun; Xiaobing Wang, Huayong Xhi, Zhurong Huang & Scott Rozelle. 2011. **Subsidies and distortions in China's agriculture: evidence from producer-level data**. *The Australian Journal of Agricultural and Resource Economics*, 55 pp. 53-71.

Huang, Zuhui, 2010, **China social protection: progress and challenges**, Presentation made 4 March 2010 to conference on Fostering Growth and Reducing Poverty and Hunger in Asia and Latin America, organised by IFPRI and Universidad del Pacífico, Lima, Peru

Lagos, Joshua Emmanuel & Lei Zhang. March, 5th, 2011. China's 12th Five-Year Plan (Agricultural Section) GAIN report, USDA.

Lagos, Joshua E. & Junyang Jiang. May 2011. **China - Peoples Republic of: Agriculture Policy Directive: Number 1 Document for 2011**. USDA GAIN

Lucas, Louise & James Fontanella-Khan. Jan 25, 2012. **Food security: Dampened prospects**. Financial Times. http://www.ft.com/cms/s/0/6ed52738-4746-11e1-b646-00144feabdc0.html#ixzz1kwrq9rH9

Maddison, Angus. 2007. **Chinese Economic Performance in the Long Run: Second Edition, Revised and Updated 960-2030 AD**. OECD, Development Centre Studies

Masuda, Tadayoshi & Peter D. Goldsmith, 2010. Ch**ina's Meat Consumption: An Income Elasticity Analysis and Long-Term Projections.** Poster prepared for presentation at the Agricultural & Applied Economics Association 2010 AAEA, CAES, & WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010. National Soybean Research Laboratory and University of Illinois. http://ageconsearch.umn.edu/bitstream/61601/2/Poster11972AAEA_MasudaGoldsmith20100503b.pdf

Mitchell, D., and M. Ingco. 1993. **The World Food Outlook**. Washington, DC: International Economics Department, World Bank.

Msangi, Siwa & Mark W. Rosegrant, February 2011. Feeding **the Future's Changing Diets: Implications for Agriculture Markets, Nutrition, and Policy**. 2020 Conference Paper 3. 2020 Conference: Leveraging Agriculture for Improving Nutrition and Health. February 10-12, 2011; New Delhi, India. IFPRI. http://www.ifpri.org/sites/default/files/publications/2020anhconfpaper03.pdf

OECD/FAO, 2011. OECD-FAO Agricultural Outlook 2011-2020. http://www.agri-outlook.org/pages/0,3417,en_36774715_36775671_1_1_1_1_1,00.html

Overseas Economic Cooperation Fund, Research Institute of Development Assistance. 1995. **Prospects for grain supply-demand balance and agricultural development policy**. September. Tokyo, Japan.

Orden, David; Fuzhi Cheng; Hoa Nguyen; Ulrike Grote; Marcelle Thomas; Kathleen Mullen; & Dongsheng Sun. 2007. **Agricultural Producer Support Estimates for Developing Countries: Measurement Issues and Evidence from India, Indonesia, China, and Vietnam**, IFPRI Research Report 152. http://www.ifpri.org/sites/default/files/publications/rr152.pdf

Pimentel, David & Marcia Pimentel, 2003. S**ustainability of meat-based and plant-based diets and the environment**. American Journal of Clinical Nutrition, Vol 78, No. 3, 6605 - 6635. http://www.ajcn.org/content/78/3/660S.long

Prakash, Adam. 2005. **Cassava: International market profile**. Background paper for the Competitive Commercial Agriculture in Sub–Saharan Africa (CCAA) Study. FAO / IBRD. http://siteresources.worldbank.org/INTAFRICA/Resources/257994-1215457178567/Cassava_Profile.pdf

Reuters, 2011. **China to extend anti-dumping probe on U.S. DDGs**. Thompson Reuters. http://af.reuters.com/article/commoditiesNews/idAFL3E7NS08I20111228

Rosegrant, M, M. Agcaoili-Sombilla, and N. Perez. 1995. **Global food projections to 2020: Implications for investment**. 2020 Vision Discussion Paper No. 5. Washington, DC.: International Food Policy Research Institute.

Sonntag, Bernard H., Jikun Huang, Scott Rozelle & John H. Skerritt. 2005. **China's agricultural and rural development in the early 21st century**. ACIAR Monograph No. 116, xxxviii + 510p

Wiggins, Steve; Sharada Keats & Julia Compton. March 2010. **What caused the food price spike of 2007/08? Lessons for world cereals markets**. ODI Food Prices Project Report

Wang, XiaoHui. April 2007. **China's Corn Processing Industry: Its Future Development and Implications for World Trade**. http://www.agfdt.de/loads/st07/wangabb.pdf

Woolsey, Scott & Jianping Zhang, Sep 2011. **China - Peoples Republic of: Livestock and Products Annual 2011**. USDA GAIN

Wright, Brian. June 6-7 2009. **A note on International Grain Reserves and Other Instruments to Address Volatility in Grain Markets**. Paper and presentation prepared for the World Grain Forum 2009, St Petersburg, Russia. UC Berkeley. FAO/WB/EBRD working paper.

Xin, Meng. Dec 2004. **Impact of Income Growth and Economic Reform on Nutrition Intake in Urban China: 1986-2000.** IZA Discussion Paper No. 1448. Canberra. http://anon-ftp.iza.org/dp1448.pdf

Yang, Jun, Huanguang Qiu, Jikun Huang and Scott Rozelle. 2008. Fighting Global Food Price Rises in the Developing World: the Response of China and Its Effect on Domestic and World Markets, ***Agricultural Economics***, 39 (2008):453-464. Zhang, Xiaobo; Jin Yang, & Shenglin Wang. May 2010. **China Has Reached the Lewis Turning Point**. IFPRI Discussion Paper 000977 http://www.ifpri.org/sites/default/files/publications/ifpridp00977.pdf

Zhang, Yin & Guanghua Wan. Aug 2006. **The Impacts of Growth and Inequality on Rural Poverty in China.** Research Paper No. 2006/94. UNU-WIDER. http://www.wider.unu.edu/stc/repec/pdfs/rp2006/rp2006-94.pdf

Zhu, Ling. Dec 2011. **Policy Response to Rising Food Price in China**. Board Policy Seminar presentation at IFPRI "Two Food Price Crises in Three Years' by Zhu Ling/Xiaobo Zhango December 5, 2011 Institute of Economics, Chinese Academy of Social Sciences http://www.slideshare.net/ifpri/policy-responses-to-food-price-fluctuation-in-china-ifpri

ANNEX

Timeline: China, 1978 – present

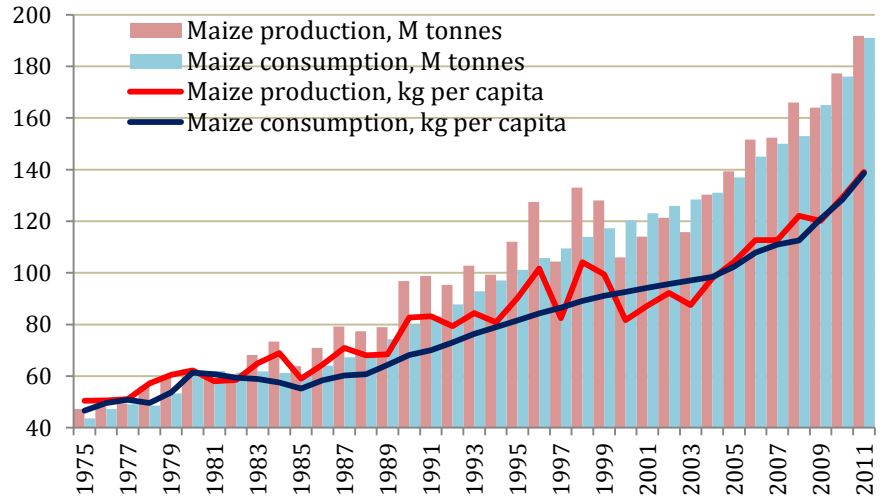
1978	• Reforms begun • Share of **agricultural** commodities **sold through markets**: **6%**
1981	• Household Responsibility System (HRS) is established, giving farm households power to make decisions, and allowing them to sell surplus crops at market prices after they had fulfilled their obligations under the state order system
1984	• As a result of the reforms, China's agriculture revives dramatically, with grain production reaching 407 MT in 1984, a net increase of more than 100MT in only 6 years (Orden et al., 2007). • In light of this bumper harvest, government replaces mandatory procurement with voluntary contracts between farmers and the government • **Leaseholds** are **extended** to 15 years
1985	• Share of **agricultural** commodities **sold through markets 40%**
1990	• Average Chinese diet has **12% animal** products, **71% starchy** staples • Proportion of children under five in China **stunted**: **32.3%** • Proportion of China's population below **US$**1.25/day [US$2/day] **poverty line: 60.2%** [84.6] • Following several years of market stability, state procurement and liberalisation systems substantially liberalized in early 1990s.
1993	• China is a **net exporter** in key cereals (maize, rice, wheat) of **8.5MT**
1994	• China is a **net importer** in key cereals of **14.8MT** • GDP inflation at 20.6% • With high food price inflation, compulsory grain procurement is reinstated
1995	• Lester Brown predicts China's need for significant cereals imports will push up world prices • **Leaseholds** are **extended** to 30 years

	• Share of **agricultural** commodities **sold through markets**: **79%** • **Governors' Grain-Bag Responsibility System** (GGBRS) is introduced, shifting responsibility for grain supply management from central government to the provinces.
1996	• Proportion of China's population below **national poverty line: 6%** • Proportion of China's rural population below national **rural poverty line**: **7.9%**
1997	• Late this year, national government reinstalls a **scheme** of **procurement protection prices** for grains. The state guarantees to purchase certain commodities at prices set by government
1999	• Share of **agricultural** commodities **sold through markets: 83%**
2000	• China begins to **abolish procurement protection prices** • **Agricultural tax reform** started
2001	• Upward revision of China's stock estimates by international agencies as it becomes clear far more must be held than previously imagined
2002	• China **exports over 15MTof grains**, credited with mitigating a spike in international prices • The National People's Congress passes the Rural Land Contract Law, effective March 2003, to establish a comprehensive legal framework for land relations between farmers & collectives. • **Direct subsidies linked to grain acreage** rolled out in **major grain producing provinces** Anhui, Henan, Hubei, and Jilin. • Farmers begin receiving small **subsidies** to buy **improved-quality seeds and machinery** • Prices found to be well integrated, moving consistently together across almost all pairs of markets across China • Quality of grain in state-run reserves low owing to deterioration of stock purchased in large quantities in late 1990s.
2003	• China is **less than 95% self-sufficient in key grains** • **Rural** labour in China begins to become in short supply and wage rates accelerate (Zhang et al., 2010) • Procurement protection prices remain for grain only in key production areas, most of which are eliminated in 2004
2004	• Proportion of China's population below **national poverty line**: **2.8%** • China **resumes futures trading** in maize which was suspended in the late 1990s. • First **nationwide direct subsidies for farmers** introduced, with total subsidies reaching RMB 11.6G, (US$1.4billion). • Agricultural tax reform is expanded across rural China with taxes set to be eliminated in five years. Total annual cost of planned agricultural tax reductions is estimated at US$5–7 billion.
2005	• Proportion of children under five in China **stunted**: **11.7%** • Proportion of China's population below **US$**1.25/day [US$2/day] **poverty line**: **15.9%** [36.3%] • Proportion of China's rural population below national **rural poverty line**: **2.5%** • China's grain markets judged among the most competitive and integrated in the world. For example, in the US the top 5 grain-trading firms have more than 80% of market share; in China this is less than 5% (Sonntag et al., 2005).
2007	• Average Chinese diet has **21% animal** products, **54% starchy** staples • China is a **net exporter** in key cereals of **4.2 MT** • China implements 4 key policy **responses to rising prices** (Lohmar & Gale, 2007) ○ Withdrawal of government rebates of value-added taxes encouraging exports;

	○ Temporary export taxes on grain & flour; ○ Scaling back ambitious policies to retire environmentally sensitive land from cultivation; & ○ Revising plans to develop grain-based biofuel production.
2008	• During global food price crisis 2007/08, Thai rice prices spike 190% from Sep 2007 to May 2008; China rice price rises increase 5 to 10% over the same period (2 to 5% of international rises)
2009	• 1978 – 2009 Agriculture Net Production Index grows 4.9% a year
2010	• **Inflation at 6.6%** • An estimated 27M rural dwellers are classified as below the poverty line
2011	• From Jan 2010 to Oct 2011, Chinese **rice prices rise 20 to 30%** • China is a **net importer** in key cereals of **4.2 MT** • Increased investment in agricultural research, education, extension, irrigation • Minimum procurement prices for wheat and rice raised • China launches a new programme for rural poverty reduction • China raises the rural poverty line to 2,300 RMB per year. An estimated 100M rural dwellers are thereby classified as poor.

Sources: Multiple, see text

Figure A.1 Maize production and consumption, 1975 - 2011

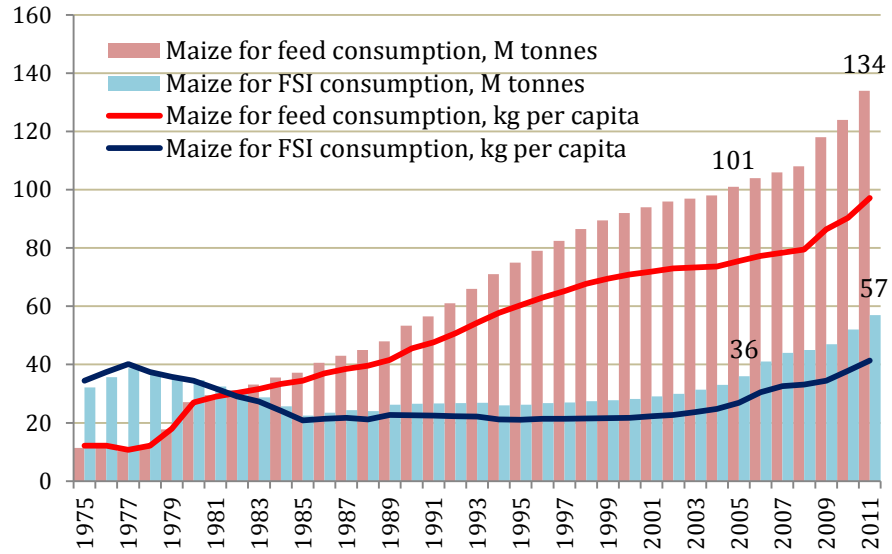


Source: Constructed with data from USDA FAS

Maize production, which dropped below consumption from 2000 to 2003 has exceeded consumption every year since, though the 2011 figures are very close.

Maize consumption per capita, while growing rapidly from the mid 80s appears to have accelerated from the mid 2000s

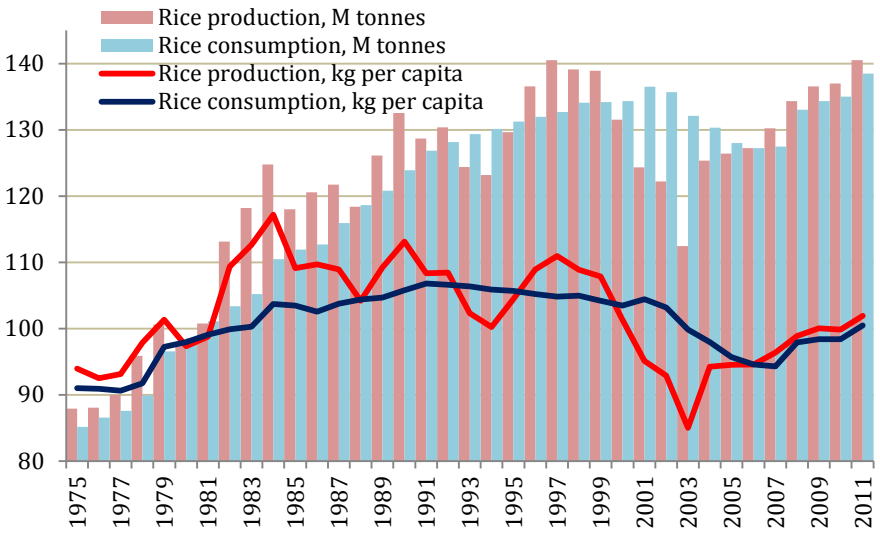
Figure A.2 Maize consumption for different uses, 1975 – 2011



Source: Constructed with data from USDA FAS

Maize for feed consumption overtook FSI consumption in 1982, since when it has been growing at a fast pace. Maize for feed use fell from the late 70s to the mid 1980s, remained mostly flat until around 2005, when it appears to have accelerated. As the industrial and food uses aren't separated, it's not clear to what extent this is driven by industrial use.

Figure A.3 Rice production and consumption, 1975 – 2011



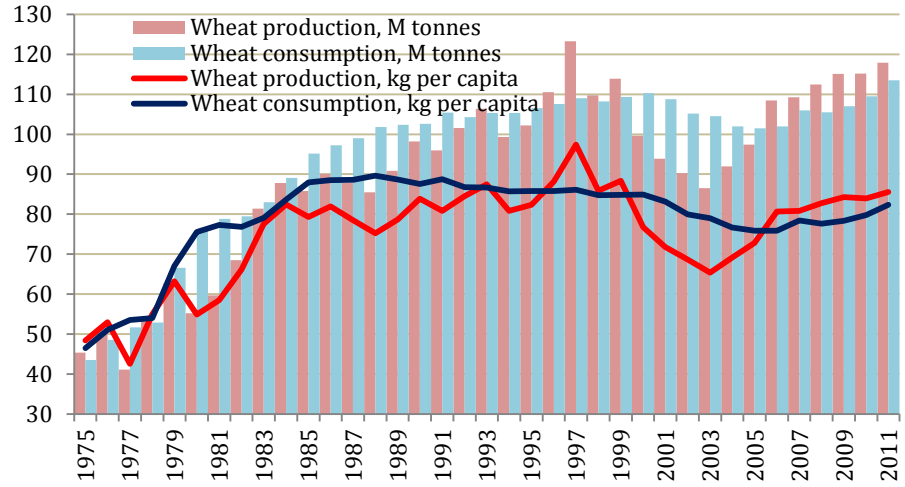
Source: Constructed with data from USDA FAS

Rice production has exceeded consumption since 2007.

In the 2000s it fell behind as there was a policy of lowering national stocks.

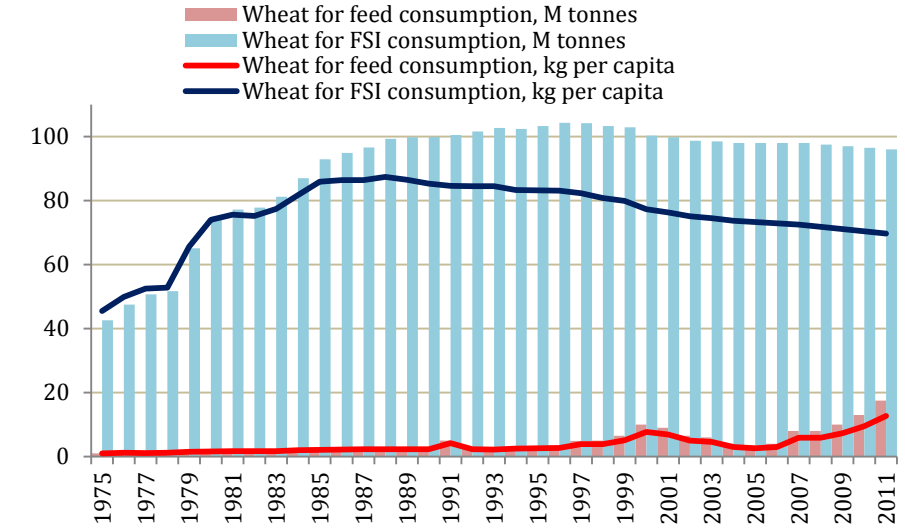
Similar trends appear for wheat, see next figure.

Figure A.4 Wheat production and consumption, 1975 – 2011



Source: Constructed with data from USDA FAS

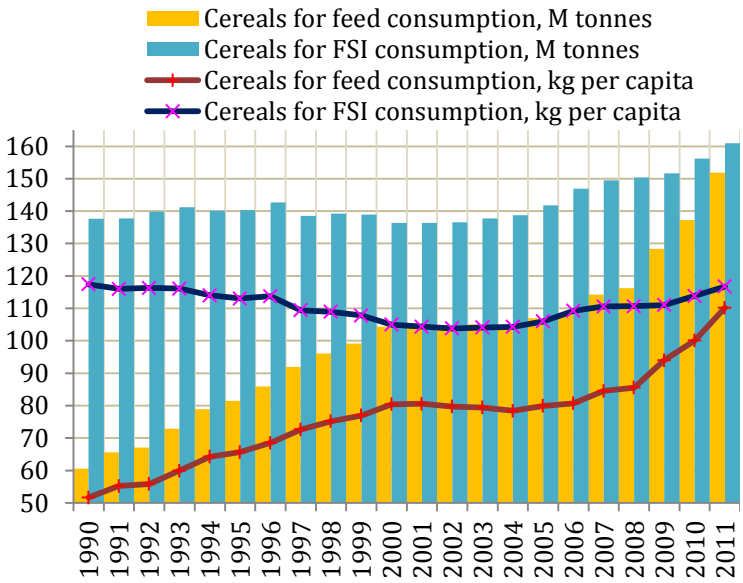
Figure A.5 Wheat consumption for different uses, 1975 – 2011



Source: Constructed with data from USDA FAS

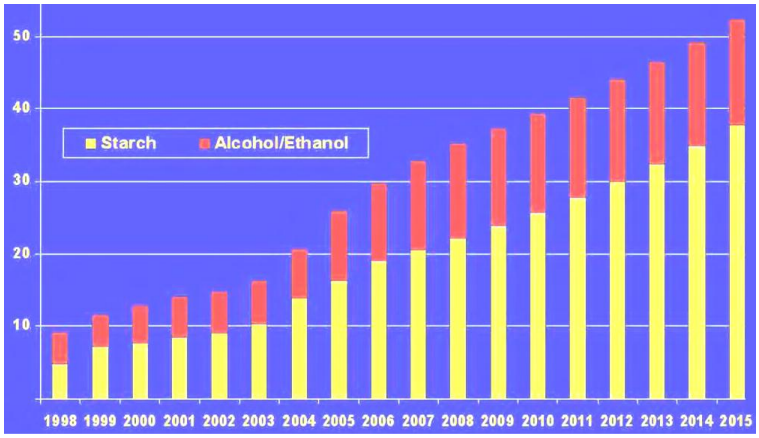
An interesting recent trend in wheat appears to be an increasing use of wheat for feed – this could reflect the smaller margin between maize and feed wheat prices improving the substitutability

Figure A.6 Cereals consumption by different types



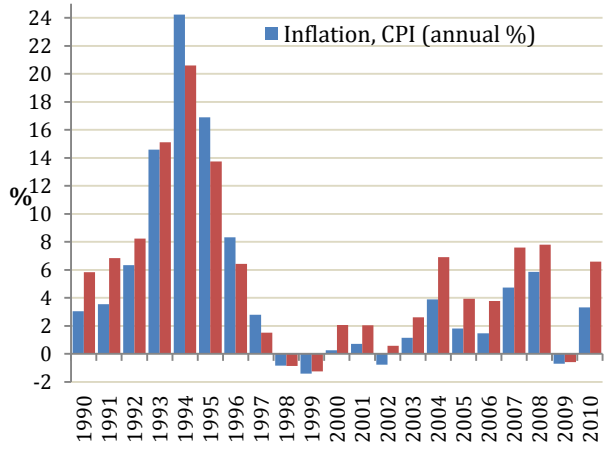
Source: Constructed with data from USDA FAS and FAOSTAT for population estimates. **Note**: Rice is expressed on a milled basis

Figure A.7 Maize use for starch and alcohol/ethanol in China, estimates from 1998 to 2006 and projections from 2007 - 2015



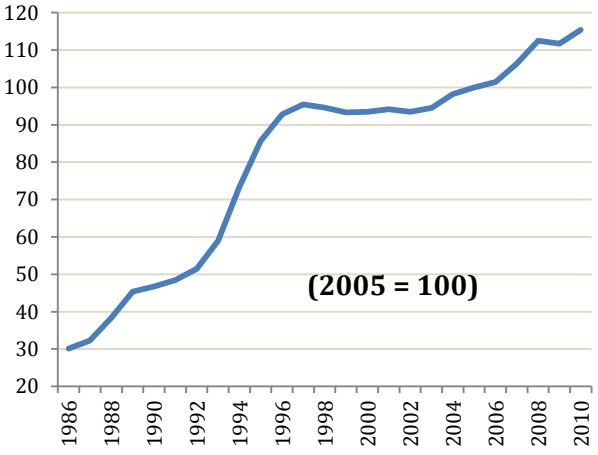
Source: Wang, 2007

Figure A.8 Inflation rates in China, 1990 - 2010



Source: From World Bank WDI data

Figure A.9 Consumer Price Index for China, 1986 - 2010



Source: World Bank, WDI

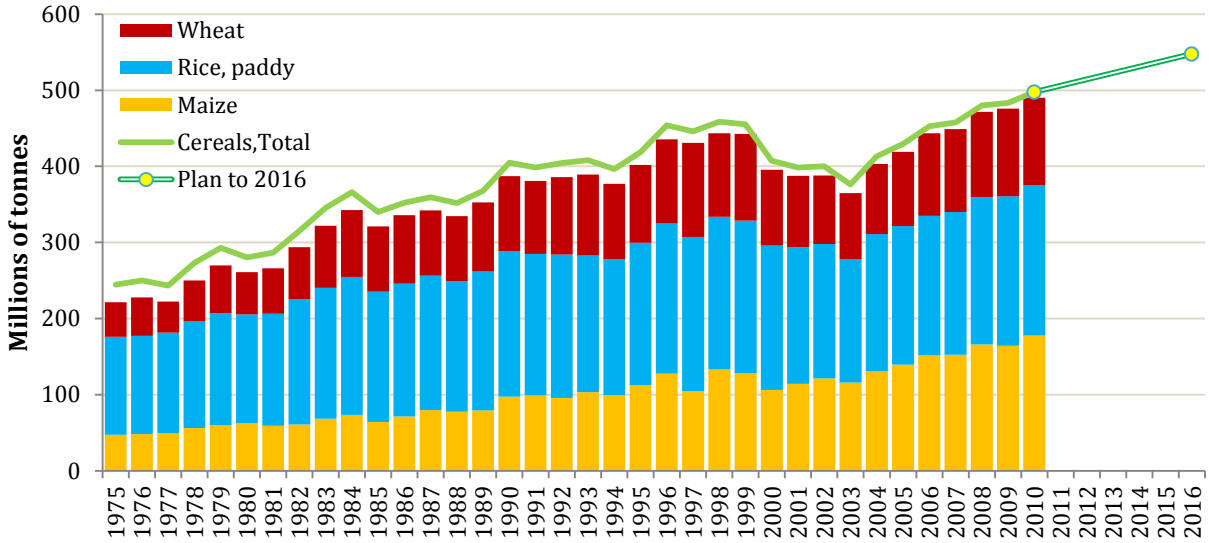
Table A.1 Outline of the agriculture section of the five-year plan: 2011 – 2016

	Strengthen Agriculture and Benefit Farmers, and Speed up the Development of the Socialist New Countryside
1. Accelerate the Development of Modern Agriculture	a. Strengthen Food Security Safeguarding Capacity
	b. Promote Agricultural Structural Strategic Adjustment
	c. Speed up Agricultural Technological Innovation
	d. Improve Social Service Systems for Agriculture
2. Expand Income Channels for Farmers	a. Steadily Increase Incomes from Household Business Operations
	b. Strive to Increase Wage Incomes
	c. Effectively Increase Transfer Income
3. Improve Rural Production	a. Raise the Management Level in Village and Township Planning
	b. Strengthen Rural Infrastructure Construction

	and Living Conditions	c. Strengthen Rural Public Services
		d. Promote Comprehensive Clean-up of Rural Environment
4.	Improve Rural Development Institutional Mechanisms	a. Uphold and Improve Basic Rural Operating System
		b. Establish and Improve the Integrated Urban and Rural Development System
		c. Strengthen Growth Vitality for the County Economy

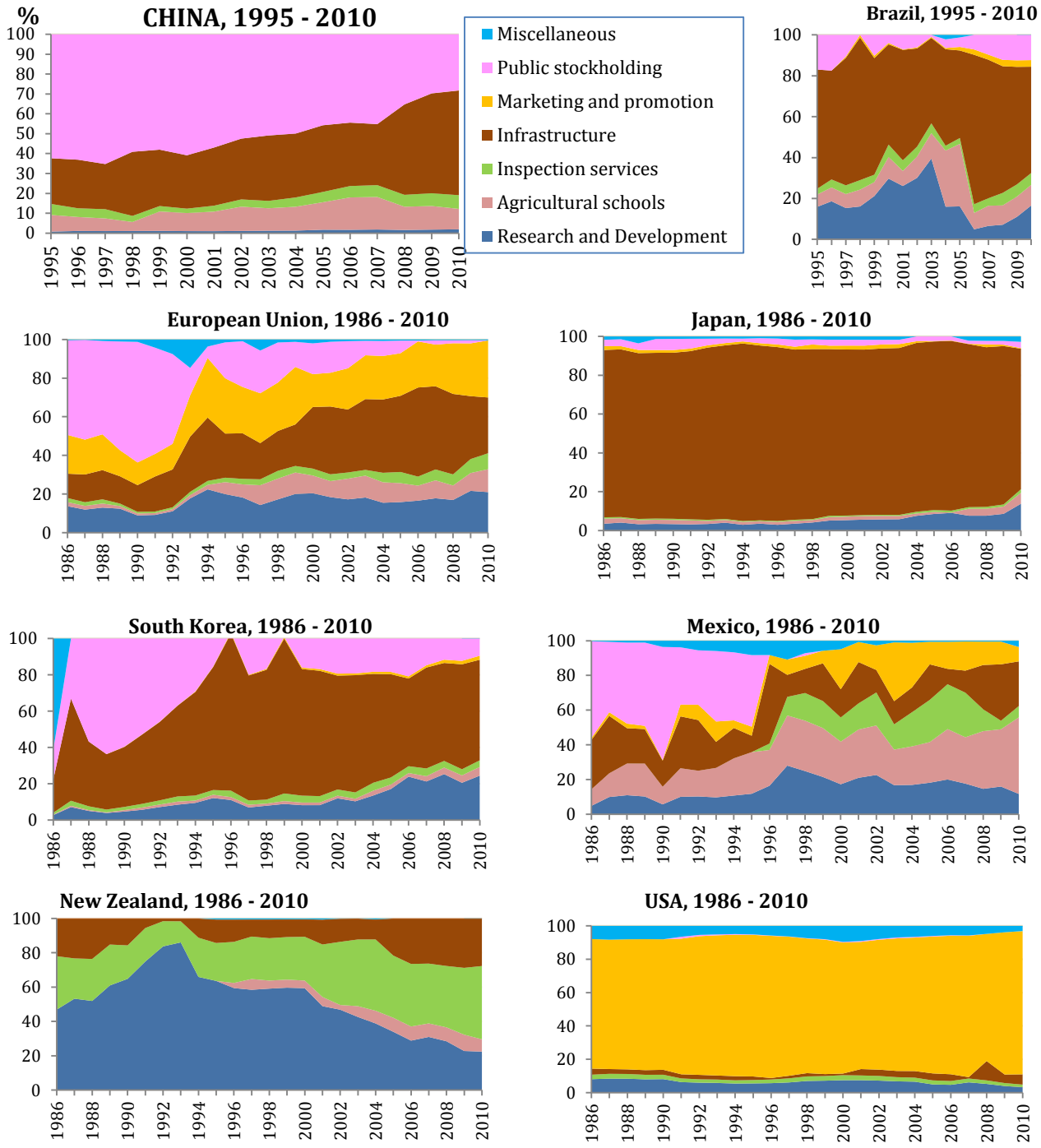
Source: Constructed from Lagos & Zhang, 2011

Figure A.10 Cereal production in China: 1975 to 2010, with goal for 2016



Source: Constructed with data from FAOSTAT and Lagos & Zhang (2011). **Note**: Amounts in this figure appear larger than in Figure 2.1 because rice is displayed on a paddy rather than a milled basis.

Figure A.11 Composition (%) of Agricultural General Services Support Estimate for China compared to other countries and the EU.



Source: Constructed with data from OECD

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