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What China wants

Analysis of China's food demand to 2050

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1 Summary

China's economic growth and process of urbanisation are bringing about profound changes to China's agrifood sector. With demand for agrifood products projected to double between 2009 and 2050, China's agricultural sector is poised to contend with the challenges of depleting natural resource and rising input costs to maintain or improve productivity growth of most major agricultural commodities.

With the population of China expected to increase to about 1.38 billion in 2050, the nature of food demand will depend on a number of factors, including income growth and urbanisation. To investigate these developing trends, this study considers demand across three different income groups: urban high income, urban medium income and rural households. An updated version of the ABARES agrifood model (Linehan et al. 2012a) was used for the analysis. This model is an economic simulation model of global agricultural production, consumption and trade. In this report, agrifood products include primary agricultural products and lightly transformed agricultural products, such as flour and meat, but exclude highly processed food items.

While it is projected that the majority of China's future food demand will be met by an increase in domestic production, there are significant challenges with which the Chinese agrifood sector will need to contend to maintain or increase productivity growth. Investment in the industry is ongoing and required to ensure the degradation and availability of land and water resources, and rising costs for intermediate inputs, do not impede production growth.

The rise in the real value of food consumption in China will be characterised by a move toward more western style diets, with higher intake of high-value foods, such as dairy products, beef, sheep and goat meat, fruit and vegetables, and lower intake of starchy staples toward 2050. Specifically, between 2009 and 2050, the real value of beef consumption in China is projected to rise 236 per cent, dairy consumption 74 per cent, sheep and goat meat consumption by 72 per cent and sugar consumption by 330 per cent (in 2009 US dollars), albeit all from a relatively low base when compared with developed countries. With the exception of dairy products, this projected rise in the real value of consumption is principally attributed to an increase in the quantity demanded rather than a significant projected rise in real prices. For meat and dairy products in particular, the trend is most pronounced among urban high income households, whose income growth is assumed to be significantly greater than the two other income groups.

For rural consumers, growth in high value commodities is also projected but the increases are smaller, on average, than both the high and medium income households in urban areas. This is attributable to the assumed decline of the rural population combined with relatively lower income growth.

For traditionally important staple grains in China, such as rice, the real value of consumption is expected to fall across all three household groups given the increasing trend to more western style diets in urban areas, combined with the declining size of the rural population.

China's production of agrifood products is projected to increase for most commodity groups but the increase is smaller than that of consumption. As a result, a portion of the demand for beef, sheep and goat meat, oilseeds and dairy products is projected to be met by imports. For these commodities, most of the import growth is projected to occur between 2009 and 2029, rather than between 2030 and 2050, because of higher population growth expected over the earlier period

To investigate the effect policy can have on agricultural prices, this report includes a scenario that assumes the gradual removal of all domestic consumer and producer support in China between 2030 and 2050. In this scenario, agrifood production and consumption continue to rise markedly out to 2050 because of China's income growth. However, the respective increases are more subdued than in the reference scenario because the removal of consumer and producer support raises production costs and consumer prices, and hence total demand for agrifood products is lower.

The opportunities that Chinese demand growth will provide to food producers and exporters to 2050 are significant. To fully realise those opportunities, it will be important for Australian industries to utilise the working relationships with different agents in the food supply chain in China. For example, supermarkets and hypermarkets, which have an increasing presence in urban food retailing in China, are playing an important role in meeting the demand for high-value products by urban consumers. With higher incomes, urban consumers are also expected to increase their expenditure on convenience foods, fast food and restaurant food. Australian industries will need to be responsive to these changes if they are to successfully compete in the Chinese market over the long term.

2 Introduction

World demand for agrifood products is expected to increase significantly through to 2050, with the real value of Asian agrifood demand expected to double (Linehan et al. 2012b). The rise in the global population, per person incomes and rates of urbanisation, especially in developing countries, are driving this increase. Nowhere is this more pronounced than in China, the world's most populous country, where over the past two decades, real gross domestic product (GDP) has risen by an average of 10 per cent a year and food consumption has also risen sharply. Over the long term, the real value of the projected increase in food demand in China accounts for more than 40 per cent of the global increase (Linehan et al. 2012b).

Given China's growing importance in world agrifood markets, the objective of this report, the second in the *What Asia wants* series, is to build upon existing ABARES analysis of global food consumption and production (Linehan et al. 2012b, 2013; ABARES 2013) by examining the factors likely to influence the future pattern of Chinese food consumption. The analysis is distinct from that carried out in *What Asia wants: Long-term food consumption trends in Asia* (2013) because it focuses on projected household consumption trends across three different income strata in China: urban high income, urban medium income and rural households.

Urban consumers generally account for most of the growth in high-value products over the projection period because of rising urban populations and incomes. As a result, per person consumption of high-value commodities such as meat, eggs, dairy products and fruit is much higher in urban areas than in rural areas, while consumption of food grains is lower. Since income growth among high income households is almost three times that of urban middle income households, most of the consumption growth is occurring in the high income group. For traditionally important staple grains such as rice, consumption is expected to fall across all three household types as high income households move away from staple grains to more high value products and as the size of the rural population declines.

For this analysis, an updated version of the ABARES agrifood model (Linehan et al. 2012b) was developed. This model is an economic simulation model of global agricultural supply, demand and trade. The agrifood products include primary agricultural products and lightly transformed agricultural products, such as flour and meat. Highly processed food items are not included. The model has been updated to a new baseline (from 2007 to 2009). Consumption in the model is apparent consumption, which reflects the total use of agrifood products (food, feed and industrial use). Income growth estimates across the three income strata are also included, as identified above. Other demand and supply-side assumptions can be found in Linehan and colleagues (2012b, 2013).

Section 2 of this report examines the demand drivers expected to influence China's food demand trends to 2050 and presents some of the income and population assumptions used in the analysis. Section 3 discusses the production constraints or challenges with which China will have to contend over the longer term in order to maintain growth in its agricultural output. Section 4 provides results from the reference scenario, which identify projected consumption, production and trade trends to 2050. Section 5 investigates an alternative set of consumption, production and import trends if all domestic consumer and producer support is gradually eliminated between 2030 and 2050. Section 6 summarises some of the main findings of the analysis and discusses some of its implications for Australia.

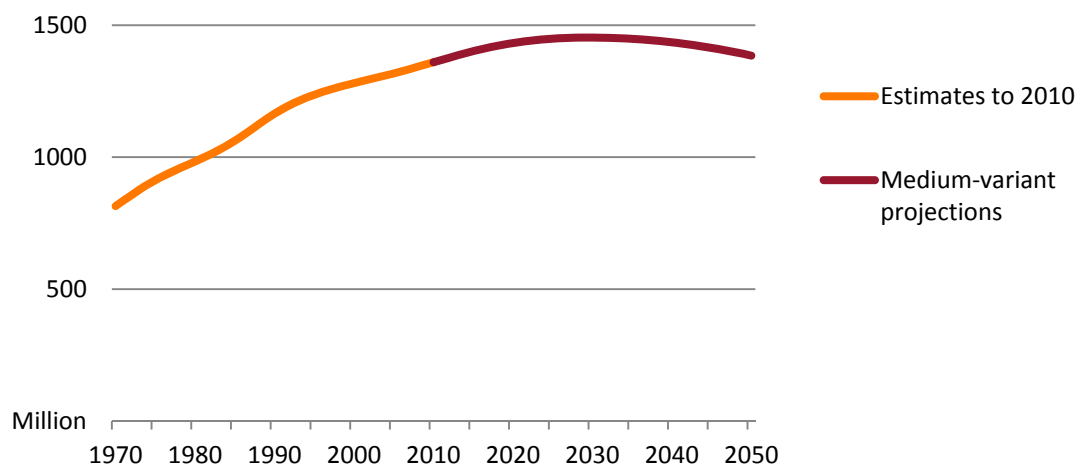
3 Drivers of food demand

Food consumption at the national level relates to the size of the population and the amount of food consumed by each person. Changes in the total quantity of food consumed per person as well as in the mix of foods in the diet are largely influenced by developments in levels of affluence and factors such as changes in the age structure of the population and lifestyle. For that reason, urban dwellers typically have different diets from rural dwellers. This chapter briefly discusses these factors with the aim of demonstrating their effect on food consumption over time.

Population

Between 1970 and 2010 China's population grew from 0.8 billion to 1.37 billion (Figure 1). The rate of growth over this period was not even. Over the first half of the period it averaged 1.8 per cent a year, while in the latter half it slowed to an average of 0.8 per cent a year. According to the medium-variant projections of the United Nations (United Nations Population Division 2013a), slower population growth of 0.3 per cent is predicted between 2010 and 2030, before the population declines to about 1.38 billion by 2050.

Figure 1 China population, actual and projected



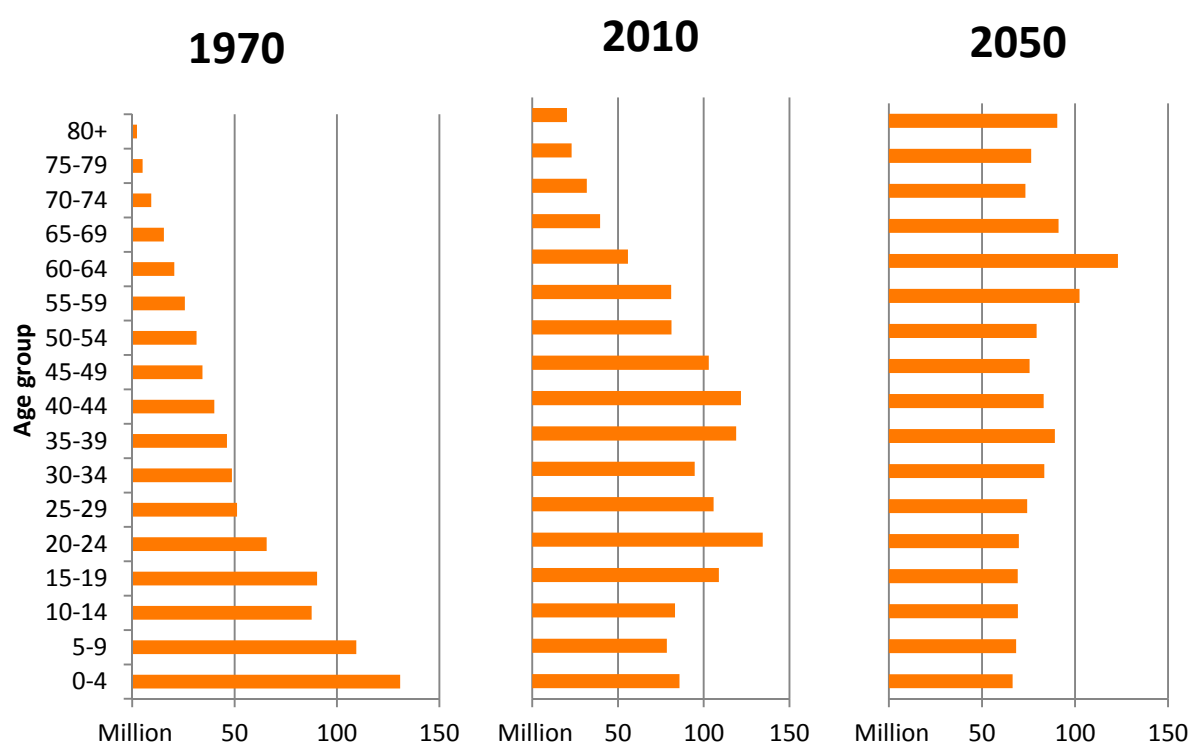
Data source: United Nations Population Division 2013a

Part of the slowing growth in population has been attributed to China's one-child policy, (Morgan, Guo & Hayford 2009). However, there are now additional economic and social factors restraining couples from having large families, such as demands for more schooling, higher professional aspirations and economic insecurity. Any increase in China's fertility rate that might result from a change to the one-child policy would therefore be likely to be small, at least after an initial surge, and fertility would continue to remain below the replacement rate (Morgan, Guo & Hayford 2009).

China's declining birth rate, coupled with increasing longevity, has resulted in notable changes to the age distribution of the population (Figure 2). The proportion of younger people in the population has declined, and is expected to continue to decline, while the proportion of older people is increasing. The number of people aged 65 and over accounted for only 5 per cent of the

population in 1990 but is expected to reach almost 25 per cent by 2050 (United Nations Population Division 2013a).

Figure 2 China, total population, male + female, distribution by age



Data source: United Nations Population Division 2013a

Notes: 1970 and 2010: Estimates; 2050: Medium-variant projections.

This changing age structure has an effect on food demand. Older people have lower nutritional needs and lower food expenditures. However, consumption of dairy products, for example, is higher when there are children in the household.

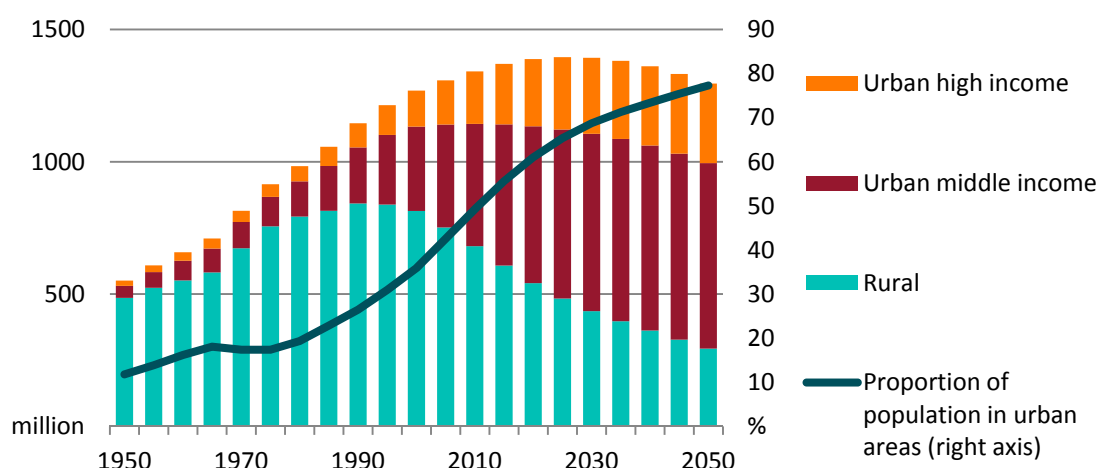
Urbanisation

Another driver of the changes in food consumption is the proportion of the population living in urban areas in China, which has increased markedly in the past few decades. In 1990 just over 25 per cent of China's population lived in urban areas; in 2011 it had increased to 50 per cent; and it is projected to increase to more than 75 per cent by 2050 (Figure 3). Urban dwellers have higher incomes and different dietary and shopping patterns from rural dwellers. Per person consumption of meats, eggs, dairy products and fruit is much higher in urban areas than in rural areas, while consumption of food grains is lower.

While many workers from rural areas migrate permanently to the cities, others work in the cities for a number of years before returning home. Permanent migration has been discouraged by the Hukou system, also known as the house registry system, that requires people to register at their place of residence and allows the provision of health, education and social welfare services only in the place they are registered (Mullan, Grosjean & Kontoleon 2011; Carrillo 2004).

In this report, the urban population is divided into two strata according to income. They are defined as urban high income and urban middle income. The term "middle income" is used to distinguish it from rural incomes, which are, on average, lower than urban "middle incomes". In 2009, urban high income households were considered to comprise the top third of urban per person incomes in China (National Bureau of Statistics of China 2013a, b, c). In this report, this definition is assumed over the projection period.

Figure 3 China's urban and rural populations



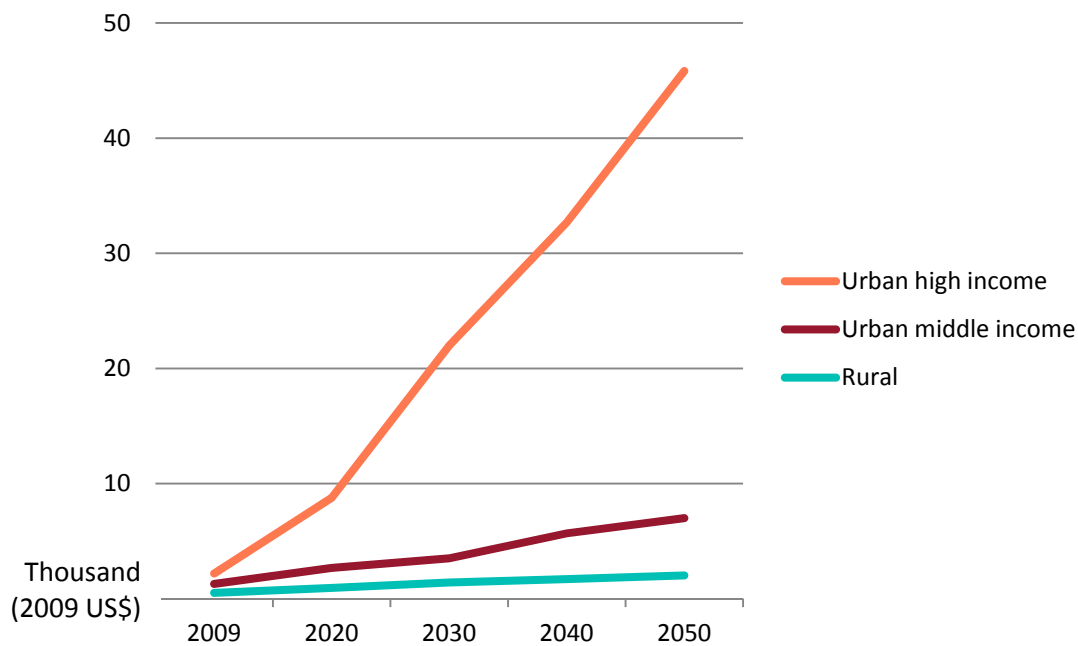
Data source: United Nations Population Division 2012, National Bureau of Statistics of China 2013c, ABARES model assumption

Income growth

China's GDP has grown more strongly than in many other countries. There have been only a few years in the past 3 decades that growth did not exceed 8 per cent. Chinese consumers now have much higher real incomes than they did 30 years ago.

Urban incomes are, on average, three times those of the rural population and the gap between urban and rural incomes has been increasing (Figure 4). Income inequality is also high and increasing within each group, and it is assumed to do so over the projection period. Despite average incomes having increased markedly over recent decades, there remains a considerable portion of the population living in poverty with limited capacity to buy food.

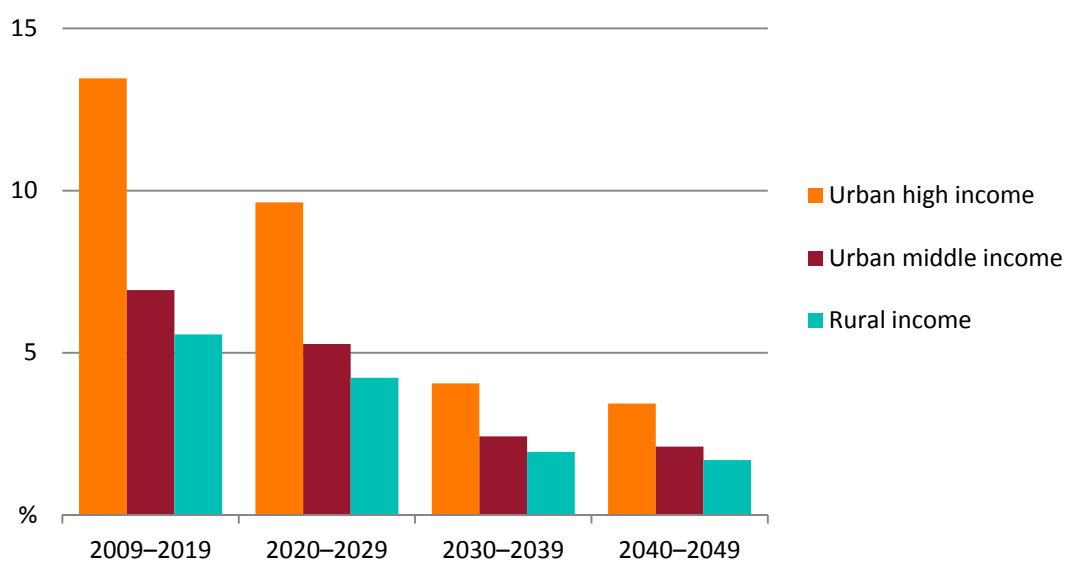
A plan to address these inequalities was released by the State Council in February 2013. (Salidjanova 2013). A reduction in income inequality would be expected to lead to increases in the level and changes in the composition of food consumption.

Figure 4 Per person income by income group

Note: 2009 incomes by income group were reported originally in yuan and were converted to US dollars according to a fixed exchange rate of 6.8310 yuan/USD, as provided by the US Federal Reserve (2013). This exchange rate was applied over the projection period.

Data source: Bureau of Statistics of China 2013a, b; ABARES agrifood model assumption

China's GDP is expected to continue to grow but at a declining rate. It is assumed in this analysis that China's GDP growth will decline to 5.5 per cent annually to 2030, then to an average of 2.2 per cent a year. Despite the lower assumed rate of growth, China's GDP in real terms will nevertheless more than quadruple between 2012 and 2050. Urban high incomes are assumed to continue to grow faster than both urban middle and rural incomes, further widening the absolute income disparity between these groups (Figure 5).

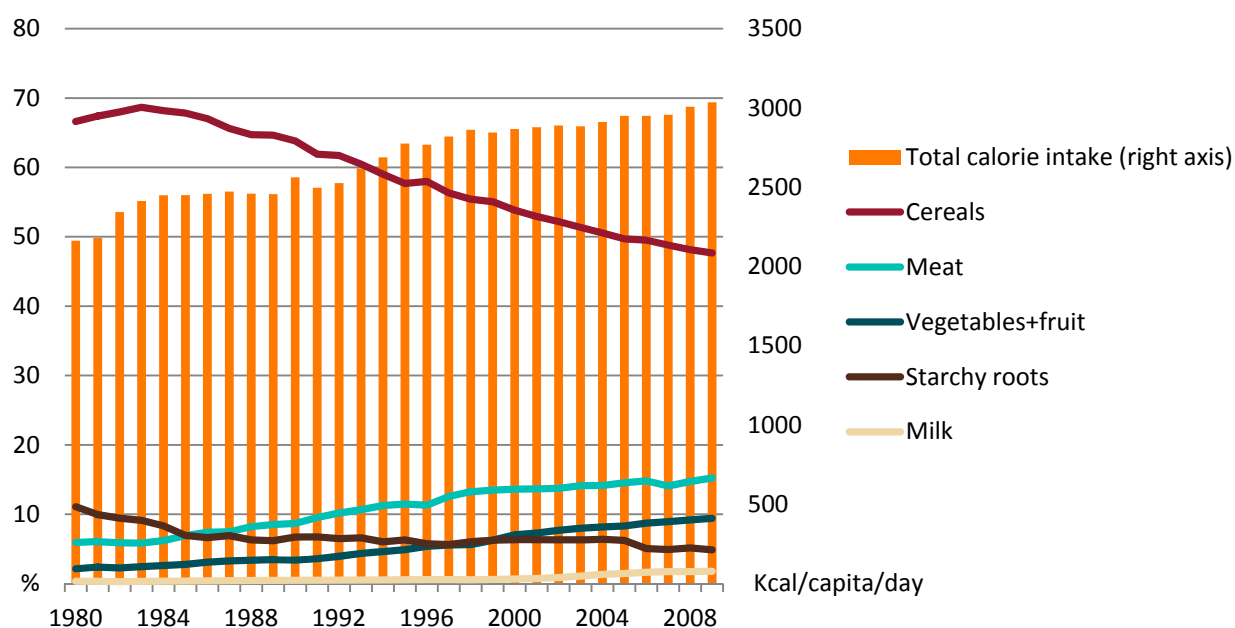
Figure 5 Annual average income growth rates

Data source: ABARES agrifood model assumption

Consumption trends

Higher incomes in China have resulted in an increase in food consumption and in changed patterns of food consumption. Between 1980 and 2009, total food consumption per person, measured in calories, increased by 40 per cent (Figure 6). Total protein intake increased by 73 per cent. The contribution of cereals to the total calorie intake declined from 66 per cent in 1980 to 48 per cent in 2009 and consumption of pulses and starchy roots, particularly sweet potato, also declined. Consumption of meat, which contributed 5.9 per cent to China's calorie intake in 1980, grew to 14 per cent in 2009. Consumption of fruit, vegetables and milk also increased over this period (FAO 2013a).

Figure 6 China – calorie consumption by source



Data source: FAO 2013a

The changing demographics and diets occurring in China have led to a change in the way food is marketed. Modern and efficient food marketing chains with established quality and safety regimes have become increasingly prevalent in response to consumers' changing demands (OECD-FAO 2013). Supermarkets account for an increasing proportion of food retailing in China and this is expected to continue as the urban centres expand.

Consumption of food in restaurants has also increased in China as incomes have risen and as the population has become more urbanised. Expenditure on food consumed outside the home by urban consumers increased from 15 per cent of total food expenditure in 2000 to 22 per cent in 2009 (Zhou et al. 2012). Consequently, the consumption of some foods, such as meat, has risen because it forms a larger component of restaurant meals than of meals consumed at home.

Growth in China's population and incomes will continue to influence food consumption in the period to 2050. Despite the slowing rate of population growth, China is expected to have 26 million more people in 2050 than in 2010, with the majority living in urban areas (United Nations Population Division 2012). With GDP growth expected to remain strong by international

standards over the projection period, China's population will enjoy the benefits of economic development. Rising incomes will ensure that demand will grow for a wider variety of foods than in the past. The form of that demand, in terms of the commodities that will be demanded and by which consumer groups, is the focus of this analysis.

4 Production constraints in Chinese agriculture

China's agricultural sector will be challenged to supply the quantity and variety of foods being demanded over the next forty years. While it is projected that the majority of China's future food demand will be met by domestic production (ABARES 2013), this will not be easy. There are many challenges to improving productivity growth, including increasing input costs and depleted or deteriorated natural resources used in agricultural production. This chapter briefly addresses some of these issues.

A historical perspective

Agricultural production in China has increased strongly over the past three decades. Between 1980 and 2011 production of vegetables increased by 10 times, meat by 5.5 times, and wheat production doubled (FAO 2013b). Coarse grain was one of the few commodity groups where production declined.

The increase in production has come from the increased use of some inputs and advances in productivity, that is, in the efficiency of input use. The inputs used in agricultural production include labour, land, capital (such as machinery and structures) and intermediate goods such as fertiliser, pesticides, energy, seed and feed. Wang and colleagues (2013) estimate that growth in productivity contributed 2.7 per cent a year to agricultural output growth, equivalent to just over half of the total 5.1 per cent annual growth between 1985 and 2007. The remaining 2.4 per cent of total annual growth was attributable to increased input use.

The use of capital in agriculture expanded by 3.5 per cent and intermediate goods by 6.4 per cent a year between 1985 and 2007. However, the use of labour and land contracted by 0.4 per cent and 0.6 per cent a year, respectively, through this period (Wang et al. 2013).

Significant improvements in yields contributed to the rise in production. For example, wheat yields increased from 1.9 to 4.8 tonnes per hectare between 1980 and 2011, maize from 3.1 to 5.7 tonnes per hectare and soybeans from 1.1 to 1.8 tonnes per hectare (FAO2013b).

Productivity growth

Agricultural research and development has been a major contributor to productivity advances and hence to growth in agricultural production in China. However, while China's aggregate spending on agricultural research exceeds that of any country other than the United States, research spending relative to the size of the agricultural economy has been low compared with other countries. Agricultural research intensity (agricultural research expenditures as a proportion of agricultural gross domestic product) in China was 0.38 per cent in 2000, while the average for developing countries was 0.55 per cent and for developed countries 2.35 per cent (Chen & Zhang 2010). While there has been some increase in private research expenditure since 2000, public expenditure dominates.

Given the ongoing investment in China's agricultural sector, the analysis in this report assumes productivity in Chinese agriculture will continue to grow, permitting China's food production to increase despite constraints on the availability of land and water (discussed below). The use of capital and intermediate inputs is also assumed to increase.

There are two types of productivity improvements in the ABARES agrifood model: improvement in land productivity and improvements in total factor productivity (TFP). Improvements in land productivity reflect a reduction in the input of land per unit of output of cropping or livestock product. This is a partial measure of productivity, where the more effective use of a single factor, land, leads to technological advancement. TFP is a measure of the ratio of total output relative to total inputs, of which there could be many. More details about productivity assumptions in ABARES agrifood model can be found in Linehan and colleagues (2013)

The productivity projections used in this study are provided in Table 1. TFP and land productivity growth rates are projected to be higher for livestock-based industries than for cropping.

Table 1 Average productivity growth rates by commodity group in China, from 2009 to 2050

Productivity type	Meat (%)	Dairy products (%)	Cereals (%)	Fruit and vegetables (%)	Other food (%)	Total (%)
Land productivity	2.35	2.35	1.12	0.54	0.18	n.a.
Total factor productivity	1.58	1.55	1.06	0.71	1.54	0.97

Note: other food includes sugar, eggs and oilseeds.

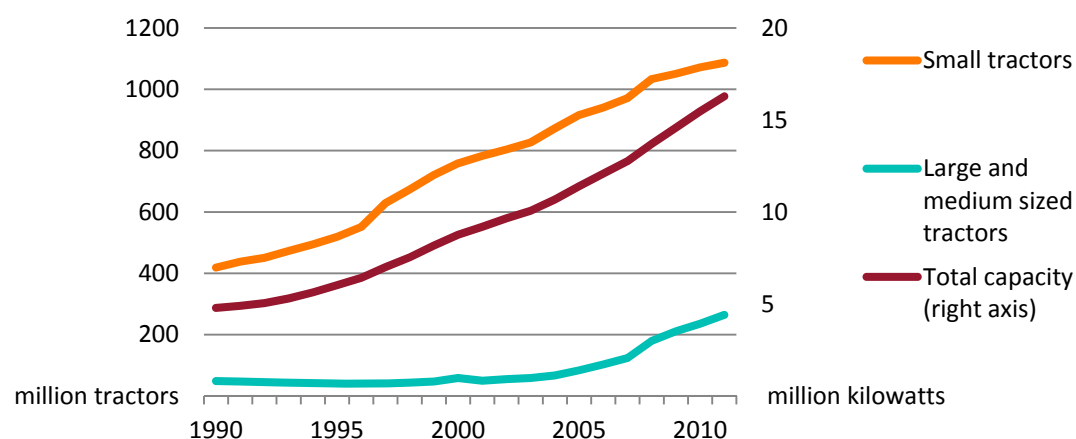
Data source: Agricultural Modelling Intercomparison and Improvement Project (AgMIP); ABARES Global Trade and Environment Model (GTEM); ABARES Agrifood Model

Productivity projections used in this study are lower than OECD–FAO (2012) 2001–2040 projections. For world agrifood production as a whole, the OECD–FAO (2012) projects the average TFP growth to be 1.38 per cent a year from 2001 to 2040. This compares with an assumption of 1 per cent a year from 2009 to 2050 used in this study.

Input use

For many decades China had a pool of excess rural labour available to agriculture. However, with industrial progress and the movement of the population to cities, this excess labour has diminished. Kwan, Wu & Zhuo (2012) estimate that between 1995 and 2009 the labour surplus fell from 119 million to 55 million, or from 37 per cent of the agricultural workforce to 22 per cent. Mai & Peng (2009) forecast that surplus rural labour will fall to about 25 million by 2015. As it contracts, wages can be expected to rise further. As a result, increases in food production can no longer be based on the utilisation of cheap surplus labour.

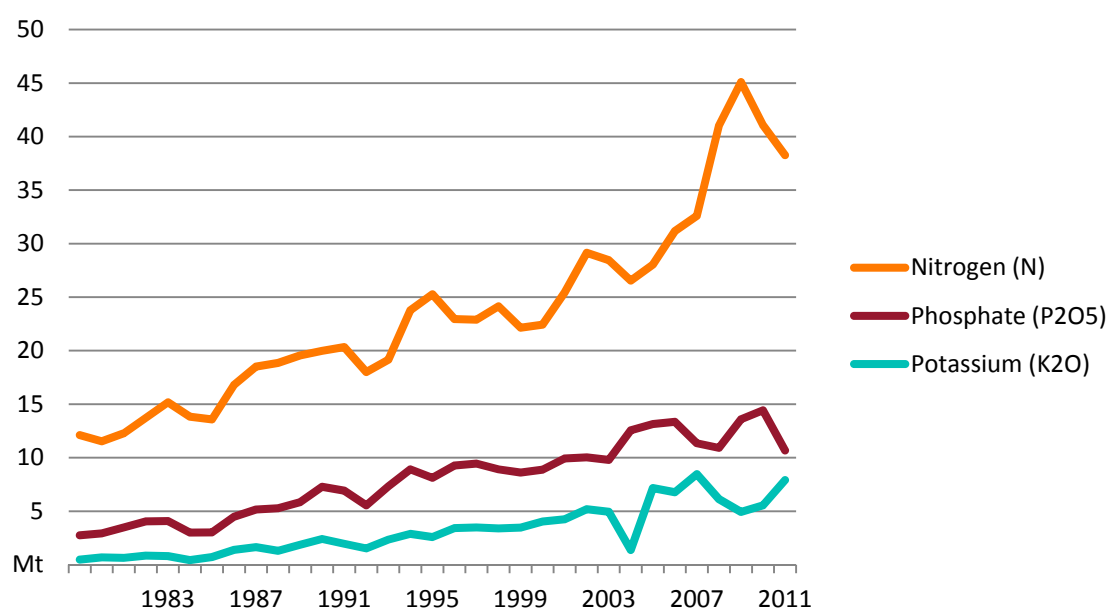
As the supply of labour has decreased, the use of farm machinery in Chinese agriculture has grown markedly. China's stock of tractors has increased steadily, from 7.8 million in 1990 to 22.5 million in 2011, an increase in aggregate capacity from 287 million kilowatts to 977 million kilowatts (Figure 7). Notably, the use of large and medium tractors has increased at a faster rate than small tractors since the early 2000s, reflecting the modernisation of the agricultural sector as land has been consolidated into larger, more commercial holdings than in the past (China Economic Review 2013).

Figure 7 Agricultural machinery, China

Data source: National Bureau of Statistics of China 2013d

China's agricultural output growth could not have been achieved without the increased use of fertiliser. The annual use of nitrogen, phosphorus and potassium in fertiliser increased by 3.7 per cent, 4.3 per cent and 9.1 per cent, respectively, between 1980 and 2012 (Figure 8), making China now one of the world's largest users of fertiliser. However, the rate of growth in fertiliser use may be reduced in the future as their costs rise, particularly if subsidies were to be reduced. In addition, restrictions on fertiliser production and use could be mandated in China in the long term given the associated negative environmental impacts.

Given the research and development being undertaken in China's agriculture sector, there is considerable potential for China to improve the efficiency of fertiliser use, thereby stabilising or reducing the quantity of fertiliser required but still achieving improvements in yields (Ju et al. 2009).

Figure 8 Fertiliser use in China

Data source: FAO 2013b

Like many agricultural producing countries, China is challenged by declining availability of land and water for production. The conversion of land from farming to urban and industrial purposes has resulted in the loss of approximately 8.2 million hectares of arable land since 1997. In this report, it is assumed that land available for cropping will decline by 4.2 per cent and pasture by 5.1 per cent over the period to 2050.

China's agriculture is heavily dependent on irrigation. Some 62 million hectares—55 per cent of the land under cultivation in China—is irrigated. To support irrigators and other water users, China has constructed 86 000 reservoirs and drilled more than four million wells since the 1950s (Yu 2011). Two recent projects aimed at providing additional water resources are the Three Gorges Dam and the South-North Water Diversion. The latter was constructed to carry water from the south, which has an abundance of water, to the drier north.

Historically the productivity of water use in agriculture has been low because of extensive waste in irrigation systems and sub-optimal allocation among crops and between regions. However, investment in the sector has led to considerable achievements in improving water efficiency. Annual water use per irrigated hectare has dropped nearly 19 per cent, from 7935 to 6450 cubic metres over the past decade (FAO 2011).

While the availability and cost of irrigation water is likely to continue to be a challenge to agricultural production, there is scope for further efficiencies to be found in a variety of ways, including the use of technologies such as drip irrigation, coupled with pricing policies that encourage effective allocation of water (FAO 2010a). Continued improvements in the efficiency of water use are expected to permit an increase in agricultural production from existing water resources, and will allow the agricultural sector to be increasingly resilient to the pressures placed on it by competing demands for water.

The gradual deterioration in the quality of arable land and water also poses challenges for China's agriculture. Land degradation is extensive, and it is estimated that polluted water is used on 7.4 per cent of China's irrigated land (Xie 2009). While various policies and programs have been implemented to address these problems, and agricultural production has continued to rise, improvements in resource productivity are not accounted for in the ABARES agrifood model.

Despite the challenges China is facing with the deteriorated state of its resource base, food production has increased markedly over the past few decades, and is expected to continue to do so. As in other countries, past increases have been based on improved yields that were realised through the effective use of inputs and improved technology. The introduction of more advanced technologies, encouraged by appropriate policies and supported by ongoing research and development, is expected to drive future productivity gains. This, coupled with ongoing capital investment in agriculture, should ensure that food production in China continues to increase.

5 Reference scenario

The objective of this analysis is to identify and to quantify projected changes in the Chinese demand for a range of agricultural commodities over the longer term across urban and rural households. An updated version of the ABARES agrifood model (Linehan et al. 2012a) was developed to investigate these potential trends. Among the changes to the model was an update of the baseline data from 2007 to 2009. Other changes include a re-aggregation of some country and commodity groups to allow for more detailed analysis.

The projections determined in the reference scenario for China of the agrifood model are dependent on a set of assumptions, as discussed in Chapter 2. To summarise,

- population growth will average 0.3 per cent between 2010 and 2030, before the population declines to about 1.38 billion by 2050
- the proportion of the population in urban areas is assumed to increase from 50 per cent in 2009 to 75 per cent by 2050
- average GDP growth of 5.5 per cent a year is assumed for China between 2009 and 2030, and 2.2 per cent a year from 2030 to 2050
- agricultural productivity in China will continue to grow according to the estimates provided in Table 1
- land available for cropping will decline by a total of 4.2 per cent and pasture by 5.1 per cent over the period to 2050.

The population is divided into three income strata, including urban high and middle income households, and rural low income households. Across these three household types, the assumptions on income growth to 2050 are made based on historical income data from the National Bureau of Statistics of China (2013a, b). Among urban households, income growth is assumed to continue at a higher rate than rural households given the faster rate of economic development in urban areas and the wages paid in these regions. Additionally, within the urban consumer group, income growth is significantly higher for high income households than for medium income households (Figure 5). The high income urban households are assumed to comprise the top third of the urban population over the projection period. Chinese household food consumption data (National Bureau of Statistics of China 2013e, f) have been used as the basis for an investigation of consumption across urban and rural households.

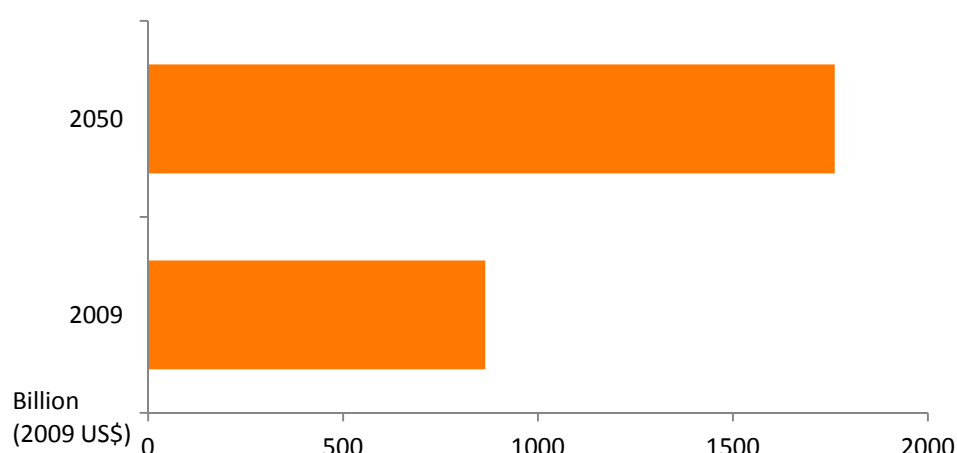
China's agricultural sector is heavily protected. On the production side, the principal form of market support is provided through tariffs, tariff rate quotas and state trading. Additionally, China offers a guaranteed price for rice and wheat and has other ad hoc interventions on a range of agricultural commodities. Producers also benefit from direct payments for grain producers, agricultural input subsidies and subsidies on agricultural insurance premiums (OECD 2013). The high level of support for the agricultural sector in China has significantly lowered the cost of production faced by producers and has, as a result, led to much higher agricultural production than would have occurred without the support. Consumers have also benefitted from government support since the price paid for food is lower than would otherwise be the case, and hence consumption is higher. In the reference scenario, no change to China's market support policies is assumed. However, a preliminary examination of the effect on agrifood consumption of changes to domestic consumer and producer support is presented in section 6.

As in any forecasting exercise, there is uncertainty around the projections in the reference scenario for China's agrifood consumption and production, as they are conditional on the assumptions made. Any changes to the assumptions could result in changes to the projections. In order to improve understanding of the relationships between the assumptions on income and population growth used in the reference scenario, we conduct sensitivity analysis, results for which are reported in Appendix A.

Consumption

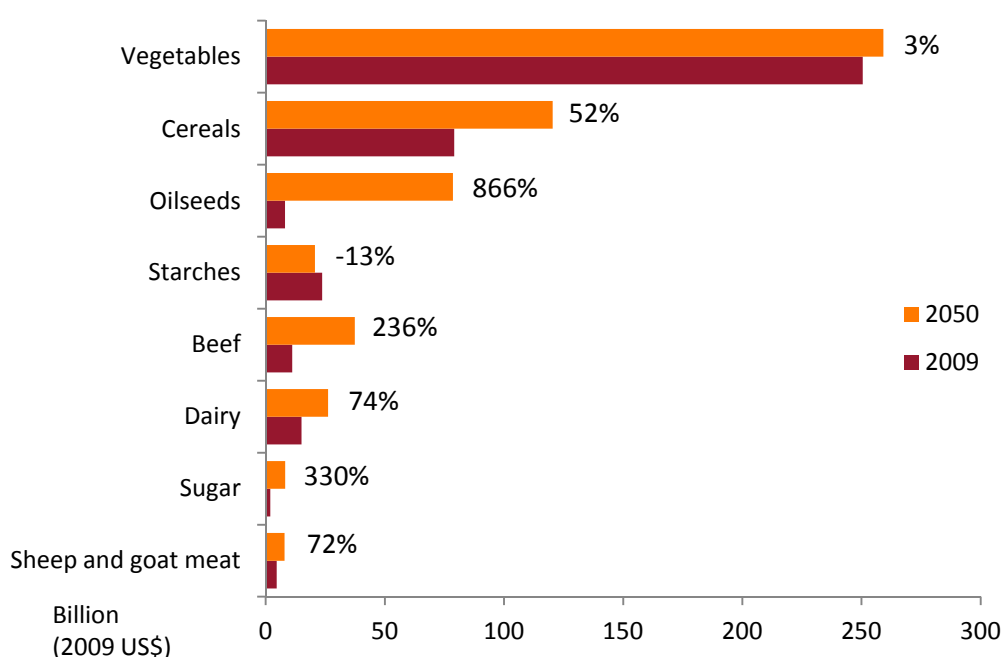
The real value of food consumption in China is projected to increase by 104 per cent between 2009 and 2050 (Figure 9). The increase reflects a dietary shift away from starchy staples to high valued products as real per person incomes increase.

Figure 9 Total agrifood consumption to 2050, China



Data source: ABARES model output

While consumption of most commodities is projected to rise, the largest increases are for high value products such as beef, dairy, sheep and goat meat, and sugar (Figure 10). Consumption growth is projected to be higher between 2009 and 2029 than between 2030 and 2050 because of projected higher population and income growth over the earlier period.

Figure 10 Consumption of selected agricultural commodities, China

Data source: ABARES model output

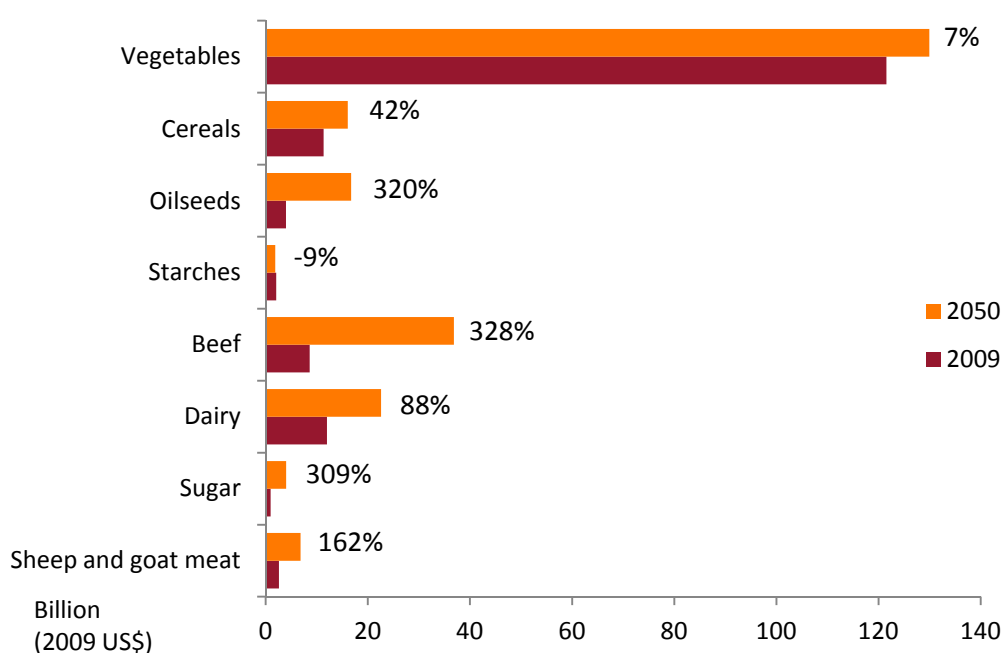
Between 2009 and 2050, beef consumption is projected to rise 236 per cent to US\$37.4 billion (in 2009 US dollars); dairy is projected to rise 74 per cent to US\$26.1 billion; sheep and goat meat is projected to rise 72 per cent to US\$7.9 billion; and sugar consumption is projected to rise 330 per cent to US\$8.2 billion.

For cereals and starchy staples (potatoes, yams and sweet potatoes), consumption is projected to either increase more slowly than higher valued products or even decline between 2009 and 2050. Wheat consumption is projected to rise 102 per cent to US\$79.8 billion (in 2009 US dollars), while for maize it is projected to rise 9 per cent to US\$27.0 billion. These increases largely reflect the projected increase in feed demand given the expected rise in livestock production. Partly offsetting this rise is the lower consumption of rice and potatoes, which are projected to fall 8 per cent and 11 per cent, respectively, to US\$12.1 billion and US\$10.5 billion.

Urban and rural consumption

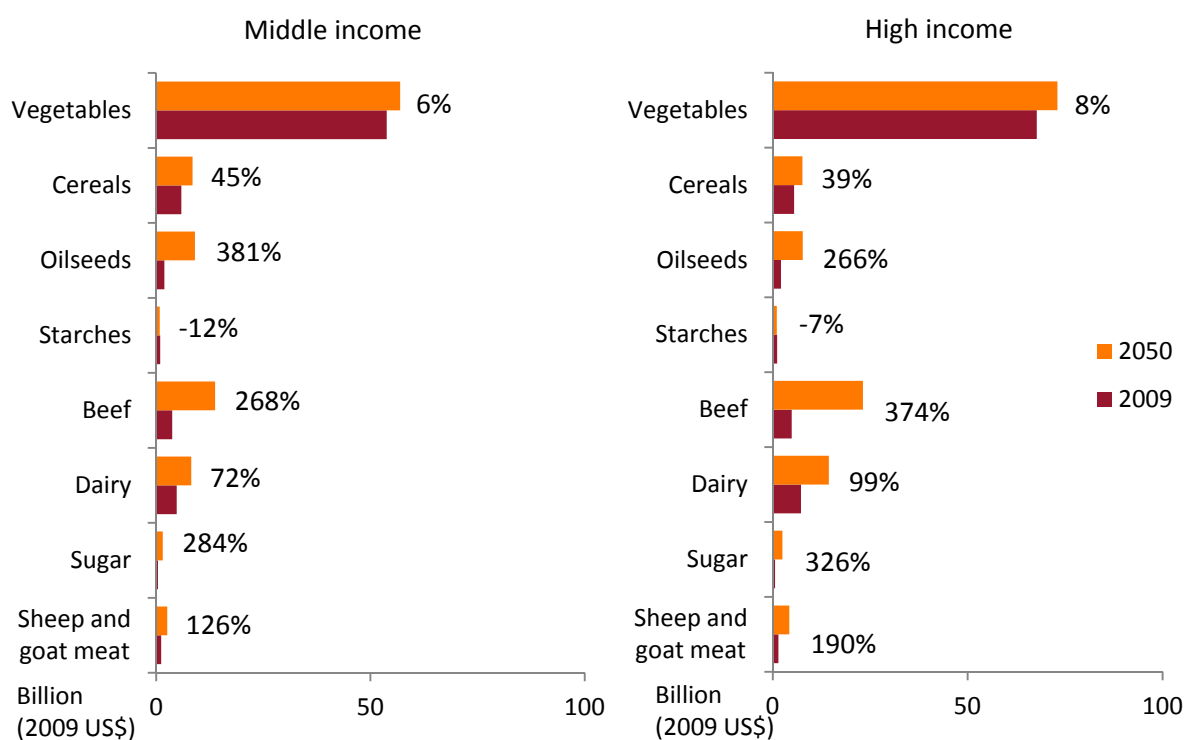
High value commodities

Urban consumers generally account for most of the growth in high valued products over the projection period because of rising urban populations and incomes. Between 2009 and 2050, urban beef consumption is projected to rise 328 per cent to US\$36.9 billion (in 2009 US dollars). For dairy, urban consumption is projected to rise 88 per cent to US\$22.6 billion; and sheep and goat meat by 162 per cent to US\$6.8 billion (Figure 11).

Figure 11 Urban consumption of selected agricultural commodities, China

Data source: ABARES model output

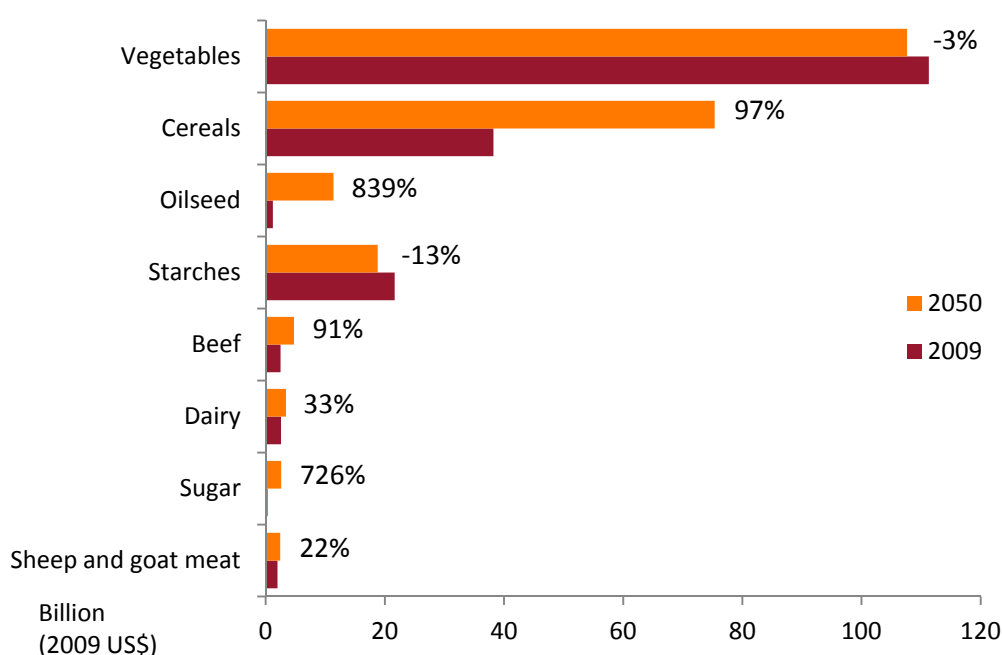
Within the urban population, food consumption and its projected changes to 2050 are not the same across households. As illustrated in Figure 12, consumption of beef, dairy, sheep and goat meat and sugar is far more pronounced in the high income group than in the middle income group. This reflects the higher assumed income growth for the urban high-income group.

Figure 12 Urban medium and high income consumption of selected agricultural commodities, China

Data source: ABARES model output

For rural consumers, growth in high value commodities is also projected but the increases are smaller, on average, than for both the high and medium income urban households. This is attributable to the assumed decline of the rural population combined with relatively lower income growth. The largest increase in the value of rural consumption between 2009 and 2050 is for cereals, which is projected to rise 97 per cent to US\$75.4 billion (in 2009 US dollars). Of that, about 72 per cent of maize and around 36 per cent of other cereals are used for livestock feed. The rise in consumption of some products, such as beef and dairy products, is large in percentage terms but from a very low base (Figure 13).

Figure 13 Rural consumption of selected agricultural commodities, China



Data source: ABARES model output

For all income groups, the rise in total consumption of beef, sheep and goat meat, and sugar in 2050 is principally the result of an increase in the quantity demanded rather than a significant projected rise in the real price. This is especially pronounced in urban households. Beef consumption by urban households in 2050 is projected to rise 234 per cent from 2009 to 10.8 million tonnes, sheep and goat meat 193 per cent to 4.3 million tonnes and sugar 93 per cent to 10.8 million tonnes. In contrast, rural beef consumption in 2050 is projected to rise 49 per cent from 2009 to 1.4 million tonnes, and sheep and goat meat 37 per cent to 1.5 million tonnes.

The change in total vegetable consumption in 2050 is projected to be driven by increased demand for high value vegetables in urban households and is, again, most pronounced in high income households. In quantity terms, total urban vegetable consumption is projected to rise 6 per cent between 2009 and 2050 to 138.4 million tonnes. For high income households, growth is expected to be higher at 7 per cent while for middle income households it is projected to be slightly less at 5 per cent. The projected marginal decline in rural vegetable consumption is attributable principally to the expected decline in the rural population.

Growth in dairy consumption is projected in both urban and rural households, although the growth is more prominent in urban households because of higher income growth. Growth in

urban dairy consumption, particularly in high income households, is expected to be driven by the demand for high valued products such as cheese and milk, while growth in rural consumption is projected to be largely for milk.

While the percentage rise in dairy consumption in real value terms is significant (Figure 12), it reflects the projected increase in dairy prices toward 2050. The projected rise in the quantity of dairy products demanded—as reported in milk equivalents—is more modest, with urban high income consumers projected to increase consumption by 62 per cent, medium income households by 40 per cent and rural households by 8 per cent.

Cereals

The value of cereal consumption is projected to increase the most among rural households. This is partly because of a rise in feed demand, given the projected increase in livestock production toward 2050. Between 2009 and 2050, rural consumption of wheat and maize is projected to rise 128 per cent and 110 per cent, respectively, to US\$64.2 billion and US\$2.5 billion (in 2009 US dollars). Rice consumption is projected to fall 3 per cent to US\$8.3 billion as the rural population declines.

Among urban consumers, consumption growth is projected to increase the most among urban middle income households because of their relatively lower incomes and higher population growth rates than high income households. Between 2009 and 2050, consumption of wheat by urban middle income households is projected to rise 65 per cent to US\$6.7 billion and maize by 30 per cent to US\$0.2 billion (in 2009 US dollars). Rice consumption is projected to fall by 5 per cent to US\$1.5 billion.

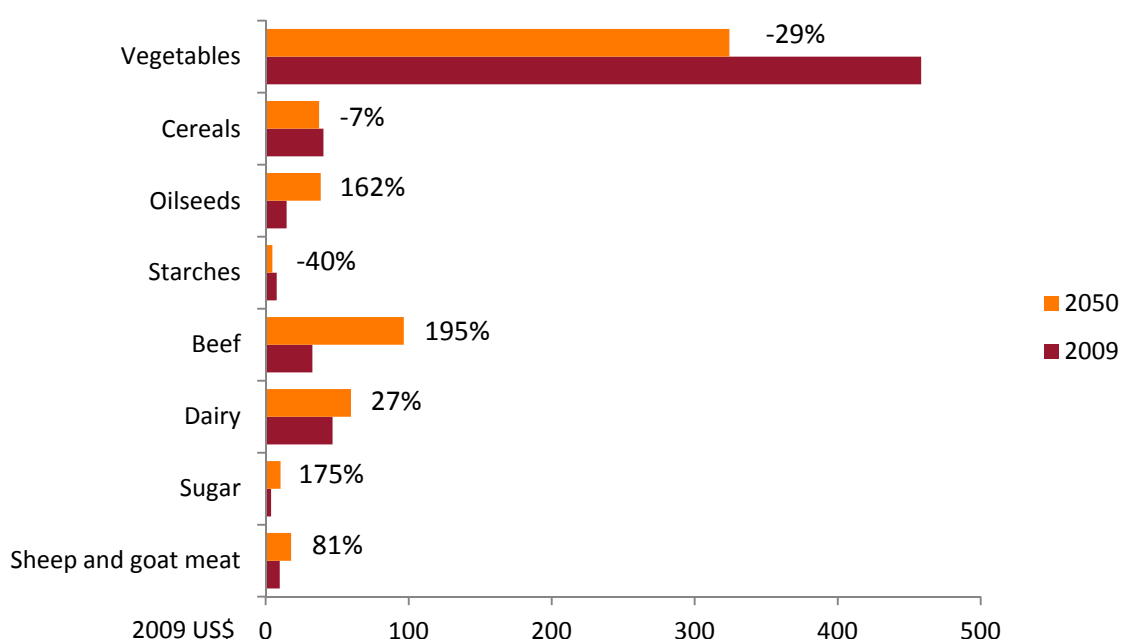
For urban high income consumers, the consumption growth out to 2050 for the three cereal grains are lower than the other two income groups as these households substitute away from grains to meat and other high value products. Wheat consumption is projected to rise 61 per cent to US\$5.8 billion and maize by 27 per cent to US\$0.3 billion. Rice consumption is projected to fall 8 per cent to US\$1.5 billion.

Diets on a per person basis

As a greater proportion of China's population is expected to live in urban areas in 2050, more Chinese consumers will have more western style diets, characterised by lower amounts of cereals and vegetables, and greater amounts of fruit, meats and dairy products. This dietary change is most pronounced for urban high income consumers and is expected to drive demand for high value products.

In value terms, total urban per person consumption of beef is projected to rise by 195 per cent between 2009 and 2050, dairy by 27 per cent, sheep and goat meat by 81 per cent and sugar by 175 per cent. This compares with a decline of 29 per cent for vegetables and 7 per cent for cereals (Figure 14).

Figure 14 Urban per person consumption of selected agricultural commodities, China



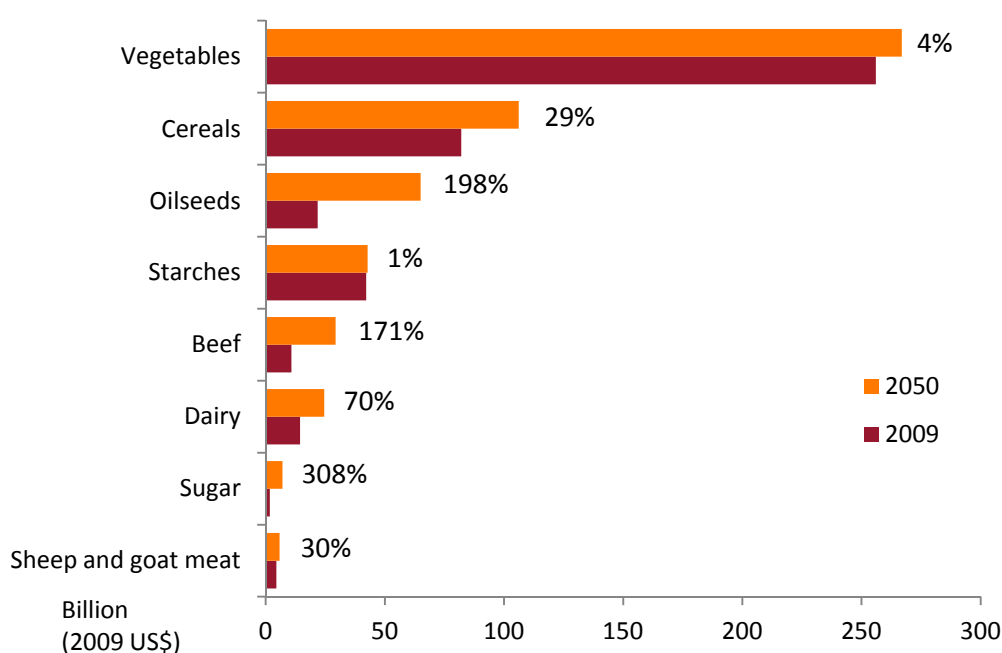
Data source: ABARES model output

Rural diets, in contrast, are projected to be oriented around cereals and starchy vegetables, such as potatoes and yams. Per person consumption of cereals is projected to rise 357 per cent between 2009 and 2050, while consumption of starchy vegetables is projected to double. Although rural per person consumption of beef, dairy, sheep and goat meat and fruit is expected to rise significantly in percentage terms, it is from a much lower base than urban consumers.

Production

China's production of most agrifood commodities is projected to increase but at a lower rate than consumption. As a result, food imports will be an increasingly important component of China's food supply toward 2050.

China is projected to produce significantly more livestock products in 2050 (Figure 15). The real value of beef production, for example, is projected to rise between 2009 and 2050 by 171 per cent, and sheep and goat meat by 30 per cent. Dairy production is projected to rise by 70 per cent.

Figure 15 Production of selected agricultural commodities, China

Data source: ABARES model output

The increased demand for feed will be a major factor driving the projected increase in cereal and oilseed production out to 2050. China's production of wheat and maize is projected to rise 58 per cent and 4 per cent, respectively. The increased production of those two grains will offset the projected 8 per cent fall in rice production stemming from the decline in demand. The production of oilseeds and meal, namely soybeans, is also projected to increase significantly given the rising demand for both feed and food products.

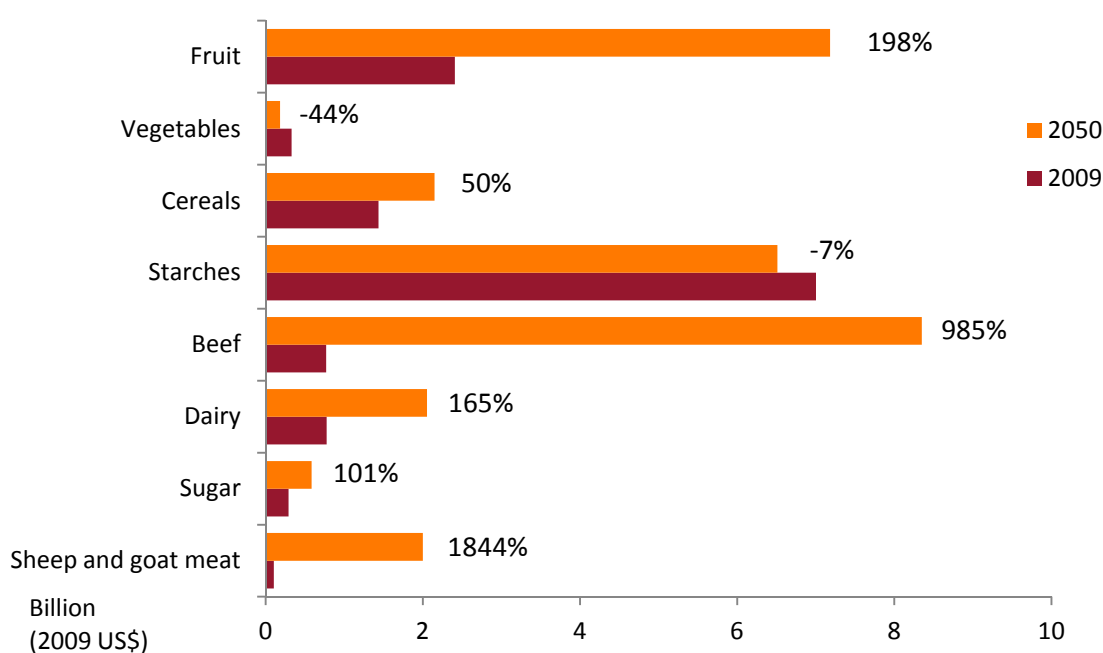
Imports

China's consumption of rice, wheat, vegetables, pig meat and poultry meat has been met mainly by domestic production, with trade playing a relatively minor role. Toward 2050, the situation for these commodities is not expected to change significantly.

In contrast, a significant portion of China's beef, sheep and goat meat, oilseeds and dairy product consumption is projected to be met by imports. For these commodities, most of the import growth is projected to occur between 2009 and 2030 because of high population growth over this period.

China is projected to remain an importer of beef in 2050, with the real value of beef imports projected to increase to US\$8.3 billion (in 2009 US dollars) (Figure 16). While this projected increase may be large, in the four years to 2013, annual average import growth was 132 per cent in value terms. Under this projected growth, the import share of total Chinese beef consumption would be about 22 per cent in 2050, compared with just 7 per cent in 2009.

Figure 16 Imports of selected agricultural commodities, China



Data source: ABARES model output

China is projected to remain an importer of dairy products in 2050 with the real value of imports projected to increase 165 per cent to US\$2.1 billion in 2050 (in 2009 US dollars). On this basis, the import share of total Chinese dairy consumption will increase from around 3 per cent in 2009 to 8 per cent in 2050.

The real value of China's sheep and goat meat imports is projected to increase significantly between 2009 and 2050 to US\$2.0 billion (in 2009 US dollars), albeit from a low base. The import share of total Chinese sheep and goat meat consumption will increase from around 2 per cent in 2009 to 26 per cent in 2050. In quantity terms, China's sheep and goat meat imports are projected to rise from 50 000 tonnes to about 1.3 million tonnes.

China imports and exports a wide range of vegetables. Given rising domestic food demand, the real value of China's vegetable imports is projected to fall by 44 per cent between 2009 and 2050 to US\$183.0 million (in 2009 US dollars). For fruit, China is projected to switch from being an exporter to an importer by 2050. Domestic production is projected to meet most of China's fruit demand, with imports projected to account for 2 per cent of total fruit consumption in 2050, down from 4 per cent in 2009. The real value of China's fruit imports in 2050 is projected to be around US\$7.2 billion (in 2009 US dollars).

China is projected to be a net importer of wheat by 2050. Wheat imports are projected to increase 299 per cent to US\$951.4 million (in 2009 US dollars). While domestic production is projected to meet most of China's wheat demand, imports will account for about 1.2 per cent of China's total wheat consumption in 2050, double that of 2009.

Although China is projected to remain an importer of maize over the projection period, the real value of China's maize imports is projected to decline by 14 per cent between 2009 and 2050 to US\$588.5 million (in 2009 US dollars). The import share of total Chinese maize consumption will fall from 2.7 per cent in 2009 to 2.2 per cent in 2050, which is equivalent to a 7 per cent fall in the quantity of maize imports to 2.8 million tonnes.

China is projected to remain an importer of rice in 2050, with the real value of imports projected to increase by 43 per cent to US\$431.9 million (in 2009 US dollars). This would increase the import share of total consumption slightly, from 2 per cent to 3 per cent, over the projection period. In quantity terms, rice imports are projected to increase 59 per cent to 1.7 million tonnes by 2050.

6 Impacts of the removal of domestic support

In the reference scenario it was assumed that China's market support remains unchanged over the projection period. However, China's agricultural and food sectors are developing quickly, becoming not only more modern but also more reliant on international trade. Over the next forty years it is likely that the degree of market support received by agricultural producers, as well as the government transfers benefitting consumers, will be reduced as income growth continues. Exactly what areas of support might be changed and who those changes would affect remains uncertain at this stage.

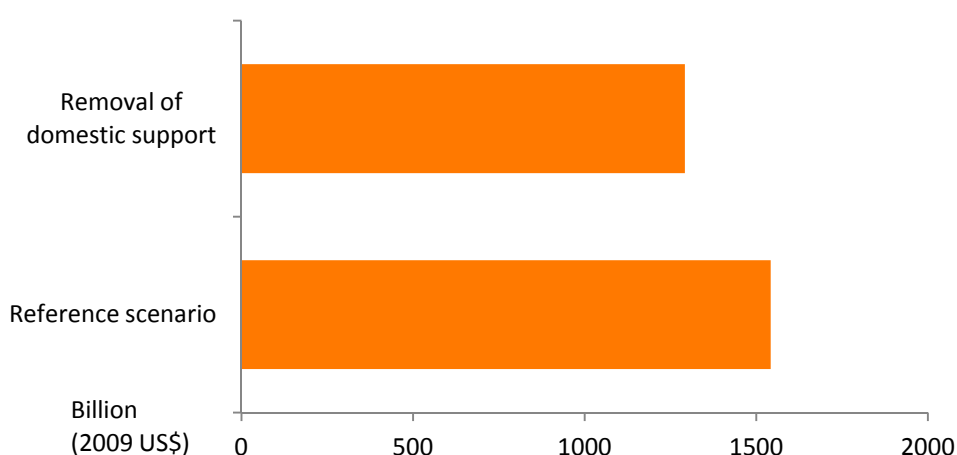
In the agrifood model there are two forms of agricultural support or protection: producer subsidy equivalents (PSEs), which act as a subsidy on the production of each commodity, and consumer subsidy equivalents (CSEs), which act as a subsidy on the consumption of each commodity. Subsidies serve to lower the costs faced by producers or consumers.

Because it is impossible to know which forms of support will change in the future, and to which degree, no assumptions are made in that regard for this analysis. Rather, in this scenario, all forms of producer and consumer support are removed gradually and evenly from 2030 onwards. While not realistic, this heavily stylised scenario provides an indication of possible food production, consumption and trade responses in China. These responses could, by construction, be far more significant than would be the case under more realistic and targeted scenarios. More refined analysis on each of the support policies and their impact on the domestic market in China is an area for future research.

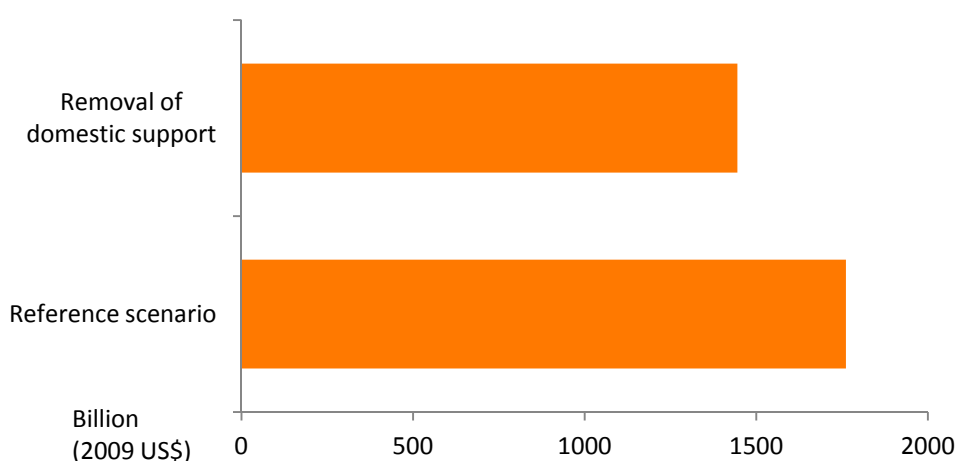
Results

When domestic support is removed by 2050, production and consumption are projected to increase but less than in the reference scenario. The more subdued increase is the result of consumption and production no longer being subsidised. As a result, production and consumption are responding more to market signals. There is upward pressure on both production costs faced by producers and food prices faced by consumers (assuming other factors remain unchanged). Notably, both production and consumption do continue to increase significantly over the projection period because of the expected increase in demand arising from the larger population and higher household incomes.

With the removal of domestic support, the real value of China's agrifood production (in 2009 US dollars) between 2009 and 2050 is projected to increase 75 per cent, a result that is lower than the reference scenario projection of 109 per cent (Figure 17). At the same time, agrifood consumption is projected to be 67 per cent higher than in 2009, a result that is 37 percentage points lower than the reference scenario (Figure 18).

Figure 17 Removal of domestic support scenario – total agrifood production in 2050, China

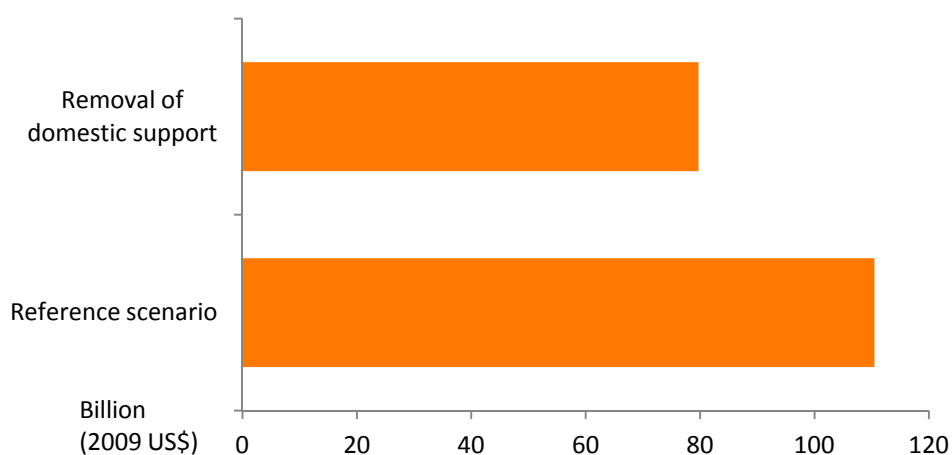
Data source: ABARES model output

Figure 18 Removal of domestic support scenario – total agrifood consumption in 2050, China

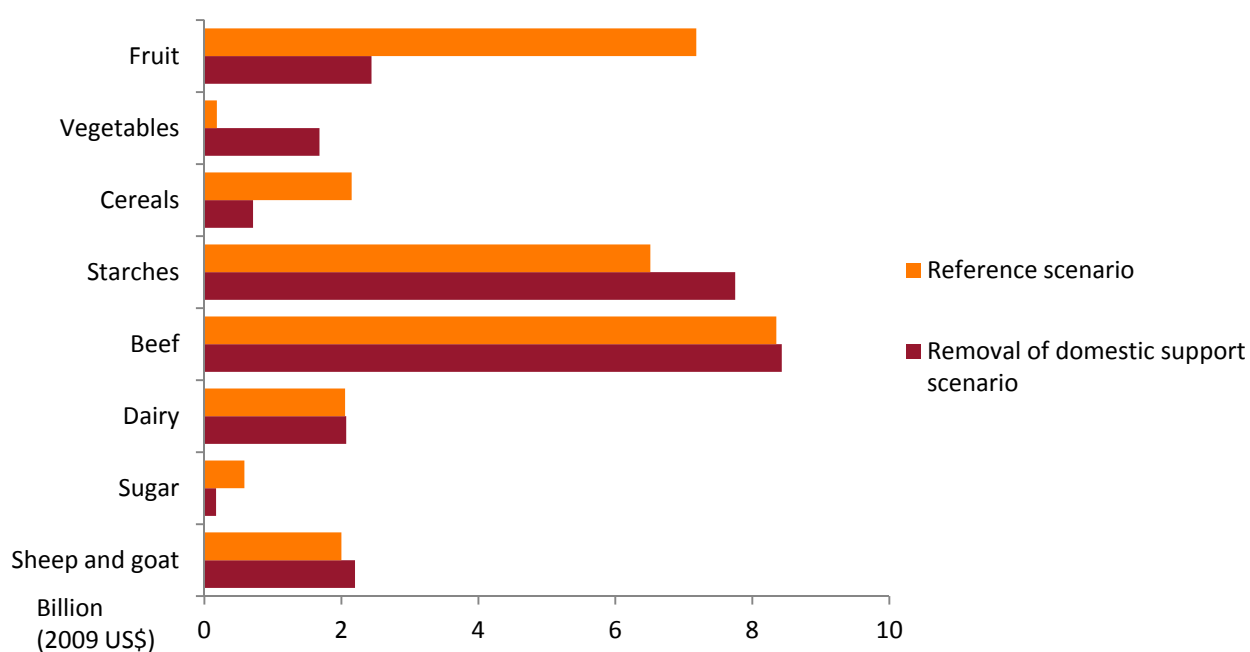
Data source: ABARES model output

As in the reference scenario, the projected rise in the real value of China's agrifood production is driven by the higher real production values of fruit, vegetables and meat (in 2009 US dollars).

In the absence of market support, the real value of China's agrifood imports increases 150 per cent between 2009 and 2050. This is lower than the projected increase under the reference scenario of 246 per cent (Figure 19). The lower level of agrifood imports under this scenario reflects reduced agrifood demand, particularly for commodities benefitting from consumer subsidies in the reference scenario, such as wheat and oilseeds. Imports of these commodities decline the most relative to the reference scenario. In contrast, the commodities whose imports are higher than in the reference scenario include beef, sheep and goat meat, dairy and vegetables (Figure 20). Significant opportunities for exporters of these commodities would therefore arise as support is lowered.

Figure 19 Removal of domestic support scenario – total agrifood imports in 2050, China

Data source: ABARES model output

Figure 20 Removal of domestic support – imports of selected agricultural commodities in 2050, China

Data source: ABARES model output

7 Conclusion

Under the assumptions established in the reference scenario, the real value of food consumption in China is projected to more than double between 2009 and 2050. Most of this increase will originate from urban high income households given their rapid shift to more western style diets and demand for high value commodities such as beef, dairy products and sheep and goat meat.

The high rate of urbanisation, combined with slowing population growth, will result in the rural population declining between 2009 and 2050. This will result in slower total food consumption growth than the urban populations. Given the projected increased demand for meat by each income strata of China's population, the size of the domestic livestock sector is expected to increase significantly to 2050. The feed requirements will therefore also increase. The projected rise in domestic grain production is expected to be inadequate to meet the resulting rise in feed demand, causing imports to rise.

While imports of many agrifood commodities are expected to increase to 2050, China's own agricultural production is also projected to rise in response to the increase in demand for food. This will require ongoing investment and innovation. Not only must productivity increase, but more modern approaches to contend with the challenges of a deteriorating resource base will need to be adopted.

When the assumptions for the reference scenario relating to producer and consumer support are removed gradually starting in 2030, the real value of total agrifood imports in China continues to increase but by less than in the reference scenario. This occurs because, as support is removed, the cost of production rises, total agrifood production falls and prices rise. Consumers demand less of those commodities which originally benefitted most from subsidies, such as wheat and oilseeds, and hence imports are lower. In contrast, imports of commodities from industries that were originally less supported, such as beef, sheep and goat meat, dairy products and vegetables, rise more than in the reference scenario. This scenario highlights the effect policy can have on agricultural prices, and the market response to the removal of distortions.

The significant rise in food consumption by high income, urban households will, to a large extent, be met by supermarkets and hypermarkets that are able to meet the specific demands of that market. Supermarkets and hypermarkets have an increasing retail market share in urban areas in China. Between 2003 and 2010 food sales by modern retail chains grew by 24 per cent a year (ABARES 2013). Because more than half of the top 50 global food retailers are active in China, there is close coordination along value chains as the supermarkets develop relationships with their suppliers, both in China and abroad. Exporters of fresh food to Asia could benefit from entering into relationships directly with these supermarket chains in order to capture the high value segment of the market.

Appendix A: Sensitivity analysis

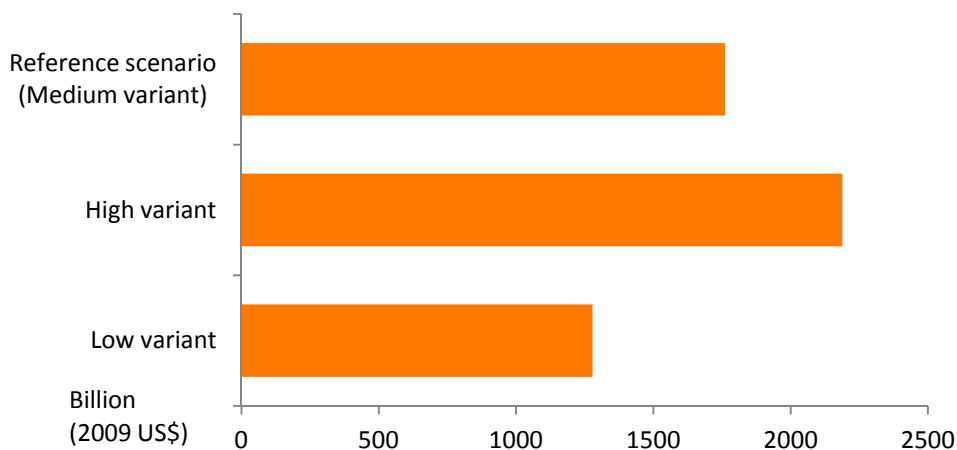
In order to improve understanding of the relationships between the assumptions used in the simulations and the model projections, sensitivity analysis around the population and income growth assumptions was applied.

Population assumptions

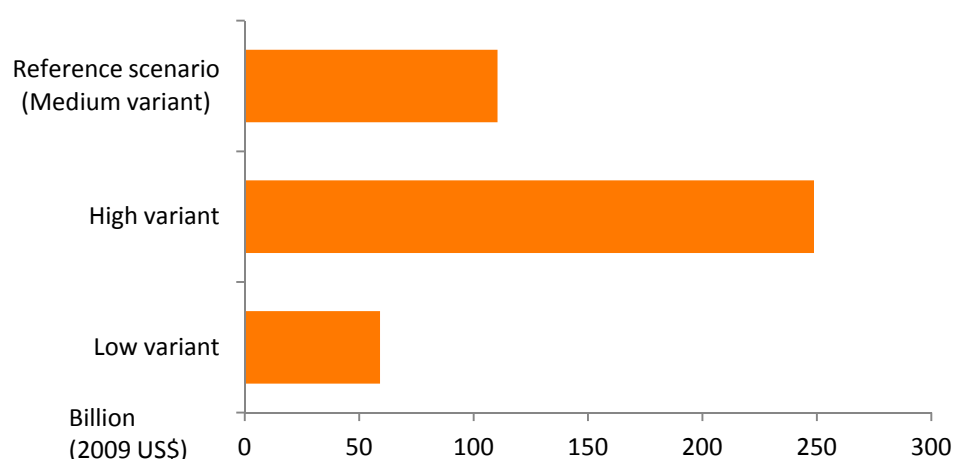
The reference scenario of the agrifood model used the medium variant of the United Nations population projections (2013a) to derive the reported projections to 2050. Sensitivity analysis around the population assumption involves using both the UN's high variant (faster population growth) and low variant (slower population growth) population projections in the agrifood model and comparing relevant model results with those from the reference case.

The level of agrifood consumption and imports in 2050 are projected to be around 24 per cent and 125 per cent higher, respectively, under the high population case and around 27 per cent and 47 per cent lower, respectively, under the low population case than in the reference scenario (Figure and Figure).

Figure A21 Population sensitivity – total agrifood consumption in 2050, China



Data source: ABARES model output

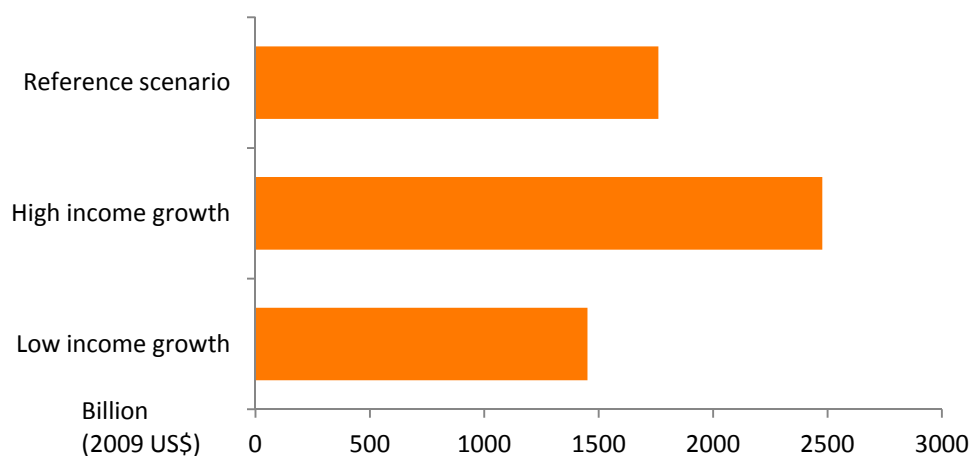
Figure A22 Population sensitivity – total agrifood imports in 2050, China

Data source: ABARES model output

Income assumptions

Sensitivity analysis around the income assumptions is conducted by increasing and decreasing the annual growth rate of income in the reference scenario for all households by 0.5 percentage points from 2009 onward, while holding all other variables constant. Results from the agrifood model under each of these scenarios are then compared with the reference scenario.

When annual income growth is 0.5 percentage points higher than in the reference scenario, the real value of total agrifood consumption in 2050 (in 2009 US dollars) is projected to be around 41 per cent higher than the reference scenario. In contrast, it is around 18 per cent lower in 2050 when annual income growth is 0.5 percentage points slower than in the reference scenario (Figure).

Figure A23 Income growth sensitivity – total agrifood consumption in 2050, China

Data source: ABARES model output

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