Chapter 2

Feeding China: Prospects and challenges in the next decade[1]

Introduction

The historic economic and social transformation of China which has been evidenced in the past three to four decades has and will continue to have huge potential implications for international agricultural markets which are the focus of this *Outlook*. China, which now holds one-fifth of the world's population, is endowed with little arable land and water supplies relative to its population base. Indicators point to continued robust growth in domestic demand for agricultural products, but also to potential challenges on the supply side. China has undertaken significant market reforms and, depending on future policy options, may engage world markets more or seek its own means to meet its increasing domestic demand.

China's success in increasing agricultural production and in feeding better its growing population in the past three decades has been remarkable. Since joining the World Trade Organization in 2001, however, trade patterns have started to change. While it remains self sufficient in specific food security commodities, China's doors have opened to certain commodities such as oilseeds and trade has grown exponentially. For some commodities, including pigmeat, dairy products, maize, and sugar, imports have grown considerably in recent years. Retail food price inflation has been significant since 2000. While it would appear that substantial room exists for productivity gains to sustain domestic market advantage, constraints of land, water, and even rural farm labour appear to limit future supply response.

On the macroeconomic side, exchange rate appreciation due to high growth in exports of labour intensive manufacturing products, has also made agricultural imports more attractive. On the other hand, China's agricultural policies are fundamentally addressed to goals of reducing the rural/urban income divide (Box 2.1), as well as enhancing food security through policies for raising agricultural production and improving productivity. Furthermore, consumption trends for both calories and protein in China, compared to the higher income economies of the OECD, indicate that the gap has significantly narrowed. Demand pressure with high income growth is expected to sustain in the medium term, but it should ease considerably compared to recent past experience.

This chapter begins by reviewing the performance of China's agriculture in recent decades and situates the sector in the context of current domestic and global conditions. It then presents the outlook for China in the context of domestic and international factors and policies which condition its medium term prospects. This includes a detailed look at certain macroeconomic and demographic factors, the emerging challenges which need to be addressed, and policy responses which will certainly underlie sectoral performance. The baseline projection for key commodities is then provided, followed by an assessment of the key risks and uncertainties that could have a major potential impact on the *Outlook*.

The baseline builds on the consensus of country and industry collaborators, which for the first time includes commodity experts at the Agricultural Information Institute of the Chinese Academy of Agricultural Sciences (CAAS). The baseline is not a forecast in the

usual sense of the term but a plausible outcome intended to facilitate discussion concerning policy choices by confirming a forward looking perspective in the context of apparent risks. While neither this chapter nor the *Outlook* in general are intended to assess agricultural policy developments or to recommend policy options, the agricultural policy environment is considered in the context of the impact on markets and trade. It also excludes consideration of the industrial, infrastructure and tax policy environment.[2]

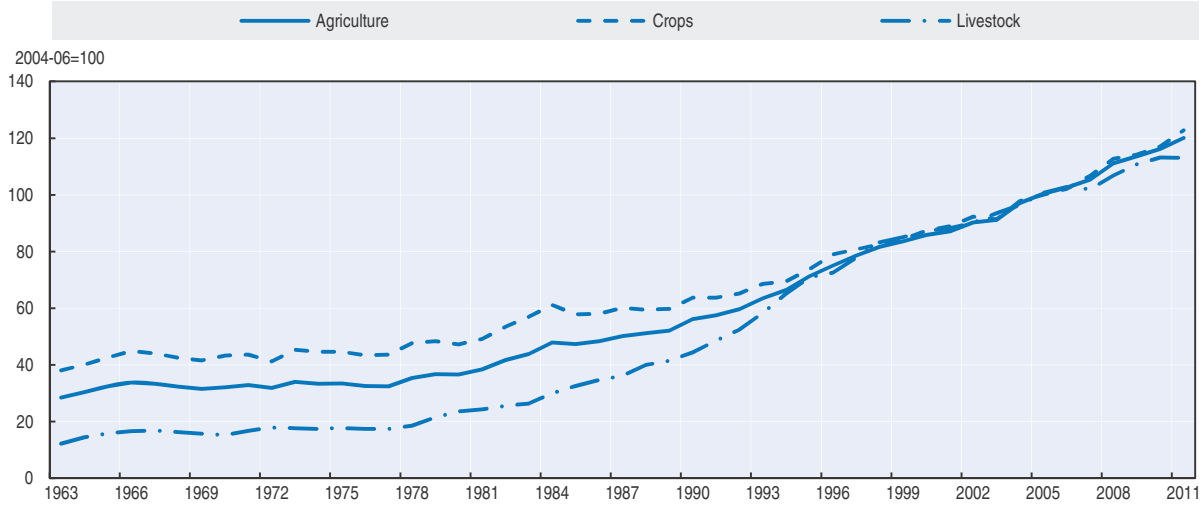
The success of China's agriculture

Over the course of the past four decades, China has displayed vigorous growth. In 2011, the Chinese economy, as measured by its gross domestic product (GDP), was almost 20 times larger in volume terms than it was in 1980. The agricultural sector, as measured by FAO's net agricultural output index grew by 4.5 times over the same period. The rapid growth in both national income and agricultural output has contributed to substantially higher national food availability and a much improved access to food. The details surrounding such success has many dimensions, including a changing policy environment, increased national investments, and improved factor productivity, all amid a rapidly changing rural, demographic and economic landscape, regional differences but also critically rising land and water constraints.

High growth in production

Growth in agriculture accelerated rapidly after the economic and rural reforms in the late 1970s (Figure 2.1). Per capita agricultural output, as measured by FAO's net agricultural production index, grew a modest 1.1% p.a. from 1961-1978. However, from 1978 to 2011, output growth averaged over 3.8% p.a. in per capita terms, with crop production growing 2.9% p.a. and livestock growing, albeit from a smaller base, by a large 5.6% p.a. in response to demand from high income growth. Livestock product growth was particularly strong during the decade post 1986, but slowed as the market matured and meat consumption levels reached higher levels. Growth in agricultural output has slowed in the past decade but is still in excess of 3% p.a. in per capita terms, almost twice the global rate of 1.7% p.a.

Figure 2.1. **Agricultural production in China**



Source: FAOSTAT.

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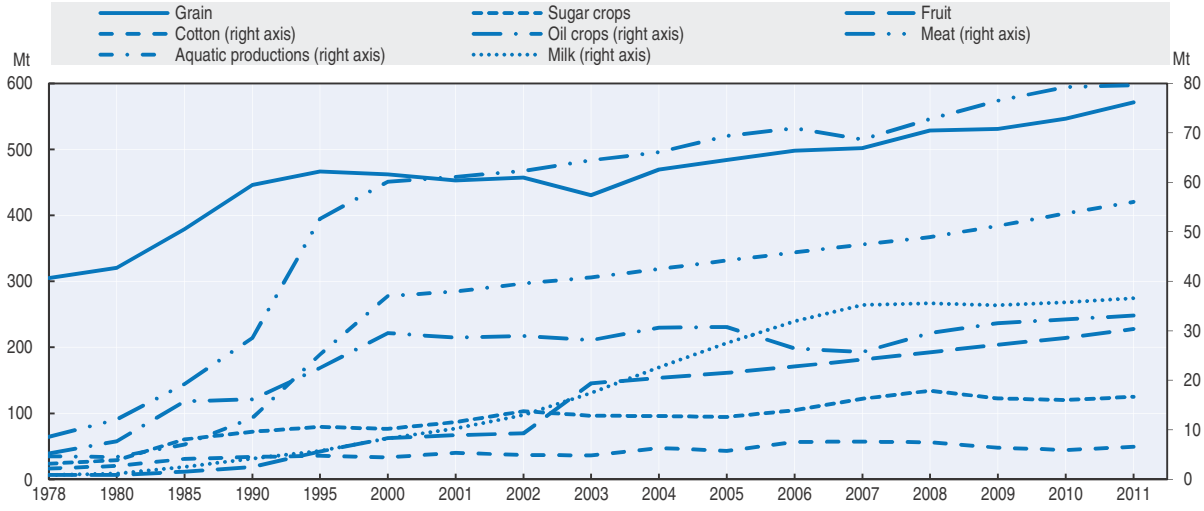
Since 1978, China's grain production (cereals, coarse grains, oilseeds) increased 93% from 305 Mt in 1978 to 590 Mt in 2012. Over this period, cotton output has risen by a factor of 2, oil crops 5, sugar crops 4, and fruits by a factor of 34. The sizeable gains in crop output have been achieved despite a decline in arable land area, due to increases in yields and increased multiple cropping. Over the period, yields have increased at trend rates for wheat at 2.3% p.a., maize at 1.7% p.a., rice at 1.2% p.a., and soybeans at 1.2% p.a. Multiple cropping – the ratio of total area sown to total arable area, reached a high in 2011 at 1.35 (based on *China Statistical Yearbook*). Production of livestock and fish products have shown significant increase, meat by a factor of 8 times, milk 16, and aquatic species by 11 times with those from aquaculture growing by 31 times since 1978 (Figure 2.2).

Figure 2.2. **Production of major agricultural products in China**



Source: National Bureau of Statistics, China.

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Higher output has been achieved as a result of high investment. Real net investment in farm capital has increased at a trend rate of over 9% per year as the government has attached a high importance to improve and modernise agricultural production systems.

- The power of agricultural machines increased by over seven-fold in the past three decades. The number of large and medium-size farm tractors, rice transplanters and corn combines in 2012 were 4.9 million, 5.1 million and 2.3 million respectively. The mechanisation level in sowing and reaping has exceeded 55%, not only for wheat, but also for rice and corn.
- Infrastructure for irrigation and water conservation has improved significantly. By 2011, the effective area with irrigation reached 62 Mha, 37% above that in 1978. The development and improvement of infrastructure in irrigation and water conservation have enhanced the ability of preventing natural disasters, providing a solid foundation for assuring agricultural production capacity.
- New prospects have been opened up in the development of modern agriculture. The pattern of agricultural development has changed with better supporting infrastructure surrounding the sector. The policy environment is more supportive to higher productivity growth with a greater emphasis on science and technology, and with facilities to improve farm productivity and higher ecological performance.

The contribution of scientific and technological progress in 2012 to growth in agriculture has reached 54.5%, doubling from 27% in the beginning of rural reform.[3] Some important agricultural technologies have emerged with breakthroughs in some core technologies such as hybrid rice, corn, and rapeseed, and transgenic anti-insect cotton. The coverage of improved varieties of farm crops has now exceeded 95% in China. Agricultural science and technology has increased the prevention of plant and animal diseases and control for insect pests, thereby decreasing crop and animal losses. Through research and innovation, agricultural and renewable resources are better managed, promoting sustainable development, and resource conservation.

Box 2.1. **China's evolving agricultural policy priorities**

China's agricultural policy framework has been evolving in line with fundamental reforms carried out since 1978 and resulting in a gradual transition from a centrally planned economy towards a socialist market economy.

During the reform period, agriculture and rural areas more generally provided two major boosts to China's development. The first came from a major transformation in the policy environment in agriculture in the early 1980s when the tightly controlled commune system was replaced by the Household Production Responsibility System (HPRS) in which individual farmers were allowed to lease land from the collectives, becoming largely autonomous in their decision, and responsible for profits or losses from their operations. The second began in the late 1980s when in order to employ workers leaving agriculture and to avoid large-scale migration to the cities, sub-national governments were encouraged to promote the growth of rural non-agricultural industries, commonly known as township and village enterprises (TVEs). These enterprises were the main vehicle for absorbing workers leaving agriculture, necessary for China's growth and development. A uniqueness of China's experience in the late 1980s and in the 1990s was that the bulk of the shift in employment took place within rural economy rather than through migration from rural to urban areas (OECD, 2005).

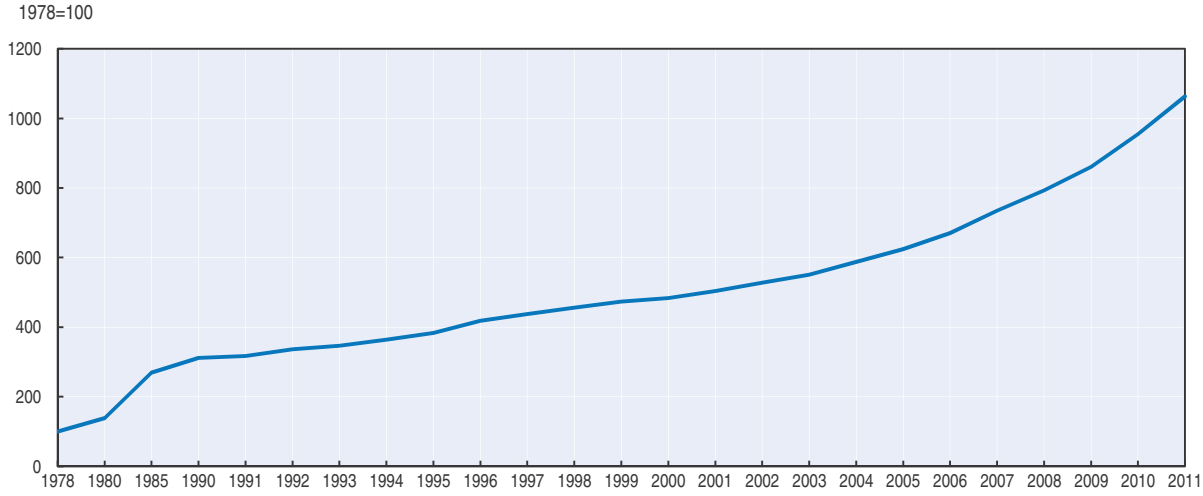
Up to the late 1990s, the principle agricultural policy objective was to increase agricultural production, especially of food grains. Gradually, more attention was given to supporting rural incomes to address the issue of the growing income gap between urban and rural populations. Accordingly, policies aimed at raising agricultural incomes were adopted with a fundamental shift from taxing agriculture to supporting it. This shift in focus coincided with China's accession to the WTO in December 2001 which placed China's support policies within a framework of internationally recognised rules and regulations. Income support policies were further strengthened through the adoption of the highest priority document of central authorities for 2004 (Document No. 1). This document put forward a set of agricultural policy measures which, through their increasing geographical and commodity coverage, became key channels for providing support to China's agriculture. An important, but also symbolic, change in China's approach to agriculture was the abolition of the long established agricultural tax, which was effectively implemented by early 2006, after 2 600 years of its application.

Following the 2004 Document No. 1, all subsequent annual versions have concentrated on various aspects of agricultural and rural development issues. The most recent ones focused on water conservation to achieve sustainable use of water resources within the next ten years (2011); on investment in agricultural science and technology to help boost agricultural production and farmers' incomes (2012); and on transition to larger-scale farms through the creation of large individual-operated farms, family farms, co-operatives and contracting arrangements between farmers and companies (2013) (OECD, 2013).

Rural incomes have increased steadily

Since reforms and the opening up of China, rural incomes have been increasing continually and living standards have been increased substantially. Based on constant prices, per capita annual income of rural residents in 2011 was ten times higher than that in 1978 (Figure 2.3). The major factors that contributed to the income growth included higher agricultural growth, better wages income for migrant workers, higher incomes from non-agricultural activities in rural areas, the elimination of the agricultural tax and increased agricultural subsidies.

Figure 2.3. **China: The growth of per capita annual income for rural residents**



Source: National Bureau of Statistics, China.

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Food security has improved significantly

According to the World Bank, poverty rates in China have fallen dramatically, from 64% in 1992 to 12% in 2009.[4] High income and agricultural output growth has enabled China to reduce its number of undernourished people. When numbers of undernourished were assessed in 1990, it was estimated that some 254 million people were undernourished, or 21% of the population. Despite the addition of about 196 million people to its population by the year 2010, the estimated number of undernourished, people fell to 158 million, or to 12% of the population (Table 2.1). Despite high success in reducing undernourishment, China still has the challenge to reduce further its number of undernourished people.

Table 2.1. **Food Insecurity in China: FAO estimates of the number of people undernourished**

	1990-92	1999-2001	2004-06	2007-09	2010-12
Number (million)	254	187	176	158	158
Percentage (%)	21	14	13	12	12

Source: *State of Food Insecurity* (2012), FAOSTAT.

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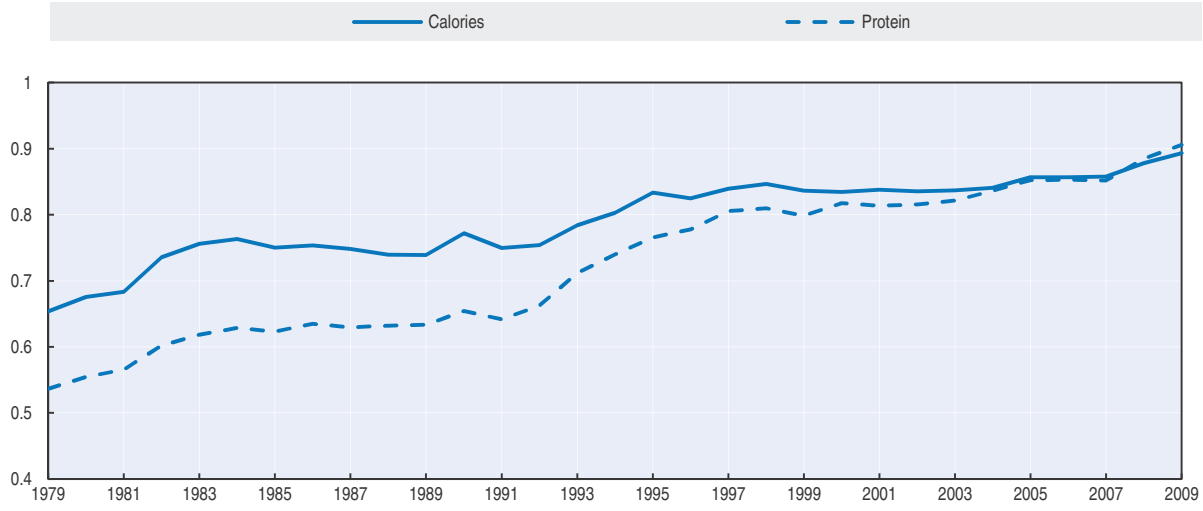
Progress in achieving higher consumption may imply that future demand pressures in China may moderate compared to the past. On average, daily calorie and protein availability per person in China were estimated at 3 038 kcal, and 94 g in 2009. This compares with the OECD average of 3 402 kcal and 104 g in 2009 respectively. Since 1978, China's calorie availability relative to that of the OECD average (ratio) has increased from 66 to 89%; for protein intake, the ratio has risen from 53 to 90% (Figure 2.4). This rapid convergence in these components, especially for protein, may indicate that China's per capita availability of calories and protein may be approaching the stable equilibrium levels for these components which is characteristic of OECD countries. As this gap closes and with low population growth, demand pressures may ease, at least as far as nutrition is concerned. However, higher availability of proteins, in the form of meat for example, may involve higher resource demands and costs from agriculture.

Figure 2.4. **China's per capita calorie and protein supply, ratio to OECD average**



Source: FAOSTAT.

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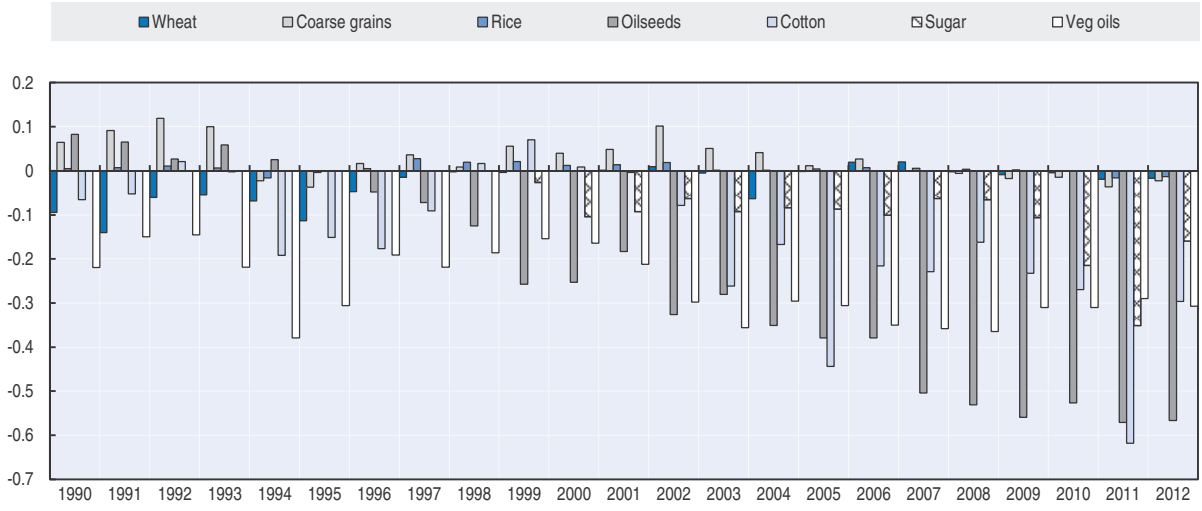
The food security situation in rural China has improved substantially, corresponding with the rise in living standards. In real terms, per capita annual income of rural residents in 2011 was 10 times higher than that in 1978. With the growth of real incomes, consumption patterns have changed considerably. Engel's coefficient (share of expenditures allocated to food) for Chinese rural households steadily dropped from 68% in 1978 to 40% in 2011, and consumption patterns have been changing towards more livestock products (Table 2.2).

Trade: Self sufficiency in food security commodities

Since China joined the WTO in 2001, the openness of its agricultural sector to global markets increased and has resulted in increased trade. From 2001 to 2012, the value of Chinese agricultural trade (total of imports and exports) increased from USD 27.9 billion to USD 155.7 billion, with an average annual growth rate of 17%. The trade dependence (i.e. trade value per unit of agricultural GDP) of Chinese agriculture increased from 15% in 2001 to 21% in 2011. Import dependence doubled from 6% to 13%. China's net trade deficit in agriculture and food widened further in 2012 to USD 31 billion, up from USD 18.5 billion in 2011.

In large part, rapid growth in both commodity supply and demand, strongly supported by its policy framework, has enabled China to achieve a high level of self-sufficiency in basic grains – wheat, rice and coarse grains (Figure 2.5) – which have been considered important for meeting food security objectives. With few exceptions, the self-sufficiency ratio for each of these commodities has ranged between 0.95 and 1.05 since 1995. It is noteworthy that since 2006 China has had a net trade deficit in these grains. However, achieving high self-sufficiency for these commodities has been attained by importing other crops/products which compete for land. For example, China has become the world's largest importer of oilseeds, with a market share in 2011-12 estimated at 54%, accounting for more than 50% of consumption by 2011; these imports have effectively freed some 28 Mha of harvested land, as measured by China's oilseed yields. Similarly for cotton, sugar, and root and tuber crops, China's net import position has deteriorated as competition for land has been steered toward food security commodities.

Figure 2.5. **China: Self-sufficiency for major crops/products**



Note: Computed as net exports/consumption, 0 indicates full self-sufficiency, -1 indicates net imports fill all domestic consumption.
Source: FAOSTAT, FAO estimates.

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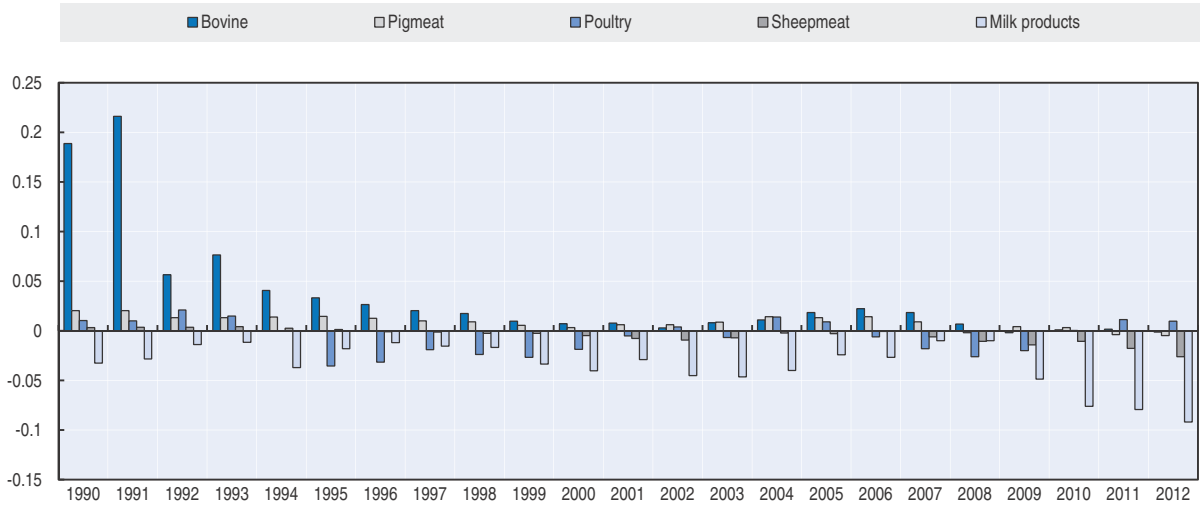
For livestock products, China has maintained near self sufficiency for all meats with net exports within 1-3% of domestic consumption (Figure 2.6). However, even with net trade at less than 1% of consumption, pigmeat imports were some 600 000 tonnes in 2012; such imports are large in the context of global pigmeat trade of about 7.8 Mt. In recent years, following China's melamine crisis and restructuring of its milk and dairy processing sector, imports of dairy products have increased substantially.

For fishery products, China is a net exporter, and by far the leading fish exporter in the world. During the last few years, China has also increased its fishery imports significantly for both domestic consumption and for its fish processing industry, as a growing share of its fishery exports consists of reprocessed imported fish.

Markets have improved

China's agricultural sector has long been influenced by government and government policy. As its state of development has changed, its priorities have evolved (Box 2.1). With

Figure 2.6. **China: Self-sufficiency in livestock products**



Note: Computed as net exports/consumption, 0 indicates full self-sufficiency, -1 indicates net imports fill all domestic consumption.
Source: FAOSTAT, FAO estimates.

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successive reforms, China's agricultural sector has been in transition from a planning economy to market based economy which has changed considerably. Prices were set in local regions and provinces, but these practices have now been changed. There are now over 4 300 wholesale agricultural product markets in China, in which over 950 markets have annual returns of more than CNY 100 million. The government has supported infrastructure construction for agricultural product markets and now a large brokerage work force of over 6 million people has been established. Leading agricultural and national business organisations play an important part in the management of agricultural product purchasing and import and export trade. Market services have become more open, unified, competitive and transparent with the establishment of agricultural product "green channel" and "one station" systems that contribute to the orderly movement of agricultural products.

The role of market information is becoming central to improved market efficiency. In 2012, the China Ministry of Agriculture started to collect price information, covering producer, wholesale and retail prices, with daily, weekly, monthly, quarterly and annual reporting integrated into a real-time monitoring system. An agricultural product monitoring and early warning system has also been established so as to help improve the sector's market responsiveness.

Recent statistical studies indicate that domestically, spatial markets for many commodities are now better integrated and hence more efficient (Box 2.2). However, the linkage between international markets and domestic markets varies significantly by commodity. Presently, of the major commodities, prices of all major commodities with the exception of pigmeat appear to be statistically integrated with global markets. However the degree of connection to global markets is low for most commodities, with soybeans showing the strongest linkage. Markets are still affected by state enterprises and by tariff rate quotas as well as minimum procurement prices and stock intervention schemes in the cases of rice and wheat.

Box 2.2. **Domestic and international market integration**[1]

Domestic market integration

Prior to 1992, agricultural prices in China were largely set by administrative processes. In 1992, China started to build its socialist market system. While prices for certain commodities remained influenced by minimum procurement prices, agricultural markets were gradually liberalised and opened to world markets. Liberalisation of meat, vegetable and fruit markets preceded those for grain, which were finally liberalised in all provinces in 2004. Recent research based on statistical analysis of price movements indicates that Chinese domestic markets are now integrated across provinces.

Recent research on domestic market integration in China

Author	Product	Data period	Result	Price transmission
Tian Zhihong (2012)	Corn	2001-10	Integrated	Producing=> deficit regions
Wang Ning (2008)	Wheat	2005.01-2007.12	Integrated	-
Li Min (2006)	Rice	2001.1-04.12	Integrated	Producing=> deficit regions
Tian Xiaochao (2011)	Hogs	2000-08	Integrated	Producing regions => deficit
Wang Yi (2007)	Apples	1998-2006	Integrated	Importing =>producing regions

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Global integration

Statistical tests with monthly wholesale market price data over the period 1996 to 2012 show that with the exception of pigmeat, domestic commodity markets for primary commodities are statistically integrated with international markets. Some domestic markets, such as rice, bovine meat, and pigmeat may also influence international markets. However the degree of market connection ranges considerably, as noted by the Timmer/Revallion Index of Market Connection (IMC), as shown in the table below. As expected, soybeans, maize and wheat show the lowest IMC values (IMC of zero indicates highest connection), whereas commodities such as rice and meat products illustrate much lower connection with international markets. Estimates made separately for the periods 1996-2004 and 2005-12, show that the IMC rose for wheat, rice and beef, and indicate that market connection deteriorated in the latter period, as international market price volatility was not reflected in domestic markets.

Indexes of market connection

	Maize	Soybean	Wheat	Rice	Chicken	Bovine meat	Pigmeat
IMC (1996-2012)	7.1	4.0	10.1	24.6	78.8	55.8	(41.4)
IMC (1996-2004)	(3.4)	2.3	5.4	17.0	(13.5)	8.9	(4.6)
IMC (1996-2004)	(10.2)	3.9	27.5	39.5	(7.0)	(46.9)	(52.3)

Note: IMC of 0 is highest connection, higher values indicate lower connection (Timmer, 1984). IMC = (1 + b1)/(b3 - b1), where in the case it is shown that international price Granger causes the domestic price PD = (1 + b1) * PD(-1) + b2*(PI - PI (-1)) + (b3 - b1) * PI(-1), where PD is domestic price, and PI is international price expressed in domestic currency. IMC results in brackets are reported but are not appropriate because statistical integration could not be established from the data during these periods.

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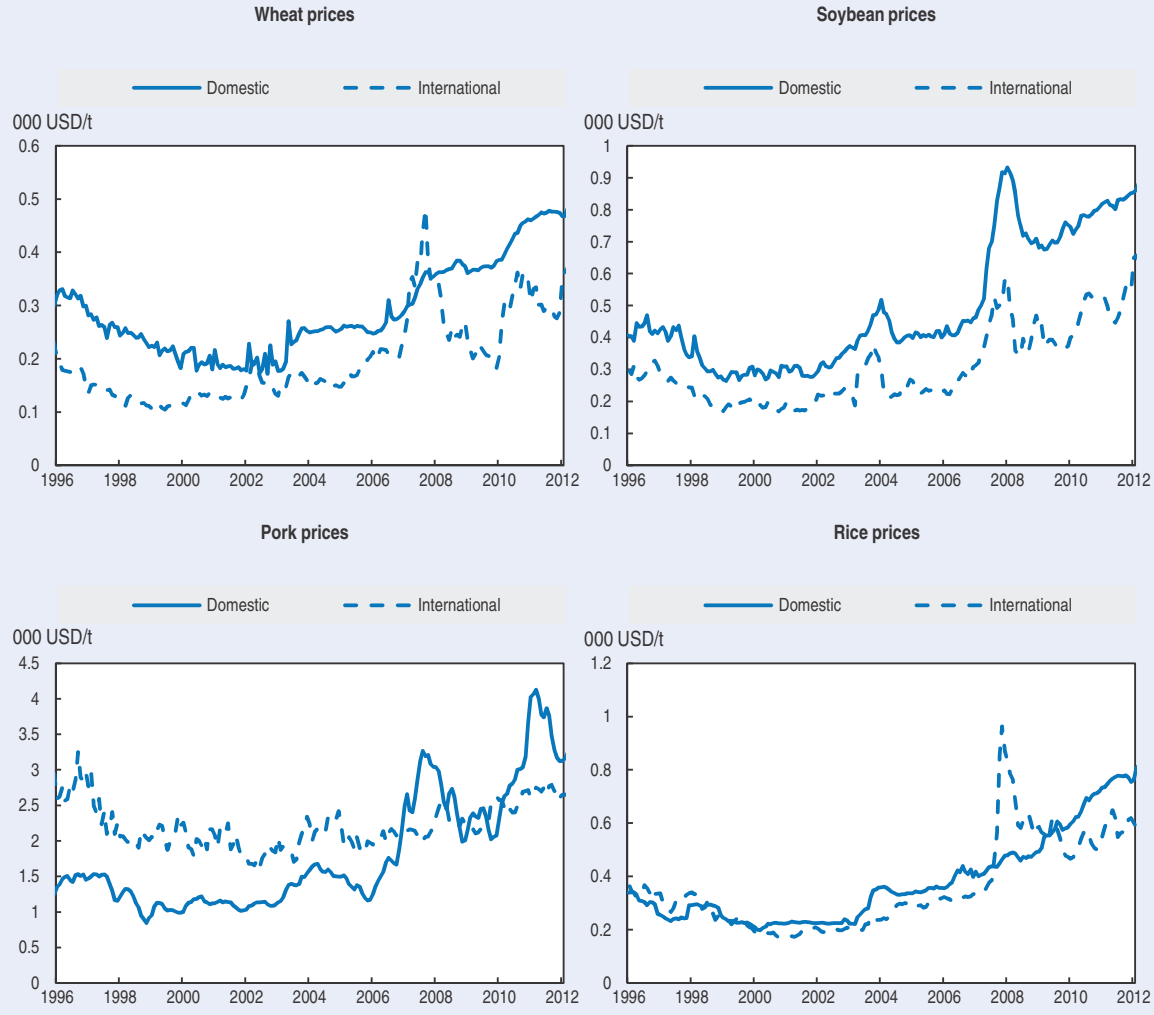
Box 2.2. **Domestic and international market integration**[1] *(cont.)*



Note: The data used is monthly prices from January 1995 to December 2012. Domestic prices are wholesale market prices from Ministry of Agriculture of China; the world prices are prices in major producing countries from FAO (*www.fao.org/economic/est/prices*). Co-integration tests use the Johannsen procedure.

Source: Data from Ministry of Agriculture, China.

StatLink http://dx.doi.org/10.1787/888932860959

1. Provided by Wu Laping, Professor, China Agricultural University. The term "integrated" in this text refers to statistical integration where a linear combination of the two prices (made stationary by eliminating trend components) is a statistical error which is randomly distributed. For example, P – b * WP = U, where P is domestic price, WP is world price and U is random error of mean zero.

The outlook for China's agricultural sector

Key factors and constraints underlying China's outlook

The success of China's agricultural sector has been remarkable. However, recent developments in its market situation raise the questions about whether China's agriculture is at a fundamental cross road in its relationship with international markets and about how emerging forces will shape its development over the next decade. Much will depend on how rising constraints to China's agricultural production evolve, and in

particular on the policy environment applied to the sector. The *Outlook* first looks at these conditioning factors which will be assumed to underpin outcomes for the next decade. These factors are many and include some contentious issues which are difficult to assess fully in terms of the extent and timing of their impact in the short, medium and long term. Within this context, the projection of China's major commodity markets is then outlined in detail.

Economic growth slower, but remains strong, stimulating demand

Growth in China's economy has been phenomenal by any standard of world economic history, with a long spurt in economic growth in the range of 8-12% p.a. over the last three decades. This growth has been largely underpinned by export-led industry, large public investments and a population-demographic dividend associated with a sharp change in fertility rates as adoption of the one-child per household policy took effect in 1979. Relatively cheap labour has situated China with a comparative advantage in labour intensive manufacturing products, resulting in imports of raw materials and large exports of finished value-added products. However, the next decade appears to be one which shows signs of slower growth as competitiveness declines.

The OECD projects strong GDP growth to gradually slow over the next ten years from the current 8% range toward 6%.[5] This still means that per capita income in China will more than double over the next decade, with an impact on domestic demand for food, particularly for those foods with higher income sensitivity. While China's Engel coefficient has declined as income has risen, and will decline much further in the next decade, it indicates a considerable impact for food demand, especially if income growth is passed down to the lower income population.

While economic growth may stimulate demand, other macroeconomic changes may further limit supply response. First, China's nominal, and especially its "real" exchange rate has appreciated. This trend is assumed to continue. The impact is to make China less competitive against international markets by reducing the Yuan price of imports. Second, labour wage rates have inflated both in urban and in rural settings, creating higher costs of production throughout the market chain, not only on farms but also in the processing and retail sectors. As further noted below, demographic projections indicate that China's working age population will decline over the next decade, increasing further pressure on wages. Higher costs create pressures on net farm incomes and, for example, place China's dominant cotton processing sector at risk compared to other international competitors.

Demographic changes will impede supply, but stimulate demand for value added products

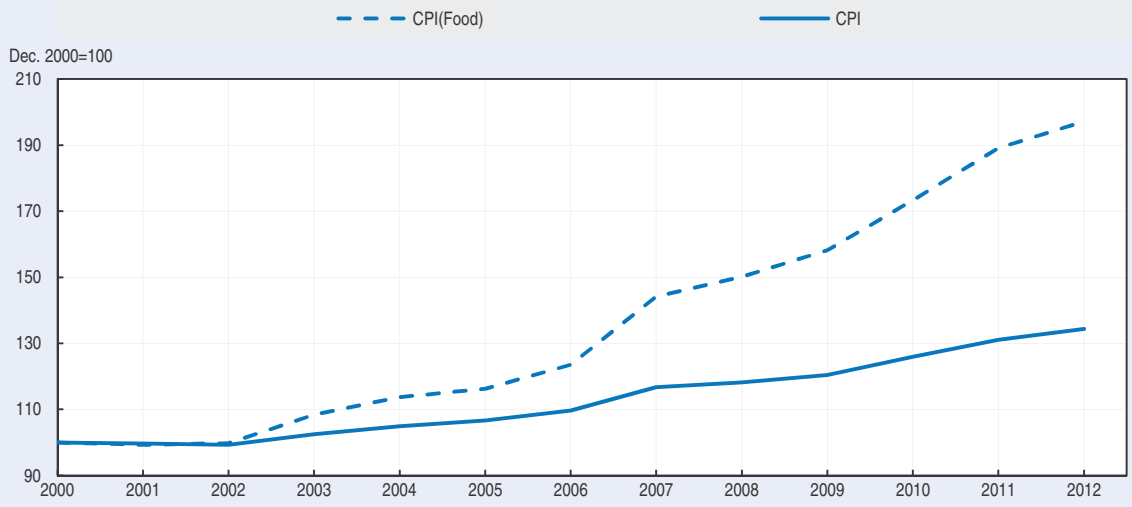
Since 1992, when it reached its historic high of 844 million, China's rural population declined to 695 million in 2012, a net fall of some 150 million people. UN population projections indicate a further net decline of 100 million people living in rural China by 2022. These are large numbers; the resulting impact on agricultural labour, farm structure, land management and especially rural economies is significant.[6]

Interaction with other demographic and economic developments yields a yet more difficult situation in the rural sector. The slowing of population growth initiated by China's family planning policy (1978), while initially leading to a population dividend with higher per capita income with proportionately fewer workers in the young and inactive segment

Box 2.3. **Macroeconomic challenges facing China in the next decade**

China is expected to continue resilient economic growth, but there are some downside risks for China. The risks include inflation, appreciation of its real exchange rate, as well as possible instability of its financial system and a plunge of property prices, all of which may be exacerbated by further external shocks, such as deepening of the euro zone crisis, or changes in US economic prospects. Inflation in China is already quite high, supported by increases in labour wages. But food price inflation has been remarkably high and will need to be contained. Food currently has a 30% weight in consumer expenditures and high inflation will impact real incomes and consumer demand, dragging economic growth down.

China : Consumer price indices, 2000-2012



Source: Bloomberg.

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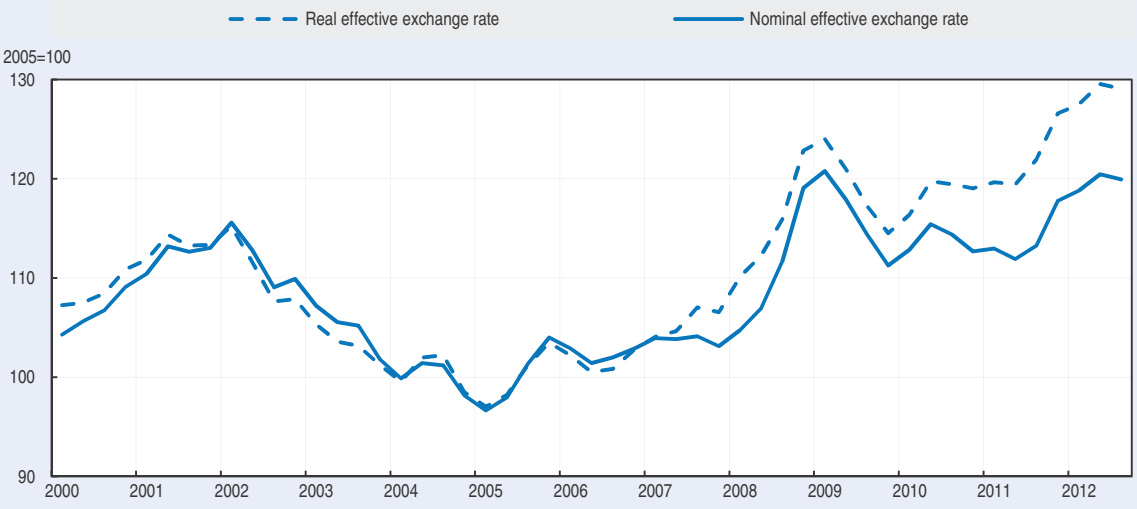
China's real effective exchange rate (nominal rate adjusted for domestic inflation relative to those of trading partners) has appreciated around 30% since 2005. If this trend continues, the result will be to make imports more attractive, and may cause minimum procurement prices to underpin markets. In this case, the government would be pressured to enhance domestic support and protect their producers from international competition. This would not only affect prices and consumption of domestic products, but will deteriorate the fiscal condition and may not be sustainable for a long time.

China : Effective exchange rates, real and nominal (index : 2005 = 100)



Source: IMF.

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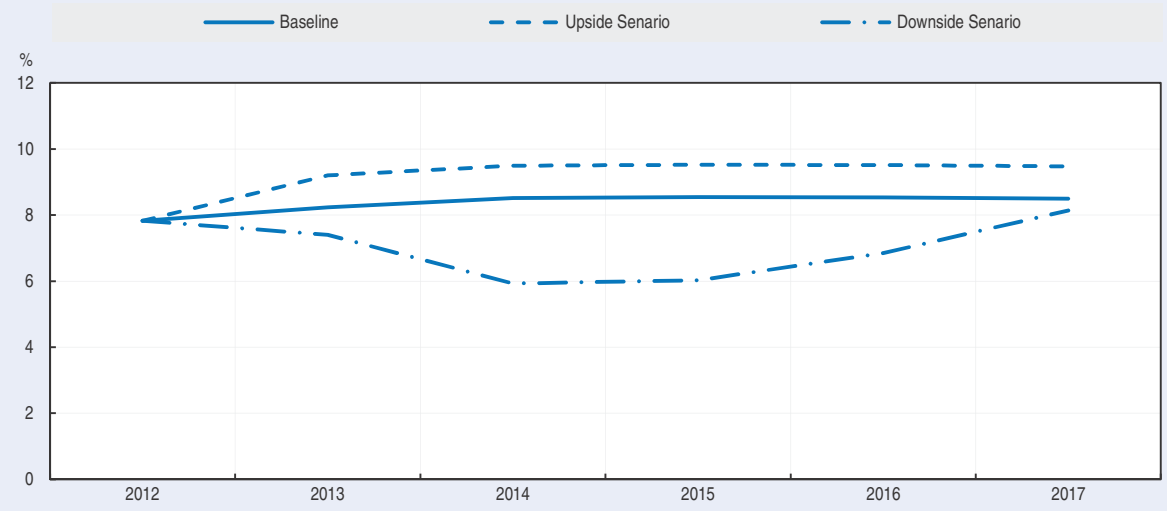
Box 2.3. **Macroeconomic challenges facing China in the next decade** *(cont.)*

OECD has projected that the pace of economic growth in China will slow toward 6% per year. The upside and downside scenarios, based on IMF estimates, still indicate a range from 6 to 9%, and while a significant range, still indicates anticipated robust growth in the future. However, China's labour force recently decreased for the first time (*Financial Times*, 2013) and there are signs of labour shortage in the near future. Real average wages have increased more than three-fold since 2000 in many provinces (IMF, 2012b). The concern is that China will eventually reach the so-called Lewis Turning Point, where higher wages will lower competitiveness and compromise future economic growth (Cai and Wang, 2012; IMF, 2012b).

China : Annual GDP growth rate scenario



Source: IMF and FAO calculations.

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of the population, has led quickly to a more rapid ageing of the population structure. Emigration out of rural communities, encouraged by higher wages in urban communities, particularly for more highly educated and younger labourers, has left a higher age labour force in rural China. Policies surrounding land tenure may also limit the incentives for younger producers to remain in rural areas and invest in productivity enhancing technologies. Effectively, this situation will continue to deprive the sector of the modern, skilled workforce which it needs for more complex and larger scale farming operations, including using modern machinery and equipment, diagnosing diseases and pests, employing investment and marketing tools, and managing effectively complex operating units. The net result will limit productivity in the future, curbing supply potential, and limiting farm sector competitiveness.

On the demand side, population growth will continue, albeit at a slower rate of 0.3% p.a. compared to 0.5% p.a. in the past decade. The rapid increase in urban population will continue to impact on food demand patterns. While the total population increase is projected by the UN to be some 38 million people to 1.392 billion by 2022, urban population may increase by 138 million over this period. In 2011, the average net income of urban dwellers was almost three times that of rural dwellers. As noted in Table 2.2, consumption patterns are strikingly different. Not only does food consumption appear higher in urban contexts, which are associated with higher incomes, consumption of meat, dairy and fish products are also

much higher. These demographic trends will support changes in diet structure, implying growth in the demand for feed grain and protein meal. They also place higher demand for modern and efficient food marketing chains which establish quality and safety regimes that must be met by supply chains reaching down to the primary sector. Nevertheless, as measured by current data on apparent consumption, consumption of both meat and fish in China on a per capita basis is similar to many OECD countries and an appropriate issue is how much the composition of protein intake will change over the coming decade.

Table 2.2. **China: Food consumption by category, rural vs. urban**

	1990	1995	2000	2005	2011
	(kg per year/person)				
Rural					
Grains (unprocessed)	262.1	256.1	250.2	208.8	170.7
Meat and poultry	12.6	13.1	17.2	20.8	20.9
Dairy products	1.1	0.6	1.1	2.9	5.2
Fish	2.1	3.4	3.9	4.9	5.4
Vegetable oils	3.5	4.3	5.5	4.9	6.6
Vegetables	134	104.6	106.7	102.3	89.4
Urban					
Grains (unprocessed)	158.4	117.6	99.8	93.3	97.8
Meat and poultry	25.2	23.7	25.5	32.8	35.2
Fresh milk	4.6	4.6	9.9	17.9	13.7
Fish	7.7	9.2	11.7	12.6	14.6
Vegetable oils	6.4	7.1	8.2	9.3	9.3
Vegetables	138.7	116.5	114.7	118.6	114.6

Notes: Note data exclude consumption outside the household; weights of measurement may differ from data of other sources.
Source: National Bureau of Statistics, China.

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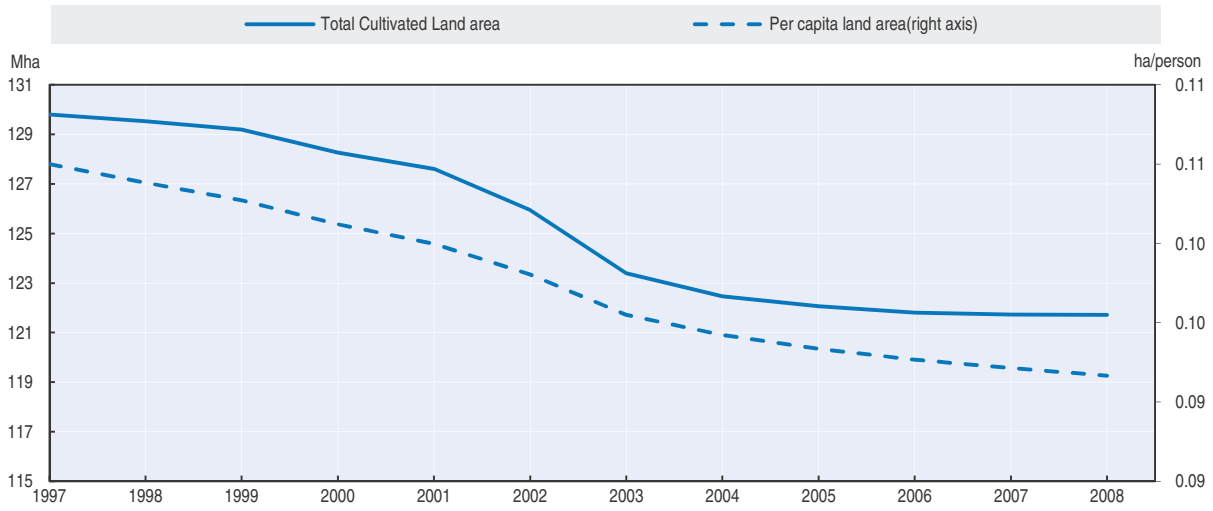
Reduction in arable land will abate, but reduction in quality foreseen, slowing crop yield growth

The previous section noted that quality labour input in rural China is becoming scarce and more expensive. However, as long recognised, China's land and water issues are the primary constraints to the expansion of agricultural production. Although China has the world's third largest area of arable land, on a per capita basis per capita arable land availability is less than one half of the global average (0.09 *vs.* 0.22 ha per capita), and about one quarter of the average for OECD countries (0.35 ha per capita).

Recently, cultivated land area (arable land including permanent crops) has decreased rapidly. According to the statistics of Chinese Ministry of Land and Resources, national cultivated land decreased from 129.8 Mha in 1997 to 121.7 Mha in 2008, a 6.2% decline (Figure 2.7). During the 10th Five-Year Plan (2001-05) for agriculture, cultivated area decreased mainly due to planned ecological cropland conversion. However, the 11th Five-Year Plan (2006-10) arrested this decline and established a legally binding minimum "Red-line" area of 120 Mha. Under the 12th Five-Year Plan, the Red-line continues to apply until 2015. This *Outlook* assumes it will be extended to at least 2022 and effectively sustain land in agriculture over the period. However, pressures from increased urbanisation will likely prevent any expansion in arable area, and with multi-cropping rates near their maximum, competition for land will remain high.

Figure 2.7. **China: Cultivated land area**



Source: National Bureau of Statistics, China.

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The quality of cultivated land is also deteriorating. According to current estimates of cultivated land resources, 70% are in low-yield farmland. There is a declining trend in soil quality. Due to serious water/land erosion and soil salinisation/acidification, land degradation has risen to more than 40% of total arable land area. In the northern oasis agricultural area, salinisation problems have become increasingly prominent. In the Ningxia Yellow River Irrigation area, salinisation of the soil has become one of the important issues that affect agricultural production, and the northern part of Yinchuan saline-alkali soil affects more than 49% of the total cultivated area. Second, wind erosion and desertification is increasing. Affected by global warming, reduced rainfall, depletion of surface runoff and groundwater levels, the northern region, especially the northern farming and animal husbandry areas, faces very serious soil wind erosion and desertification problems. Soil pollution has become serious in many areas. In city suburbs, farmland suffers pollution from sewage, garbage and other pollutants. Near mines, farmland suffers pollution from slag and harmful mining drainage. Farmland near factories suffers from pollution by industrial emissions and sewage. According to recent statistics, nearly 20% of the total arable land in China is polluted to various degrees. These indicators suggest that productivity will be affected and that the costs of production may need to rise to repair environmental damage.

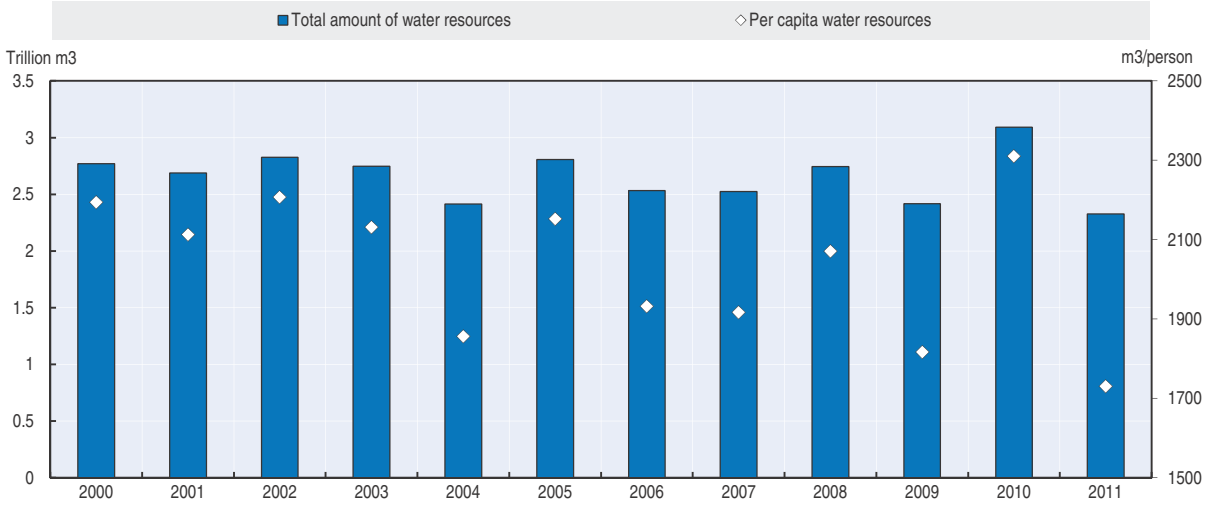
Less and more variable water resources – impact of climate change is evident

China has water shortage problems, with relatively low levels of precipitation and high annual variations (Figure 2.8). Its total water resources ranked fourth in the world, but per capita water resource was only one quarter of the world average for the period 2000-11. China's average annual total water resources is 2.7 trillion cubic meters; in 2010, water resources reached 3.1 trillion cubic meters but in 2011 it was only 2.3 trillion cubic meters. The difference between these two years is 33%. Per capita water supplies of 2 194 cubic meters in 2000 decreased to 1 730 m^3 in 2011, and annual average per capita water resource was only 2 036 m^3.

Although the share of agriculture's water use has trended down in the last decade, it is still more than 60% of total water use. Under the conditions of climate change, reduction of agricultural water availability may affect the stability of food production. According to

some experts, the production of one tonne of grain consumed about 1 300 m^3 of water in China, but less than 1 000 m^3 of water is needed to produce the same quantity of grain in developed countries. Since 2000, the water gap in China's agricultural irrigation system was about 40 billion m^3, equivalent to the water demand of 30 Mt of grain, accounting for about 5% of the current grain production. Water shortage, including issues related to water pollution may also affect future expansion of aquaculture production.

Figure 2.8. **The fluctuation in water resources in China**



Source: National Bureau of Statistics, China.

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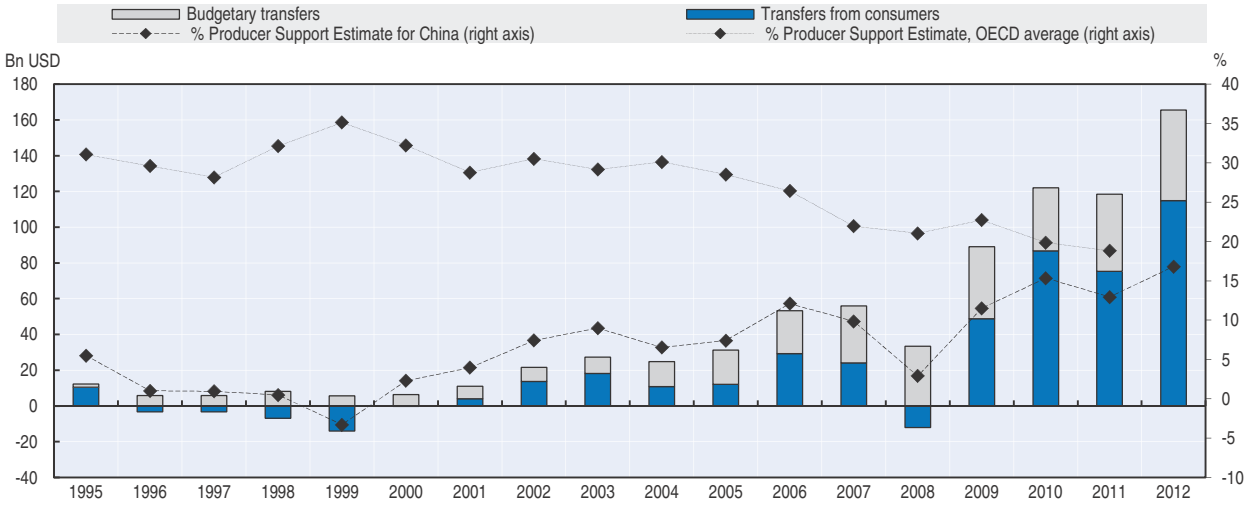
The policy environment will remain supportive

This *Outlook* assumes that the current policy framework will remain intact over the next decade. While government policy has promoted the reform of domestic and, in some cases, international market linkages, the OECD's measure of Producer Support Estimate (PSE) for China has been rising, showing higher transfers in the form of subsidies and price support to producers.[7] While still below the OECD average, the estimate of support has risen since 2000 (Figure 2.9). These transfers reflect the intent of policy to support farmers and rural communities, given large pressures for adjustment.

OECD's PSE for China indicate the nature and extent of measures to increase farmers' incomes. Transfers from consumers associated with minimum procurement prices for rice and wheat and with a growing range of commodities covered by market intervention mechanisms are a main channel for providing support. These may keep prices higher than what they otherwise would be, effectively transferring income to producers, from consumers. In particular, if minimum procurement prices are adjusted for domestic inflation, they will support prices far beyond international price levels and effectively draw in imports up to tariff quota levels, if not beyond. While the amount of transfers provided through this channel has been trending up since the end of the 1990s, it has fluctuated significantly over the last ten years, partly as a result of the government's policy to balance producers' and consumers' interests in the context of reducing price volatility compared to international markets. Thus, high international prices for agricultural commodities, as in 2007 and 2008, were only partly transmitted to domestic markets, resulting in a significant fall in measured market price support to farmers. In 2008, market price support was negative as international prices rose

Figure 2.9. **China: PSE level and composition, 1995-2012**



Source: OECD (2013), "Producer and Consumer Support Estimates", OECD Agriculture statistics (database).

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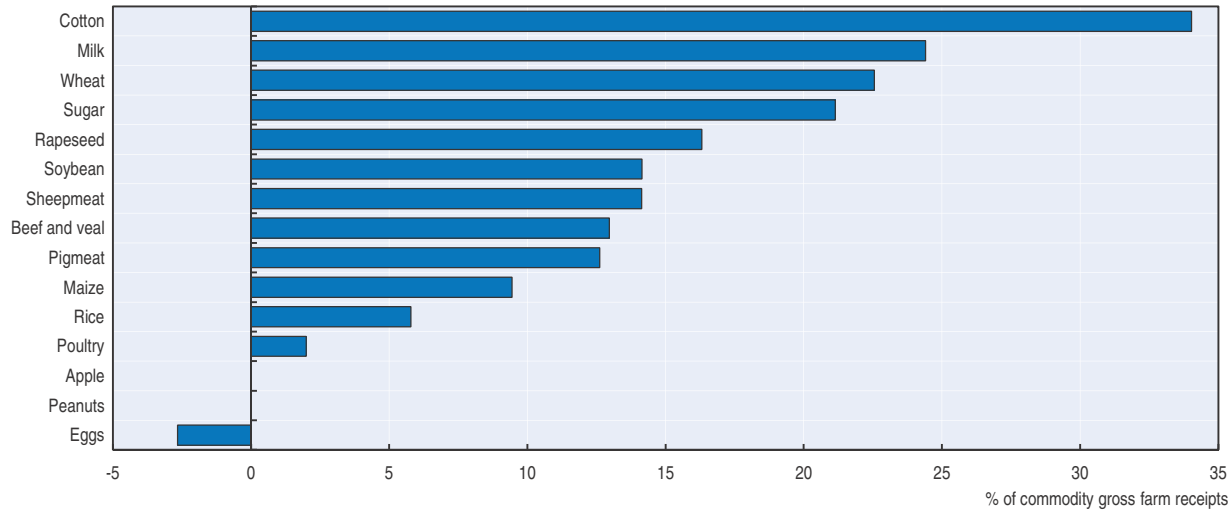
above domestic levels, but has increased since then as international prices have fallen from peak levels and as minimum procurement prices have risen.

Budgetary transfers for producers have been growing constantly since the end of the 1990s and are provided mostly through direct payments for grain producers, payments compensating increase in prices of agricultural inputs, in particular fertilisers and fuels, payments enhancing use of improved seeds and through subsidies for purchases of agricultural machinery. A positive feature of these transfers is that to an increasing extent they are provided through direct payments at a flat rate per unit of land which is effective in supporting farmers' income and have limited influence on production and trade. If these two channels are summed up and related to gross farm revenues (% PSE), it turns out that the level of support in China has been growing closer to the OECD average (Figure 2.9). The level of commodity specific transfers from consumers and taxpayers measured as a percentage of gross farm receipts from the production of a given commodity (Producer Single Commodity Transfer, SCT), shows that the importance of transfers varies considerably by commodity from above 20% for cotton, wheat, milk and sugar, to zero for exportable apples and peanuts and even slightly negative for eggs (Figure 2.10).

Notwithstanding these OECD measures of support, China's domestic support remains well within its WTO commitments. Subsidies under the Green Box at USD 88 billion and USD 100 billion in 2009 and 2010 respectively. Under the Amber Box, non-specific subsidies were 1.6% for non-specific products in these years, and product specific subsidies were less than 8.5% of agricultural output values.[8]

China's medium term policy priorities and its success in achieving these goals will have a large impact on the structure and output of its agricultural sector over the next decade. A summary of the stated priorities is presented in Box 2.4. By identifying clear policy objectives and measurable, quantitative targets, progress towards these goals will be easier to monitor and evaluate over time.

Figure 2.10. **China: Producer single commodity transfers, 2010-12**



Source: OECD (2013), "Producer and Consumer Support Estimates", OECD Agriculture statistics (database).

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Box 2.4. **China's medium term policy priorities**

China's medium term policy priorities are enunciated in its 12th Five-Year Plan for National Economic and Social Development of the People's Republic of China (2011-15) and National Modern Agriculture Development Plan (2011-15), which strive to solve the "Sannong" issues: agriculture, rural community, and farmers. These priorities focus on the following areas.

- Safeguard national grain security, transform agricultural development, and improve agricultural production capacity.
- Increase farmers' income and living standards, narrowing the gap of living standards between urban and rural areas.
- Ensure food quality and safety.
- Protect agricultural resources and promote environmental sustainability.

The 12th Five-Year Plan targets include the following.

- Grain-sown area will stay at above 106.7 Mha, and overall production capacity will reach above 540 Mt.[1] Ensure general self-sufficiency in food production.
- Per capita annual net income of rural residents will grow more than 7% and the impoverished population will be significantly reduced.
- New added farmland effective irrigation area will reach 2.7 Mha and efficient utilisation coefficient of agricultural irrigation water will increase to 0.53, grassland degradation will be effectively curbed.
- Improve resource utilisation and land productivity, strengthen risk prevention and emergency management capacity development.

The main measures taken by the government will focus on the following.

- Strengthen agricultural development and institutional reform.
- Enhance policy support and protection for agriculture.
- Promote the opening-up of agricultural markets.
- Improve and develop the legal system supporting the agriculture and food sectors.

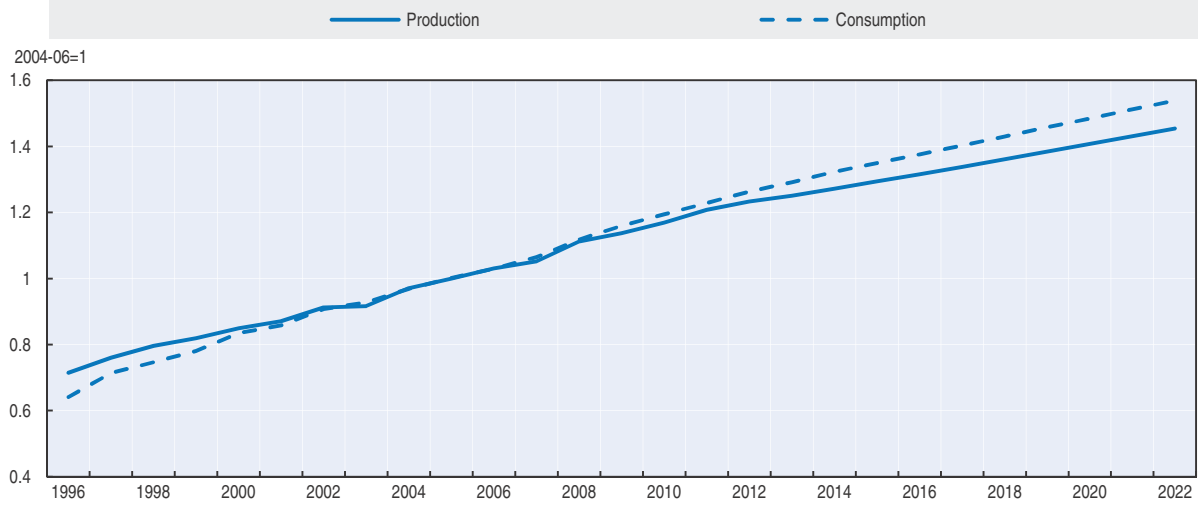
1. The definition of grain used in China's documents includes rice (paddy), wheat, maize and other coarse grains, soybeans and tubers (dry basis).

The commodity outlook for China 2013-22

Overview

The leading question concerning the commodity outlook for China, in the context of the underlying driving factors and growing production constraints as described in the previous section, is whether supply growth will be able to respond to growth in demand. According to this *Outlook*, the answer varies by commodity. Overall, the *Outlook* portrays consumption growth as exceeding production growth (Figure 2.11). As reflected by indexes of net agricultural production and consumption of commodities contained in the *Outlook*, a slow growing import situation is foreseen over the next decade. This trend was evident in the previous decade when agricultural production grew at 3.2% p.a., compared to consumption, which grew at 3.4% p.a. Over the next decade, growth is again expected to slow down, with agricultural production growing by 1.7% p.a. and consumption by 1.9% p.a. These trends anticipate a further, but modest opening of China's agricultural sector, the details of which can be examined by commodity in the following sections.

Figure 2.11. **China: Consumption growth will modestly exceed production growth**



Source: OECD and FAO Secretariats.

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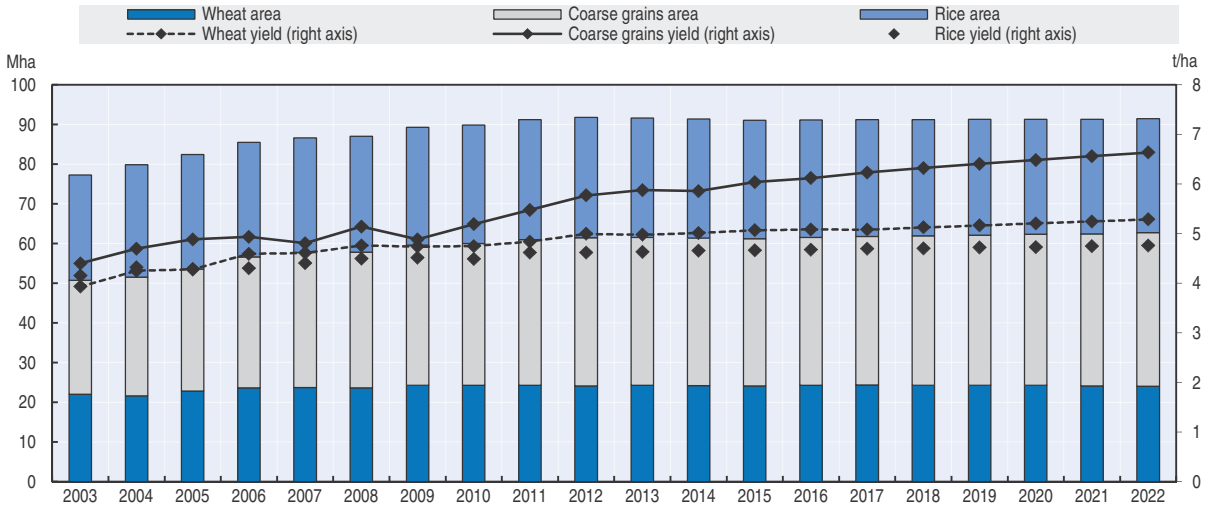
Cereals

Production – growth will slow

By 2022, the wheat area is projected to be 1% lower than the base period (Figure 2.12). China's wheat production is projected to be 127 Mt by 2022, about 8% higher than the production in the base period of 2010-12, but with slower annual growth relative to the previous decade (Figure 2.13). The production increase is attributed to yield growth. Annual yield growth for wheat is projected at only 0.6%, which is lower than that of the period 2003-12 (2.3%). As the area is decreasing slightly, how to improve productivity will be a key issue in the coming years. But raising yields will also bring pressures. Wheat stocks increase slowly over the projection period, exceeding the five-year average but lower than the period before 2003, reaching 51 Mt by 2022 (Figure 2.13). The ratio of wheat stocks to utilisation will approach 40%, which is about the same level as in 2013.

Figure 2.12. **China: Slight decrease in area with slow yield growth**



Source: OECD and FAO Secretariats.

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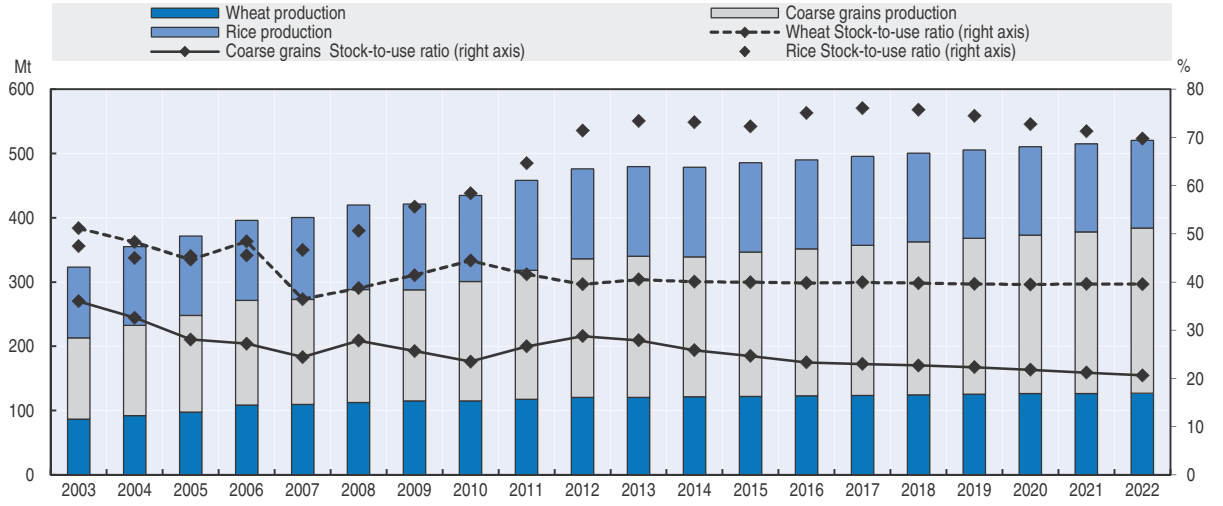
Figure 2.13. **Cereal production and stock ratios in China**



Source: OECD and FAO Secretariats.

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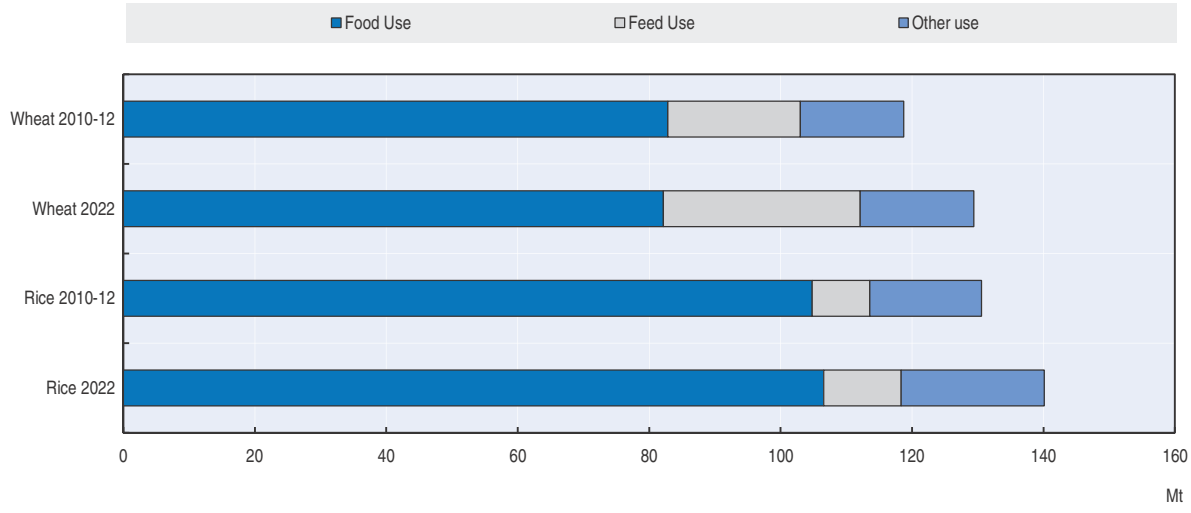
The coarse grain area is projected to be 6% higher than the base period, with an increase of maize at 8%. Coarse grain yields are projected to increase by 1.5% p.a., well below historical trends (Figure 2.12). China's coarse grain production is projected to attain 257 Mt by 2022, up 28% from the base period (Figure 2.13). Competition for land, and land quality concerns remain limiting factors to production growth, but coarse grain will take a higher share of land area. The key driver of growth is high demand for feed for a growing livestock sector. Stocks of coarse grain are projected to 56 Mt by 2022, about 1% below the 2013 level. The ratio of coarse stocks to utilisation will drop to 23%, 3 percentage points lower than 2013 (Figure 2.13).

Rice production in China is projected to reach 137 Mt by 2022, 1% lower than the production in the base period (Figure 2.13). The annual growth rate during the *Outlook* period is projected at -0.2%, significantly lower than the 2.3% p.a. of the previous decade.

The main driver behind this contraction is identified as the declining harvested areas at a pace of about -0.5% p.a., an annual yield growth of just 0.3% (Figure 2.12). Rice stocks are projected to remain around the 100 Mt level over the *Outlook*. Although the stock-to-use ratio for rice should fall to 70% by 2022, it remains at a relatively high level (Figure 2.13).

China's total wheat consumption is projected to reach 129 Mt by 2022. Wheat is expected to remain as a commodity that is predominantly consumed for food, about 63% of total use by 2022, 3% below the share in 2013 as more will be used as feed. Per capita food consumption is projected to reach 59 kg per person, roughly 1 kg decrease from 2013, and about 6 kg lower than the world average level. China's wheat feed utilisation is expected to reach 30 Mt by 2022, growing at a much slower pace than during the historical period, and representing 23% of total use, about 2 percentage points higher than in 2013. Feed use of wheat in China rose rapidly in the last decade from only 5.5 Mt to 26 Mt in 2012 given rising demand for feed and a more favourable price of wheat compared to coarse grains. Other use of wheat is projected to increase from 15 Mt in 2013 to 17 Mt in 2022 (Figure 2.14).

Figure 2.14. **China: Wheat feed consumption increases, rice food consumption stagnant**



Source: OECD and FAO Secretariats.

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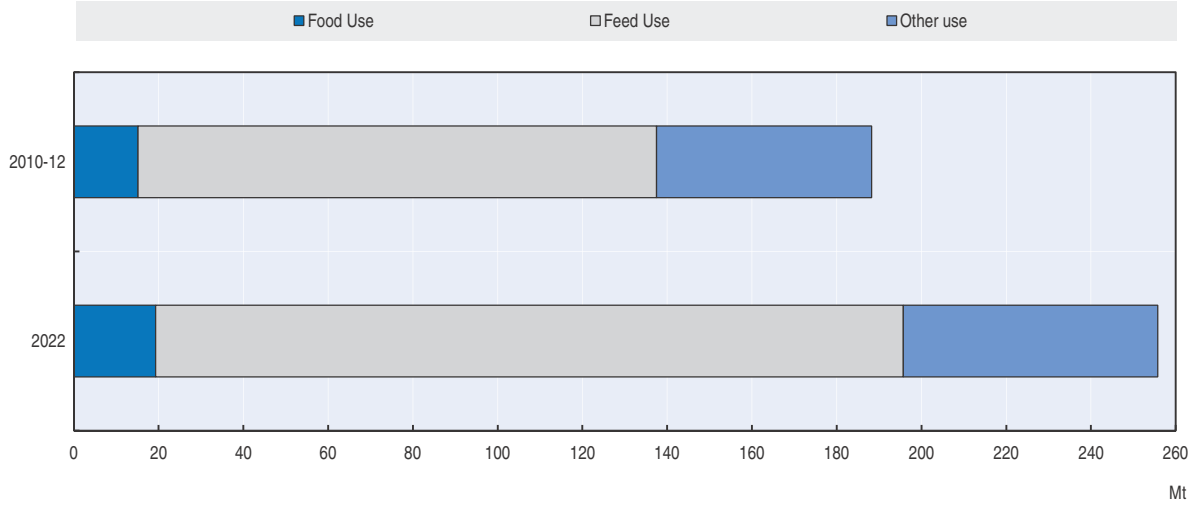
China's utilisation of coarse grains is projected to increase by 35% by 2022, compared to base period and reach 270 Mt, driven mainly by expansion in demand for feed. The projected annual growth (2.1%) is less than observed over the previous decade (5.2%) largely because China will exercise strict control over the industrial usage of maize. Food use is projected to reach 19 Mt, which is a rise of 2 kg per capita over the period. Total feed use is projected at 176 Mt, growing at 2.6% p.a., slightly more than the 2.5% growth in non-ruminant meat output (Figure 2.15).

Rice consumption is set to increase a modest 0.3% p.a. over the *Outlook*. Rice is consumed chiefly as food (78%), and consumption is set to reach 107 Mt in 2022, up slightly from 106 Mt in 2013. However in per capita terms rice food consumption is projected to decline by 0.2% p.a. to 76.5 kg. This decline continues the trend of the previous decade as consumers spend additional income on other foods.

Figure 2.15. **China: Coarse grain feed consumption increasing with meat production**



Source: OECD and FAO Secretariats.

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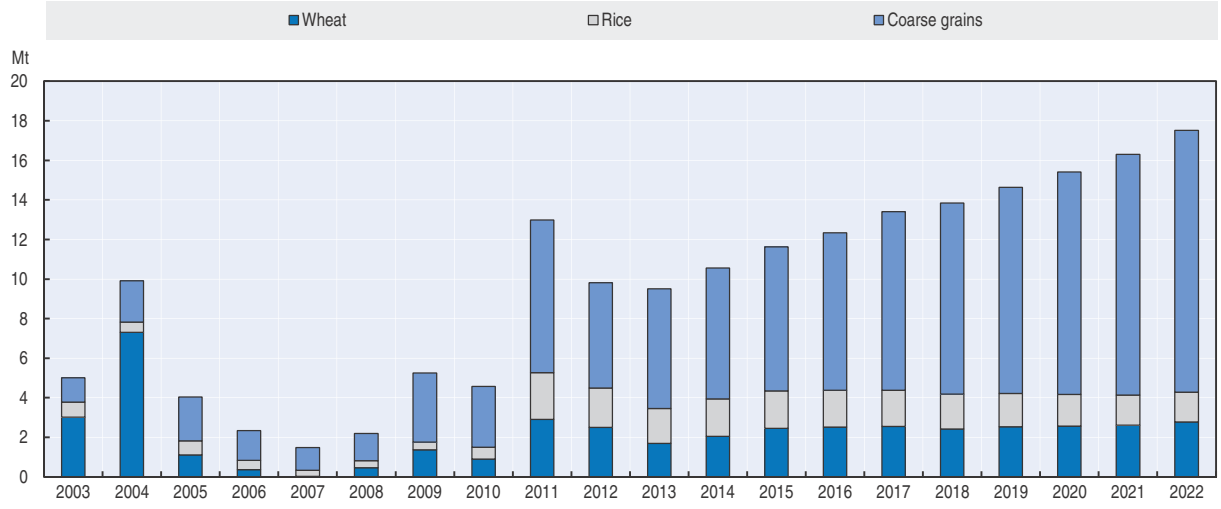
Increasing imports of wheat and maize

China's export of cereals will continue at a very low level, but imports will expand except for rice. China's import of wheat in 2022 is projected to expand to 2.8 Mt, up from an average of 2.1 Mt in the base period, still maintaining China at about 98% self sufficiency. However, imports of coarse grains are projected to reach 13.2 Mt, and beyond the limit of China's tariff quotas. This sharp rise is mainly driven by stronger import demand for feed. Imports may also be affected by the decision to allow imports of maize for industrial purposes. China's import of rice, contrary to wheat and coarse grains, is projected to decline to 1.5 Mt, somewhat lower than the average of the base period 2010-12. The sharp increase during the period 2011-12 will not be sustained because of sufficient domestic supply and accumulated stock (Figure 2.16).

Figure 2.16. **China's cereals imports**



Source: OECD and FAO Secretariats.

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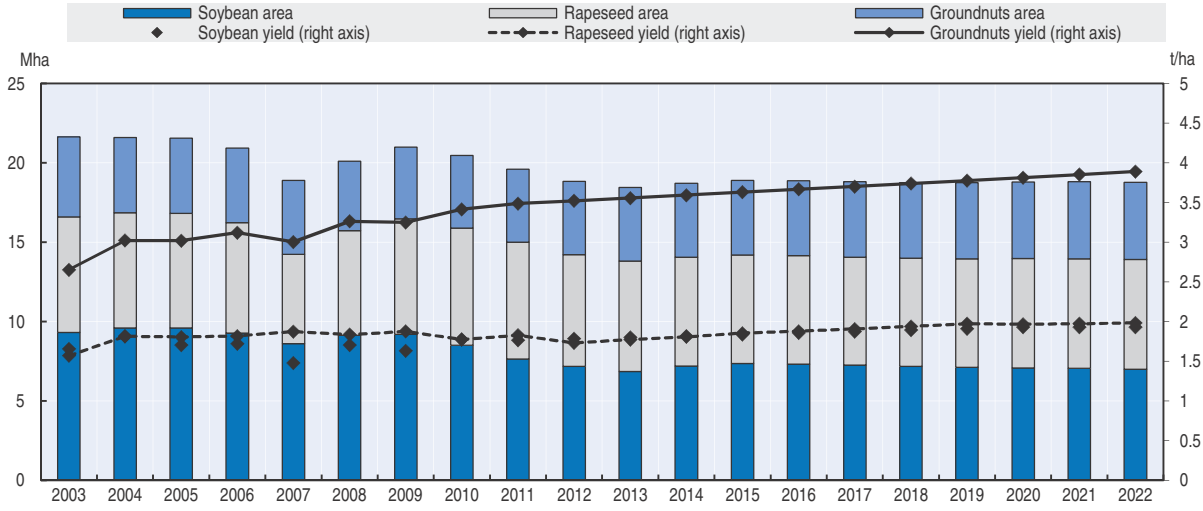
Oilseeds and oilseed products

The oilseed sector in China is relatively less supported by the government than other crops, and tariffs are low. China's oilseeds production is projected to exceed 48 Mt by 2022, about 8% higher than the production in the base period (Figure 2.18). Compared to the previous decade, growth is expected to increase moderately, mostly driven by a small increase in area, with the exception of rapeseed. Annual yield growth for oilseeds is projected at 1.1%, slightly lower than that of the last decade (1.3%). Largely due to higher yield levels, soybean production is projected to reach 13.5 Mt by 2022, 14% above the level of 2013, recovering from the decrease trend during 2003-12. Rapeseed plantings in China are expected to decline to 6.9 Mha, about 2% lower than the current level, mainly due to high marginal costs of planting increases and sustained profitability of competing crops such as maize. The yield of rapeseed is projected to grow at 1.3% p.a. and expected production will reach 13.7 Mt by 2022, increasing about 11%. Groundnut production, another important oilseed of China, is projected to reach 19 Mt by 2022, 15% higher than in 2013, growing at the same stable pace as during the historical period, while the annual yield growth rate is expected to be 1% (Figure 2.17).

Figure 2.17. **China's main oilseed area and yield growth**



Source: OECD and FAO Secretariats.

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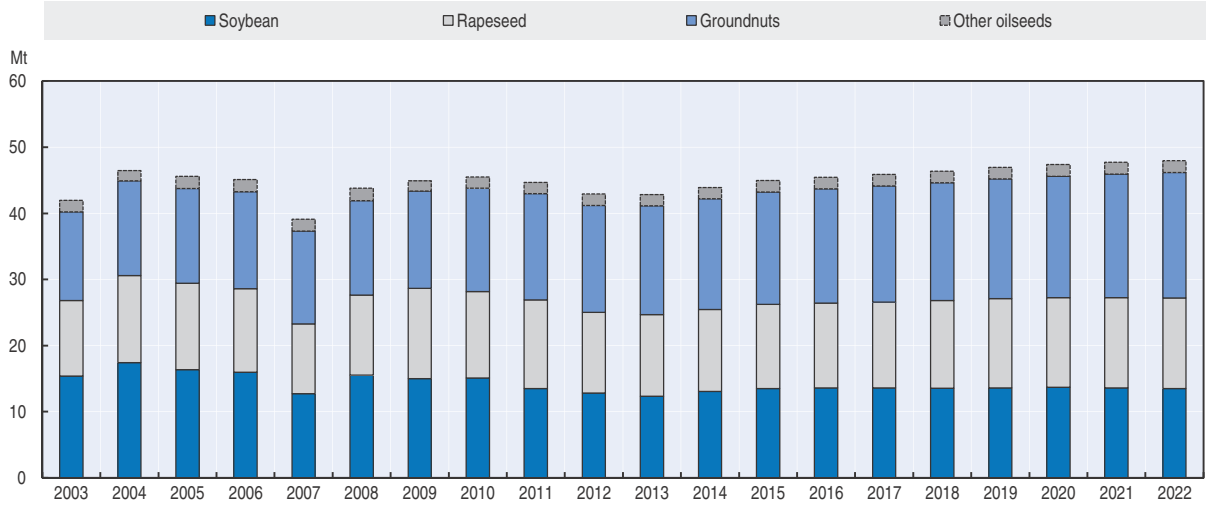
Increased consumption has lead to a concurrent increase in China's oilseeds stocks. However, over the projection period, stocks stabilise around 18.3 Mt by 2022, which represents an annual growth rate of only 0.1%, significantly lower than the growth rate during the previous ten years (16.5% p.a.). The ratio of oilseeds stocks to utilisation will approach 14.2%, about 2-3 percentage points below that of recent levels.

China's vegetable oil production, relying on both domestically grown and imported seed, is projected to reach 25.7 Mt by 2022, up 21% from the base period (Figure 2.19). The annual growth rate during the next decade is projected at 1.7%, well below the level of the previous decade (5.4% p.a.). Vegetable oil consumption is expected to grow by 1.6% p.a., about one-third of the rate observed during 2003-12 (4.5% p.a.). Vegetable oil in China is consumed mainly as food and is expected to reach 36.6 Mt by 2022, up 16% from 2013,

accounting for 99% of total domestic use. Per capita consumption is projected to reach 26 kg, an increase of around 13% from 2013, while the annual growth rate (1.4% p.a.) is slower than the level during the last decade (4.0% p.a.).

Figure 2.18. **China's oilseed production and composition**



Source: OECD and FAO Secretariats.

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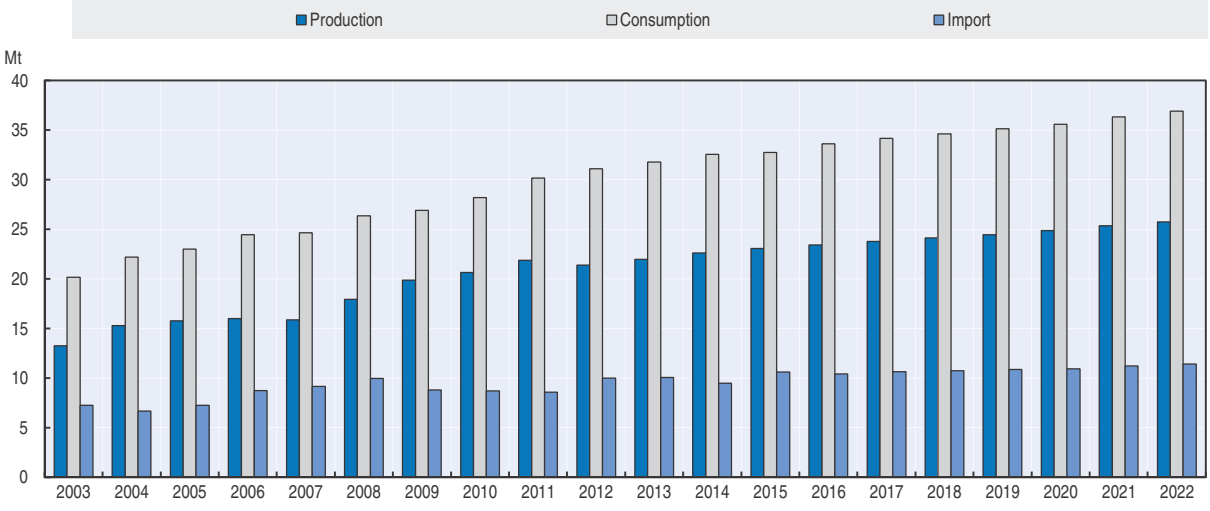
Figure 2.19. **China's vegetable oil production, consumption and imports**



Source: OECD and FAO Secretariats.

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China's oil meal output is projected to increase by 21%, reaching almost 75 Mt by 2022. Oil meal production continues to rely on crush of both domestically grown and imported seed. The annual growth of production is expected to be 2%, markedly lower than the level during 2003-12 (7.4%). This reflects the much higher base level of production and the fact that demand driven by livestock industries will grow also at a slower pace than before.

Imports of oilseeds rise to over 80 Mt

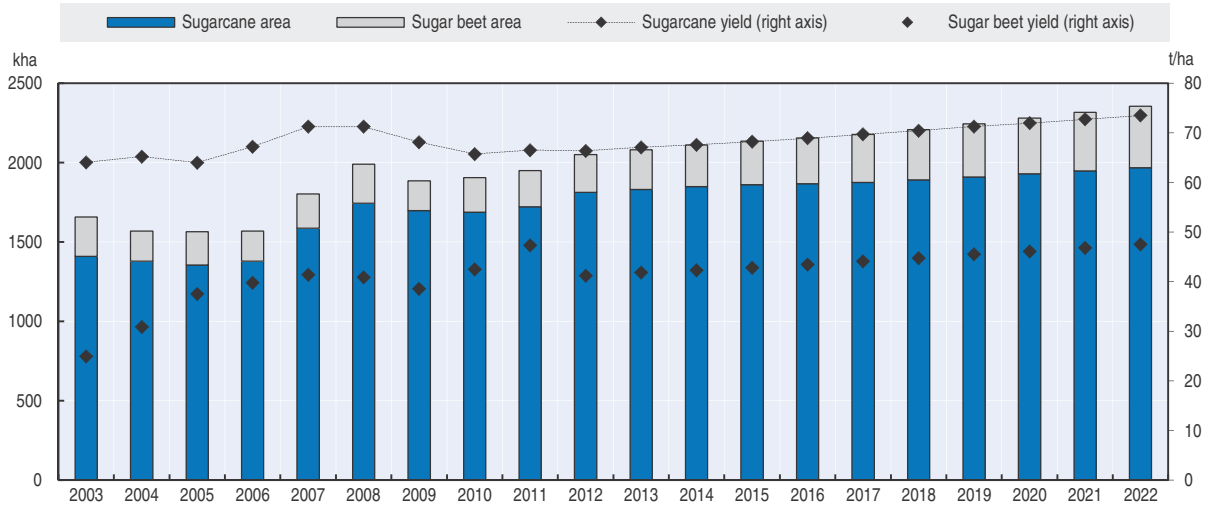
China's export of oilseeds will continue to decrease and remain at a very low level. Imports will reach 83 Mt, 41% higher than the base period level, and will account for 59% of global trade, up from around 54% in the base period. Import growth should slow down compared to the last decade, on account of the deceleration in growth of the crushing sector, as demand growth for both protein meal and vegetable oil eases, from a higher base. The annual growth rate is expected at 2.6%, down from 13.3% p.a. in the previous ten years. As for vegetable oils, China's imports are expected to reach 11.4 Mt, up 25% from base period values, with an annual growth rate (1.6% p.a.) less than half of the previous decade (3.5% p.a.). Because China covers a considerable part of its oil requirements via the crushing of imported oilseeds, the annual growth of imports will also be somewhat slower than that of production and consumption (Figure 2.19). With respect to protein meals, China's imports are projected to expand to 5.8 Mt by 2013, significantly up 267% from the base period, because of the development of the livestock industry and the relative small scale in the base year.

Sugar

China's sugar production is projected to expand faster in the coming ten years to reach 16.4 Mt, about 28% higher than the production in the base period (Figure 2.21). Annual growth for sugar production is projected at 2.7%, about the same as that of the last decade. Perennial sugarcane production continues to dominate sugar beets in the production of sugar. Although sugar beet production is expected to grow at 6.5% per year, markedly faster than sugarcane (1.8% p.a.) over the next ten years, sugarcane will still account for 89% of total sugar output by 2022.

Sugarcane planting area in China is expected to reach 2 Mha by 2022, up 13% from the base period, with a yield growth rate at 1% p.a. during the projection period, higher than the level in the previous ten years (0.4% p.a.). Sugar beet area is projected to increase to 0.4 Mha by 2022, about 55% above the current year, and the annual yield growth rate over the next ten years is expected to be at 1.5%, higher than that of the last decade (0.7%) (Figure 2.20).

Figure 2.20. **China's sugar area and yield growth**



Source: OECD and FAO Secretariats.

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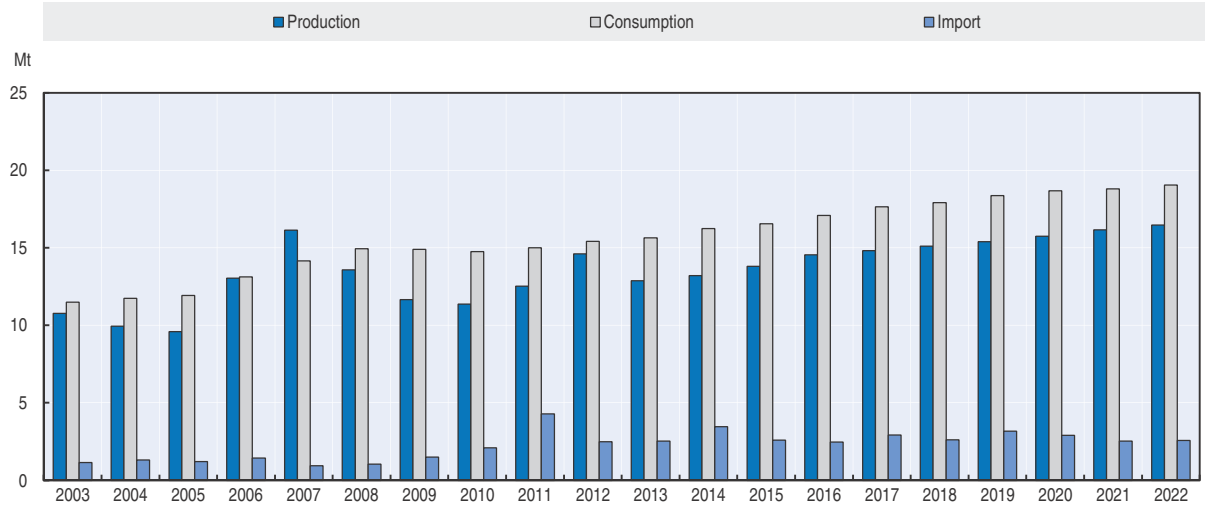
China's sugar consumption is projected to reach 19.1 Mt by 2022, up 27% from the base period, due to rising incomes and growing populations. Per capita sugar consumption is projected to increase to 14 kg per person, roughly 3 kg higher than in the base period.

Imports of sugar to rise above import quotas

China's import of sugar in 2022 is projected to reach 2.6 Mt. China's recent import growth should slow down significantly compared to the last decade, and remain below the peak reached in 2011. The sharp increase of imports during 2011/12 and 2012/13 will not be sustained in the *Outlook* because of sufficient sugar stocks, which expanded to 4.1 Mt in 2012/13, almost double the level during the last ten years, and production is increasing with demand (Figure 2.21).

Figure 2.21. **China's sugar production, consumption and imports**



Source: OECD and FAO Secretariats.

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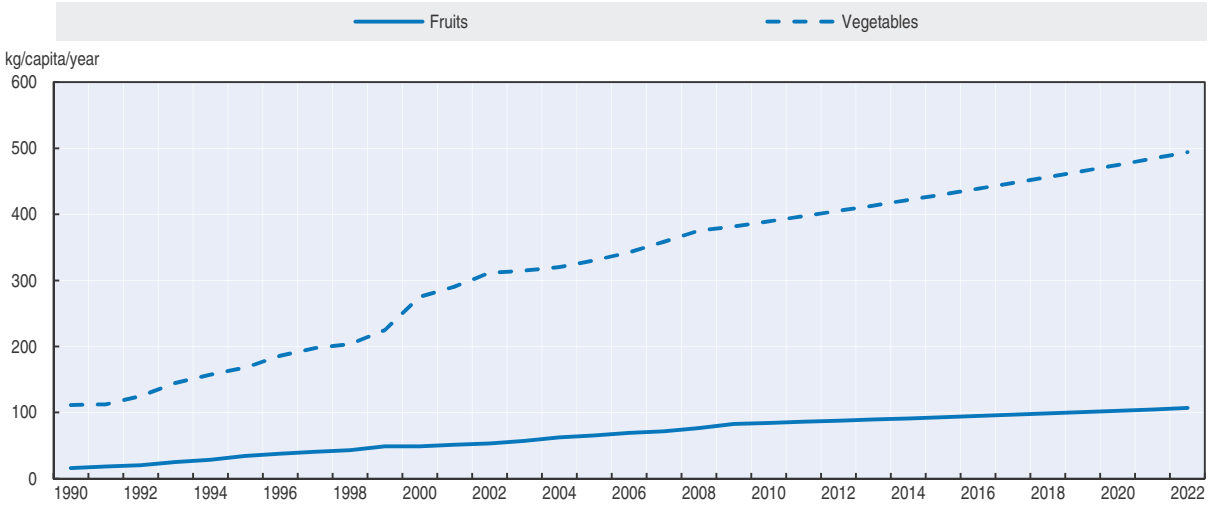
Vegetables and fruit

The *Outlook* does not include international markets for vegetables and fruits. These markets can be very important in the agricultural sectors of certain countries, and this is very much the case for China in terms of farm value and growth. In the last decade, per capita consumption of vegetables grew at a rate of 6% p.a., and that for fruits grew at 3.5% p.a. (Figure 2.22). It is anticipated production in these sectors will both grow in the 2-3% p.a. range over the next decade, with slower growth due to rising water and labour constraints. The crop areas of these commodities measured 20 Mha for vegetables and 12 Mha for fruits in 2011, representing almost 20% of total crop area sown in that year. It is projected that total area to these crops will rise to 38 Mha by 2022, further pressuring area competition with other crops for scarce land and water resources.

Figure 2.22. **China: Per capita vegetable and fruit consumption is rising rapidly**



Source: OECD and FAO Secretariats.

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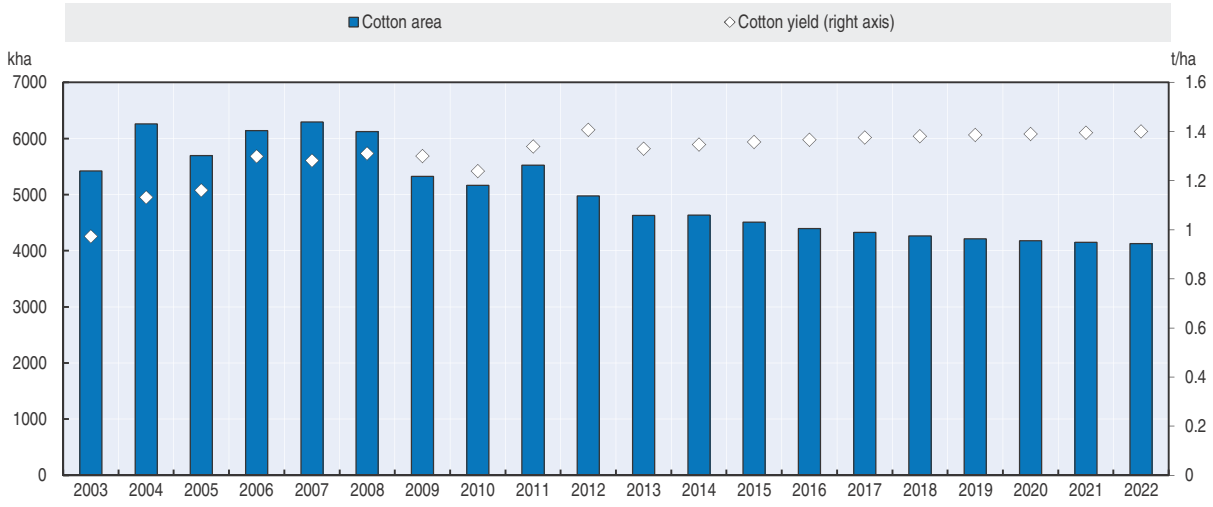
Cotton

China's cotton production is projected to decrease as a result of a decline in area to 5.8 Mt by 2022, about 17% lower than in the base period of 2010-12. By 2022, the harvested area for cotton is projected to be 20% lower than the base period. Yield will continue to expand, but at a slower pace than in the past, reaching 1.40 t/ha by the end of the projection period (Figure 2.23).

Figure 2.23. **China: Decrease in area and yield growth also slows**



Source: OECD and FAO Secretariats.

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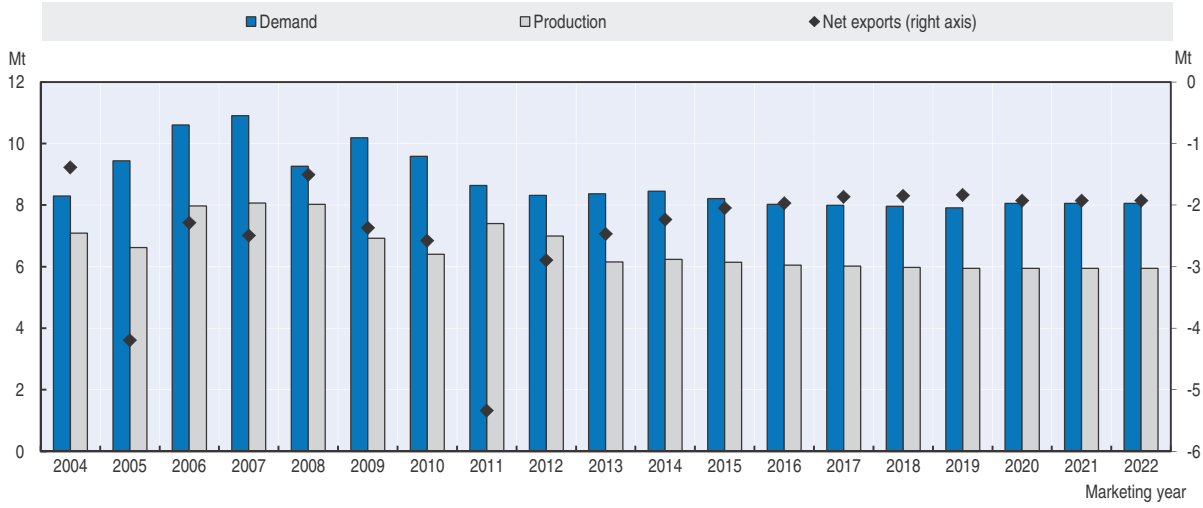
While domestic consumption of textile products is likely to increase, the intensification of competition in cotton spinning products, especially from India and other countries with low cost labour, the use of cotton in China will decline. Total cotton utilisation is projected to reach 8 Mt by 2022, decreasing at a rate of 0.4% p.a. over the *Outlook* period, which is significantly different to the trend shown in the last decade.

Figure 2.24. **Production, utilisation and net trade for cotton in China**



Source: OECD and FAO Secretariats.

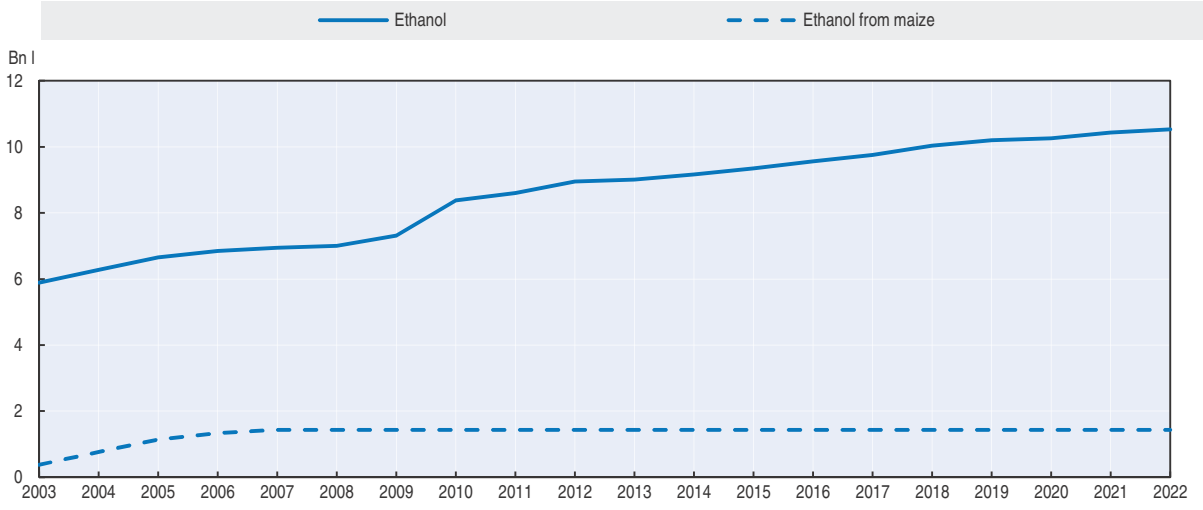
StatLink http://dx.doi.org/10.1787/888932858926

Due to the decrease of domestic utilisation, cotton imports will experience a further reduction and is projected to decrease to 1.9 Mt by 2022, 1.7 Mt (46%) lower than in the base period 2010-12.

Bio-fuels

In the previous decade, ethanol production grew from just under 6 bnl to 9 bnl by 2012. About three-quarters of ethanol production is used in non-fuel uses, although fuel use has been increasing. Production feed stocks have been primarily cassava and specific grains such as sorghum. The rapid increase in production of ethanol from maize, before 2007, raised concerns, given the sensitivity of using this food security crop for non-food purposes. Further increases in ethanol production from maize have been prohibited since 2007.

Figure 2.25. **China: Ethanol production grows slowly, with no direct impact on maize**



Source: OECD and FAO Secretariats.

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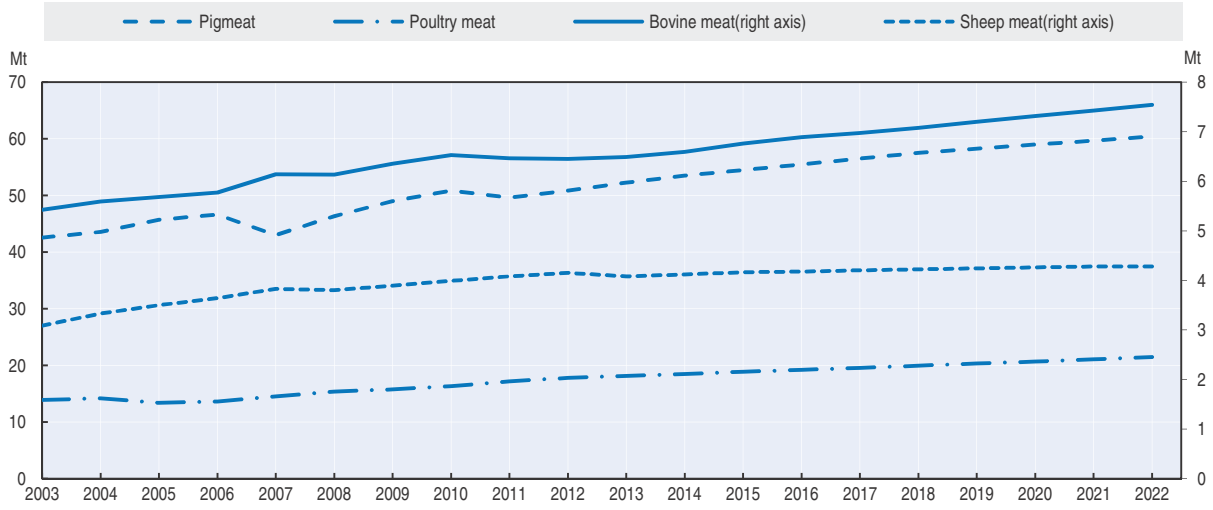
Production of ethanol is anticipated to rise to 10.5 bnl by 2022, a rise of 1.8% annually over the *Outlook* period. Production of ethanol from maize will remain less than 1.5 bnl with the remaining production using feedstocks from other crops (Figure 2.25). Trade in ethanol is anticipated to remain negligible over the *Outlook* period.

Meat

In response to increasing demand, total meat production in China should reach 93 Mt by 2022, an increase of 1.5% p.a. over the *Outlook* period. This is somewhat lower than the 2.3% p.a. in the previous decade. Pigmeat production is projected to increase by 1.6% on average each year, while that for poultry and sheepmeat may grow 1.9% and 0.5% respectively. Bovine meat is anticipated to grow 1.7% p.a. However, each of the meat categories will grow more slowly than in past ten years, as higher prices slow consumption growth. In terms of share in total meat production, on a retail weight basis, pigmeat will remain by far the highest at 63%, followed by poultry at 25%, bovine meat at 7%, and sheep at 5% (Figure 2.26).

Figure 2.26. **China: Meat production – Pigmeat will continue to dominate**



Source: OECD and FAO Secretariats.

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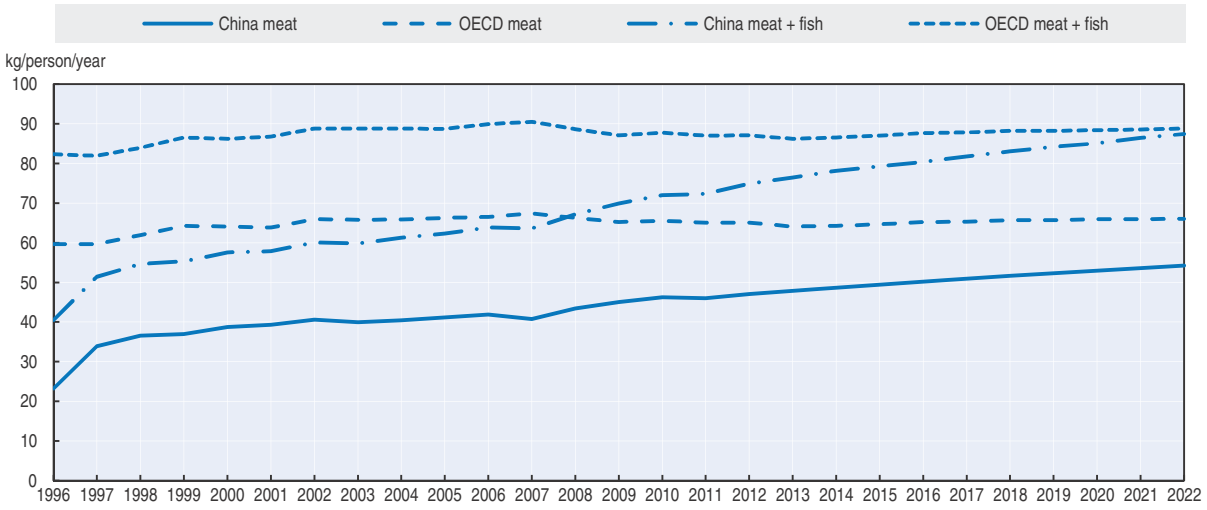
Consumption growth will mirror production growth for China's meat sector. Total meat consumption on a retail weight basis will grow by 1.6% p.a., which is lower than 2.5% p.a. in the last ten years. Per capita consumption will increase by 7 kg p.a. over the period. Pigmeat will capture 66% of the additional meat consumption over the projection period, and poultry meat will experience the fastest increase rate of increase at 1.7% p.a. Total meat consumption in China will be about 54 kg/capita p.a., compared to 64 kg/capita in OECD countries (Figure 2.27). However, average pigmeat consumption in China will be some 34 kg/capita (retail weight basis) compared to the OECD average of 22 kg/capita. OECD consumers eat much more poultry at 28 kg/capita compared to China at 14 kg/capita, and much more bovine meat at 14 kg/capita compared to China at 4 kg/capita. When assessing meat consumption comparatively in this manner, account should be taken of fish consumption, which has grown rapidly in China in recent years (see Fish and food section). It is projected that over the *Outlook* period, China's total of meat and fish consumption may converge to the average of OECD countries in per capita terms (Figure 2.27).

Figure 2.27. **China: Per capita meat consumption is rising towards OECD levels**



Source: OECD and FAO Secretariats.

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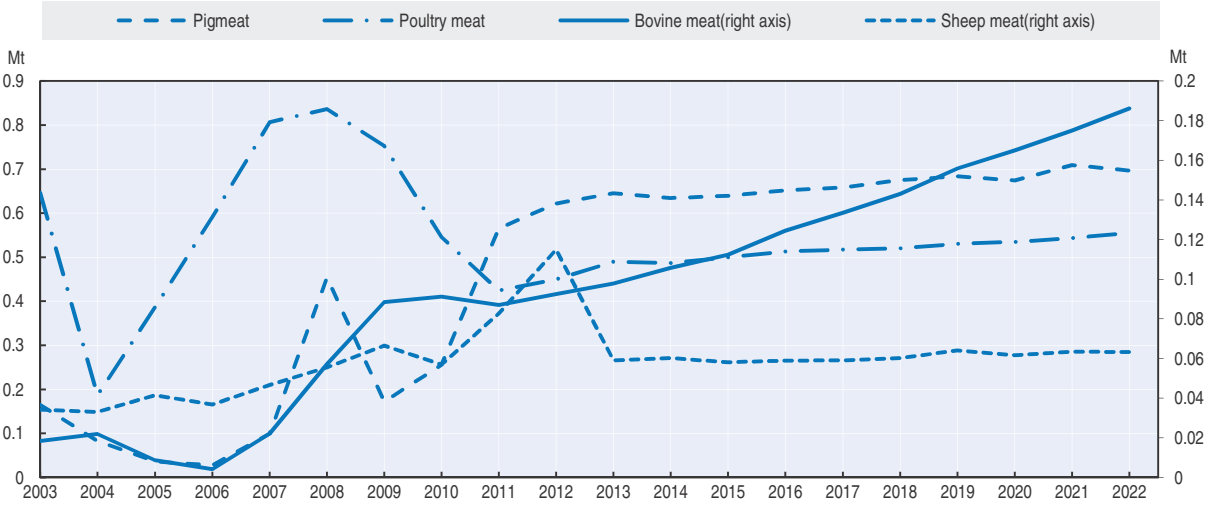
With strong meat prices through the projection, Chinese meat imports are expected to increase by 3% p.a. and reach 1.7 Mt by 2022, driven by population and income growth and high income elasticity of demand. Bovine meat will become the fastest growing import sector with a growth rate of 7% p.a. (Figure 2.28).

Figure 2.28. **China: Bovine will be the fastest meat import sector**



Source: OECD and FAO Secretariats.

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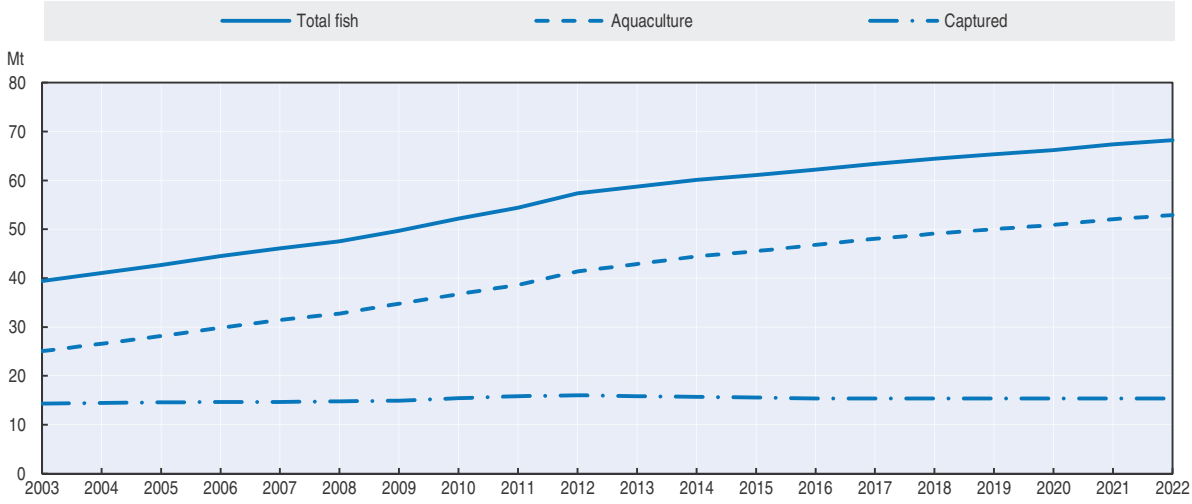
Fish and seafood

China capture and aquaculture fisheries production is projected to reach about 69 Mt by 2022, a growth of 26% above the average level for 2010-12. The increase will be driven by aquaculture, which will rise by 37% over the *Outlook* period compared to a 3% decline of capture fisheries. Aquaculture production is projected to reach about 53 Mt, or 63% of

global aquaculture production (Figure 2.29). However, due to water and land constraints, a slowing down of aquaculture growth is anticipated, from an average annual rate of 5.4% per year in the last decade to 2.4%. Notwithstanding the slower growth rate, aquaculture will continue growing faster than the animal food-producing sectors. There are significant concerns, however, that expanding aquaculture production at this rate will encounter considerable environmental challenges. Environmental issues are attracting more attention, and the government is setting new regulations and enhancing technological innovation to strengthen sustainability and environmental responsibility in aquaculture (12th Five-Year Plan for Chinese Fishery). For capture fisheries also, the government is setting regulations to improve fishery resources through volume controls, curbing illegal, unreported and unregulated fishing (IUU), as well as encourage structural adjustment and efficiency.

Figure 2.29. **China: Aquaculture drives total fishery production increase**



Source: OECD and FAO Secretariats.

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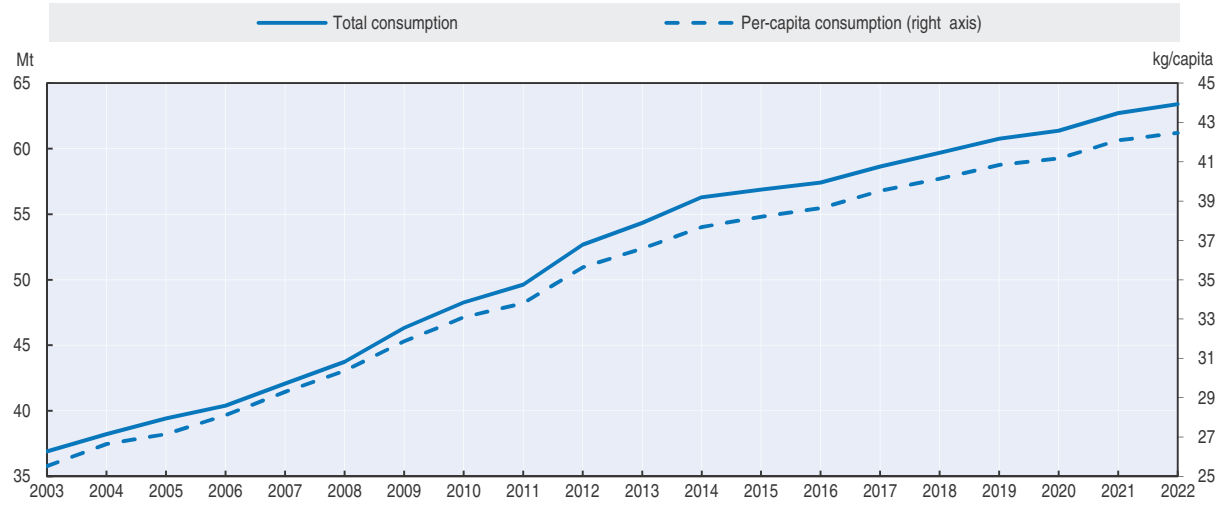
Due to growing demand, per capita fish consumption is expected to expand over the next decade, reaching 42.6 kg in 2022, growing at the rate of 1.5% p.a. Total fish consumption is projected to reach 63 Mt in 2022, 26% more than the average level for 2010-12 (Figure 2.30). But growth is expected to slow to 1.8% p.a. over the projection period compared to 3.7% p.a. in the previous decade.

Rising fish consumption reflects the change in availability of fish and other alternative products. Growth in consumption will be the result of complex interactions between several factors, including rising living standards, population growth and dietary changes linked to rapid urbanisation with an increase in demand for animal food.

Imports and exports of fish are expected to expand moderately over the *Outlook* period. Fish imports for human consumption will reach 4.4 Mt, growing by 2.1% p.a. in the next decade and its share of domestic consumption in China will gradually rise from 7% to 8%. China will remain the world's leading exporter with total exports reaching almost 10 Mt by 2022, an increase of 28%. A significant share of fish exports will continue to consist of reprocessed imported raw material.

Figure 2.30. **China: Fish consumption grows more slowly**



Source: OECD and FAO Secretariats.

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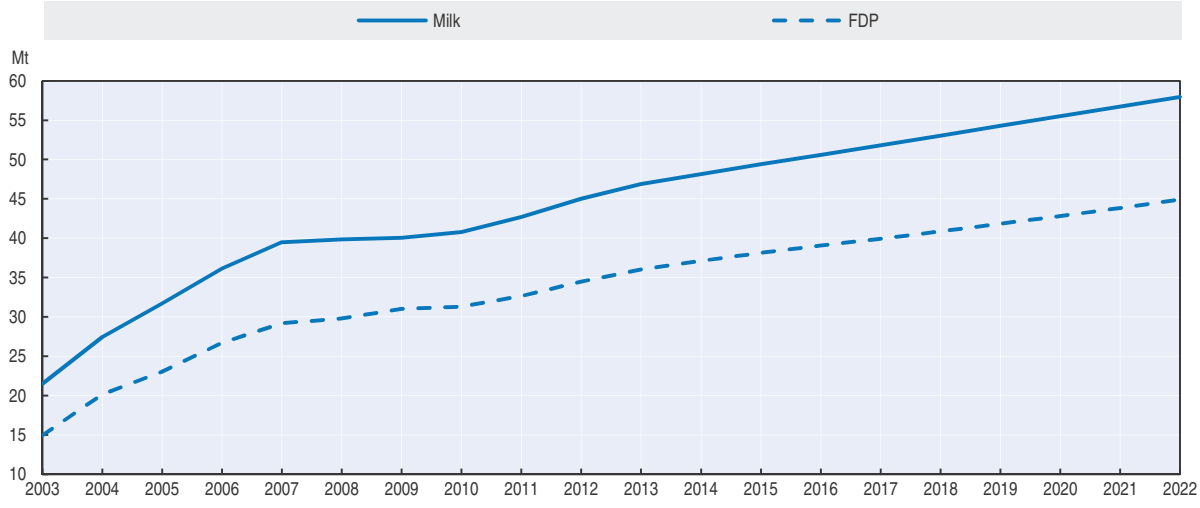
Dairy

Milk production over the *Outlook* period reflects considerably slower growth from the last decade with an average growth rate estimated at 2.4% p.a. Total production will reach almost 58 Mt by 2022 (Figure 2.31). Although the growth rate is lower than the 6.9% level witnessed in the last decade, the dairy sector remains among the fastest growing sectors covered in the *Outlook*. Slower growth is largely due to reform of the production-processing chain following the melamine crisis in 2008-09. The projection includes lower growth of cow inventories with per cow productivity growth at 0.7% p.a.

Figure 2.31. **Growth of milk production in China slows**



Source: OECD and FAO Secretariats.

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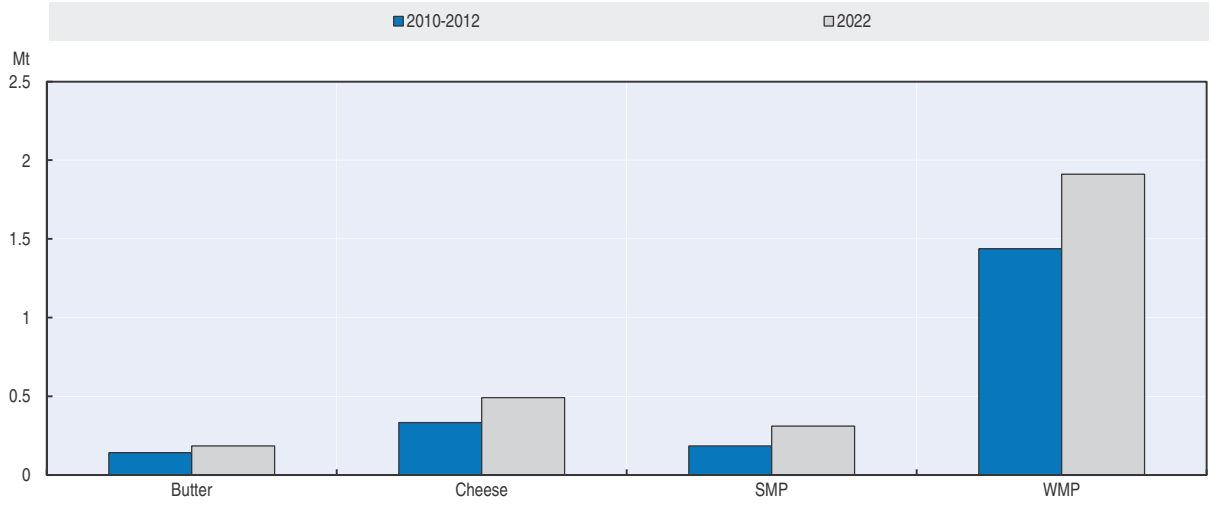
Whole milk powder (WMP) and cheese production will experience the largest increase of 32%, while skim milk powder (SMP) and butter will gain 3% and 21% respectively. Production of fresh dairy products will absorb most of the additional milk production, growing by 36% compared to the base period 2010-12.

Although dairy product consumption is expected to increase by around 38% from the 2010-12 base period, this is much slower than the past decade, since the base is now much higher. While consumption of all dairy products will increase considerably, fresh dairy production will account for most of the volume increase.

Figure 2.32. **Growth of dairy product consumption in China**



Source: OECD and FAO Secretariats.

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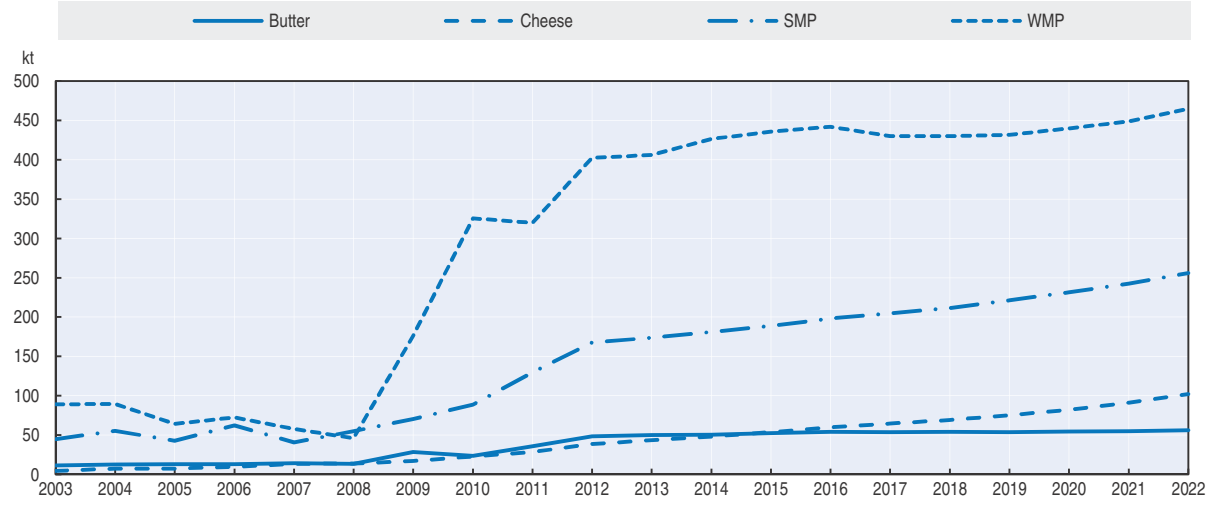
Figure 2.33. **China: Dairy product imports will remain high over the outlook period**



Source: OECD and FAO Secretariats.

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Per capita consumption of butter is expected to grow by 1% p.a. while cheese, fresh dairy products, SMP and WMP gain 3%, 2%, 3% and 2% respectively over the *Outlook* period. This increase is mostly driven by income levels and the growing influence of multinational companies which are introducing new retail products and processing efficiencies, as well as government programmes that promote, for example, school milk consumption.

The total dairy product import growth (in milk equivalent) is projected to rise by about 60% in 2022 compared to the base period, largely as a result of slower growth in domestic production. The rate of import growth of milk products significantly differs among categories (Figure 2.33). Imports of SMP and WMP account for 88% of total dairy product imports. These products are primarily used in the processing of foods where animal proteins and fats are required.

Risks and uncertainties

The *Outlook* provides a plausible projection for China's markets, given the assumptions underlying the conditions of these markets. As such, it would appear that China, despite a strong demand context, with high growth in incomes, will continue to meet its main policy objectives for food self-sufficiency, especially for food security sensitive products, including wheat, rice and vegetable oils. If high income growth is sustained, China's food security situation is most certainly to improve. According to this *Outlook*, achieving these objectives with a slowdown in the growth of crop yields will require an increase in imports of maize for feeding a growing livestock sector. Sugar imports may also rise above tariff quotas. However, the *Outlook* projections suggest that while income growth and urbanisation continue at a fast pace, their marginal impact has been slowing.

Three broad types of scenarios are examined which illustrate the sensitivities of the *Outlook* to possible risks. One potential risk concerns the overall macroeconomic projection. Another concerns issues such as those related to increasing constraints on land and water, or due to rising environmental issues, which may inhibit agriculture's ability to meet rising demand. A third scenario examines risks related to climate change and the potential domestic and international market impacts that could result from potentially lower and more variable crop yields. This section seeks to evaluate these risks with stylised model based scenario analysis with the OECD-FAO global commodity model.

Impacts of alternative economic growth

China's last recession was in 1993. Since that year, economic growth has ranged between 5% and 15% every year, at a trend growth rate of 9.6% per year. The assumption underlying the projection of this *Outlook* is that economic growth will slow to a trend rate of 7.4% p.a. This may seem to be a considerable slow down, but at this trend rate Chinese per capita incomes will still double over the projection period. Sustaining the previous trend growth would obviously add to the demand pressure on China's commodity markets. Given current policy objectives, this growing demand would likely require higher coarse grain and oilseed imports to feed the growing livestock sector, as well as to meet further growth in vegetable oils production. A naïve higher growth scenario, where GDP growth remains at 9.6% p.a. over the *Outlook* period, was conducted with the OECD-FAO commodity model. Results illustrate potential outcomes, whereby meat consumption rises by 6% and production by 4.5% by 2022, inducing an increase in meat imports of some 65% compared to the baseline. Higher meat production induces higher feed grain production,

and a 14% rise in imports of coarse grain. In this scenario, world coarse grain prices rise almost 4%, but Pacific pigmeat prices rise by 8%.

A weaker growth scenario is generally viewed as more likely than a stronger growth scenario. The issue concerns how long China's high growth can be sustained. The development literature refers to the "Lewis Turning Point" or the condition in which fast growing developing economies outrun the labour market competitiveness that has driven export led growth. Recent literature suggests that this point would not be experienced in China within the horizon of this *Outlook*. However, in recognition of this issue, a low growth scenario, with a strong drop in growth by 2016, to 4% p.a. out to 2022 provides alternative assessment of the sensitivities of the *Outlook* to lower growth. This scenario portrays a drop in meat production and consumption by 6% and 7.5% respectively, and a drop in meat imports by 45% by 2022 compared to the baseline. Pacific pigmeat prices fall by almost 5% in this scenario. These economic growth scenarios are extreme, but illustrate the sensitivity of the China's and global markets to its economic performance.

Impacts of increasing constraints to production

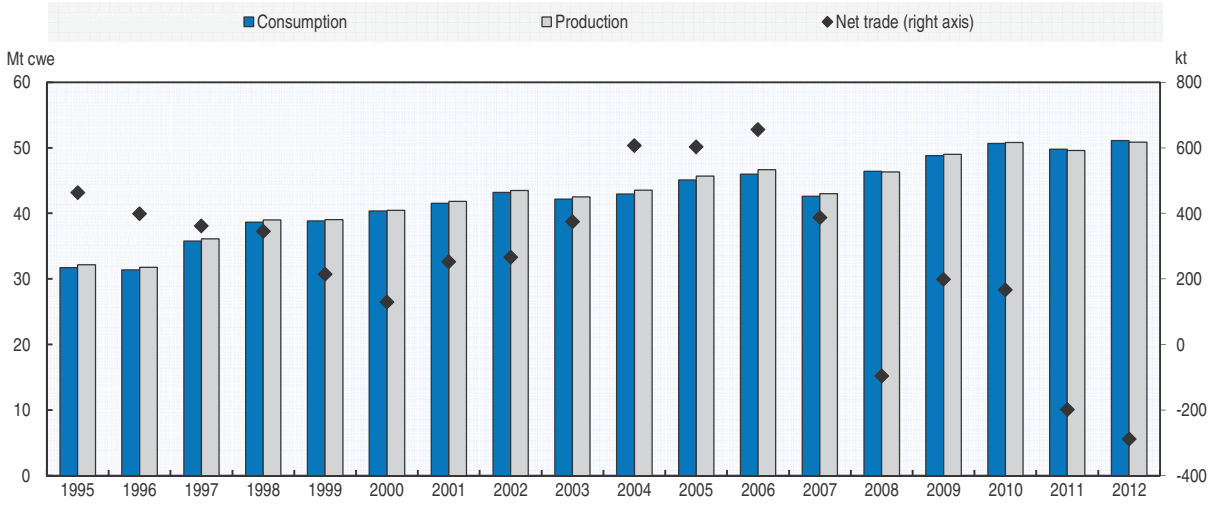
While the *Outlook* illustrates that China will achieve its basic targets for self-sufficiency and grain production, it is apparent that environmental challenges exist with relatively limited, and potentially shrinking, arable land and depleting water resources. In this context, policy choices could be made, for example, to: *a)* import more meat, for example to contain environmental problems associated with livestock production and limit the growth in feed requirements, and/or *b)* lower competition for land and land stress associated with high intensity crop production by importing more coarse grain, to meet rising demand. With arable land potentially falling to the limit of the "red line", importing coarse grain area would reduce intensity of crop production and perhaps enable further growth in other rapidly growing high value vegetable and fruit crops. These scenarios illustrate the types of choices available to address issues of domestic resource constraints, but imply higher imports from global markets.

a) Increase pigmeat imports

China has been emerging as a major player in the world pigmeat market. Its market presence is not only due to its leading position as the world's largest pork producer and consumer, but also increasingly due to the volatility of its pigmeat trade, which has cycled between a trade surplus of over 600 Kt in 2006, and a deficit of over 200 Kt in 2012 (Figure 2.34).

Per capita pigmeat consumption in China increased to 38 kg in 2010, up 13% in ten years. It is expected that total consumption will continue its upward trend over the *Outlook* period, with average annual growth estimated at 1.6%. Coarse grain consumption in China represented roughly 18% (213 Mt) of world consumption in 2012 and is estimated to continue growing by 1.3% over the *Outlook* period. Historically, China has been mostly self-sufficient in pigmeat and coarse grains. Over the *Outlook* period, China's average self-sufficiency levels for pigmeat and coarse grains are roughly 100% and 95%, respectively. Maintaining these self-sufficiency levels in both commodities over the ten-year period will be a challenge. Management of land and water constraints, for example, will play a major role in China's ability to remain self-sufficient. In the next decade, China's pig population will rise to almost 550 million head, further stressing the environment, often in areas surrounding cities.

Figure 2.34. **China pork production consumption and trade**



Source: OECD and FAO Secretariats.

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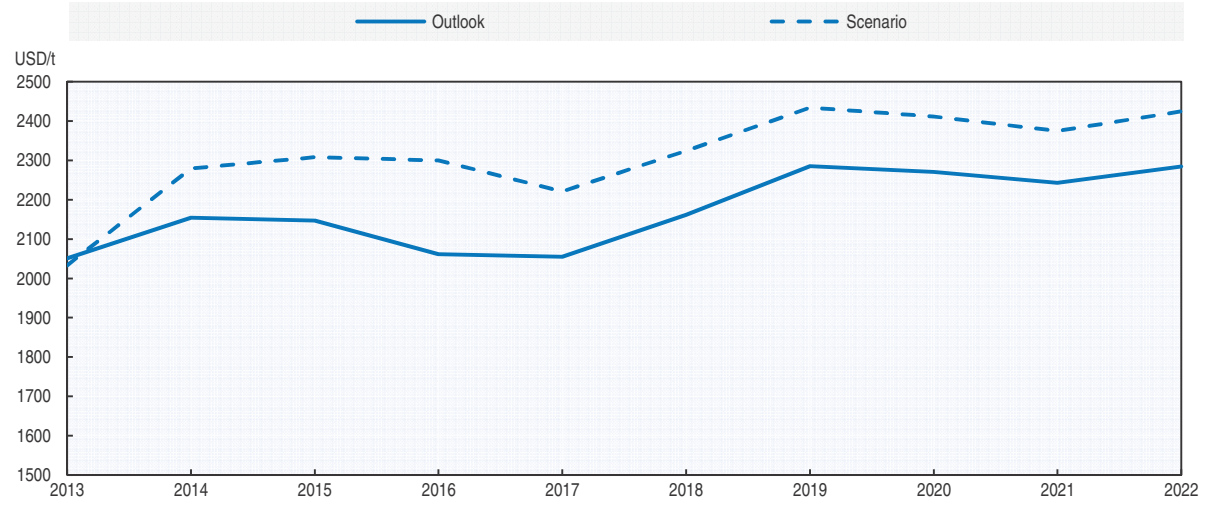
Figure 2.35. **Impact on global pork prices of higher imports by China**



Note: The price reference chosen is for the Pacific markets. Price impacts in other markets are similar.
Source: OECD and FAO Secretariats.

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A scenario analysis was undertaken that assumes lower growth in pigmeat production such that pigmeat and coarse grain self-sufficiency levels are both at 95%.[9] Chinese pigmeat production decreases by an annual average of 2.3 Mt (a 1% annual decline in self-sufficiency). As a counterbalance to this lower production, Chinese pigmeat imports increase by an annual average of 1.5 Mt. These imports are distributed among current top Chinese pork suppliers: the European Union, the United States, Canada, and Brazil.

The increase in Chinese pigmeat imports is sufficient to have international price effects. On average, the Atlantic and Pacific pigmeat prices would increase by 5% and 8%, respectively, over the *Outlook* period and EU prices would be 5% higher. Also, with Chinese pigmeat imports more than doubling over the *Outlook* period, domestic prices become

more closely linked to international prices, rising 6% and resulting in some reduction in domestic consumption.

b) Opening coarse grain markets

With land quality erosion and with urbanisation pressure to reduce arable land, one option is to reduce crop production and cropping intensity. In the last decade, China opened its markets to oilseed imports, largely recognising its land base was insufficient to support growing demand for both protein meals and vegetable oils. In so doing, it facilitated the achievement of self-sufficiency in basic food security crops – wheat, rice and maize by reducing competition for land. The imports of oilseeds were the equivalent of some 28 Mha by 2012, and according to the projection of this *Outlook*, would replace some 34 Mha by 2022. Higher demand growth for livestock products requires higher supplies of feed, and imports of maize have been increasing in recent years. This trend is anticipated to continue as production for higher income sensitive meat and dairy products grows. Growing area allocation to feed grains will pressure other crops. One option is to open markets for coarse grain, allowing yet higher imports.

To illustrate the impact which the opening of coarse grain markets would have on China and international markets, a scenario was undertaken in which the price of maize in China was set at the world reference price, plus fixed trading cost.[10] Compared to this *Outlook* projection, the scenario aligns domestic prices with international prices and clears domestic markets with trade. The results indicate that imports of coarse grain could be 28 Mt higher than the baseline projection by 2022. Increased imports would reduce domestic grain prices by some 17% and raise international market prices by 8%. In this scenario, domestic rice and wheat prices would decline by about 3%, while their international market counterparts rise about 1% for rice and 3% for wheat compared to the baseline projection. Lower feed grain prices enable livestock sectors to expand, by about 1% for pigmeat and milk, 1.6% for poultry, and 0.2% for bovine meat. In the scenario area harvested for grains in China remains near 2012 levels compared to an increase of about 0.7% p.a. in the baseline projection. This scenario is highly stylistic, and results are only indicative. However, they show that, similar to oilseeds, without an increase in crop and animal productivity, higher consumer demand will place increasing pressure on China's resource base, and may induce significant imports from international markets.

Impacts of climate change

The *Outlook* provides a "single line" projection for key outcomes under strict assumptions concerning underlying driving forces. These, however, are subject to high uncertainty or variations, such as is the case for crop yield outcomes. The current impact associated with climate change has not been effectively evaluated, and most studies which have, include time frames beyond that of this *Outlook*. However, given the intensity of land and water use, and the growing fragility of these productive assets, it is anticipated that climate change will play a large role in China's future. As shown by simplified scenario analysis, even small changes in China's markets have potential for global impact. Alternative yield trends, with higher variation could impact China's self-sufficiency targets and perhaps as importantly may impact world markets, as apparently small percentage variations in domestic production could invoke large changes in trade.

In the past 100 years, average annual mean temperature in China increased by 0.5-0.8 C. According to some studies, it may further increase by 1.3-2.1 C by 2020, and by

2.3-3.3 C by 2050 in comparison with 2000. The frequency and intensity of extreme weather events are most likely to increase; water scarcity and droughts in the northern part may increase, and water logging and floods in the southern part may also increase. Food availability will be impacted by changes in temperature, water availability, extreme weather events, soil condition, and pest and disease patterns. While the temperature rise and fertilisation function of CO_2 may bring some benefits to crop production, it is likely that if no proper adaptive action is taken, production of the three major food crops in China, i.e. rice, wheat and maize, may decline. It has been estimated by some sources that total food production in China could be reduced by 14-23% in comparison with 2000.[11] Such a scenario would have large implications for domestic and international markets, further underscoring the basic fact that China's resource base, on a per person basis, is and will continue to be both intensively used and fragile.

Conclusion

The prospects for China's agriculture, and potential implications for global markets have been studied often in the past several decades. The challenge is clear: feeding China in the context of its rapid economic growth and limited resource constraints is a daunting task with both potential risks and opportunities for global markets. The *Outlook* projects that the challenge will remain omnipresent in market assessments over the coming decade, and deserves ongoing monitoring and analysis.

China has been thus far very successful at meeting its key goals. How can this success be sustained? Continuing the success, given rising issues of land degradation, water depletion, pollution, rural labour shortages and such poses significant policy challenges for the next decade. Nevertheless, China is anticipated in this *Outlook* to meet its production targets, and make further gains in food security indicators, albeit at likely higher support for agriculture. As for global agriculture, enhancing productivity growth will remain a key priority for China. An important issue for the longer term relates to the extent of expansion which will be required to meet rising demand, the growth of which is set to slow considerably by 2022. China has opened several key markets, and trade will continue to expand vigorously in some cases to help meet higher demand.

The *Outlook* projects a further opening of markets in the next decade, both for China, as for many other countries. As markets are increasingly integrated markets, global information sharing to support policy cohesion will be critical in best utilizing global resources to feed the world's population sustainably in the longer term.

Notes

1. This chapter has been developed and written in collaboration among FAO, OECD, the AII of CAAS, and the Ministry of Agriculture of China. However, the data, analysis and projections are those of FAO/OECD and do not necessarily represent those of its collaborating partners.
2. For the latest review of agricultural policy developments in China as well as OECD and selected emerging economies, see OECD (*forthcoming*), *Agricultural Policy Monitoring and Evaluation 2013*.
3. Contribution rate to growth by science and technology is computed from output growth compared to input growth of factors of production, including labour, material, and land. This estimate therefore also includes improved efficiencies from better management, factor consolidation, and improved infrastructure.
4. Percentage of population below USD (2005) 1.25 per day. World Development Indicators (see data.worldbank.org).

5. See OECD (2012), *China in focus: Lessons and challenges*.
6. See Barrett, C., (ed.) (2013), Chapter 17 "When China runs out of farmers" by Luc Christiansen.
7. The PSE methodology focuses on transfers targeting farmers individually and the agricultural sector as a whole, thus does not include other policies which create more favourable conditions for the Chinese farmers such as: support for the agro-processing industry, economy-wide development of infrastructure, subsidies for rural health and educations systems as well as for rural pension systems.
8. Data provided by the Ministry of Agriculture, China.
9. See Chapter 7 on meat for more detail on the specifications and results of this scenario.
10. See Box 4.3 in Chapter 4 on cereals for more explanation of the scenario and results.
11. See China National Development and Reform Committee, *National Strategy on Climate Change*, June 2007.

References

Cai, F., and Wang, M. (2012), "Labour Market Changes, Labour Disputes and Social Cohesion in China", *OECD Development Centre Working Paper No. 307*, Paris.

Carter, A., et al. (2012), "Advances in Chinese Agriculture and its Global Implications", *Applied Economic Perspectives and Policy*, Volume 34, Number 1.

Chen Lei, (2012), Minister of the Ministry of Water Resources, the Report of State Council on the Development of Farmland Water Conservancy, the 26th Session of the Standing Committee of the 11th People's Congress, 25 April 2012, Beijing.

Christiaensen, L (2013), "When China Runs Out of Farmers in Food or Consequences: Food Security and Global Stability," ed. by C. Barrett, Oxford University Press (*forthcoming*).

Das, M, and P. N'Diaye (2013), "Chronicle of a Decline Foretold: Has China Reached the Lewis Turning Point", *International Monetary Fund, Working Paper* WP/13/26, Washington.

Financial Times (2013), "Chinese Labour Pool Begins to Drain", 18 January 2013, *Financial Times*, London.

IMF (2012), *World EconomicOutlook October 2012: Coping with High Debt and Sluggish Growth*, International Monetary Fund, Washington DC.

IMF (2012), *People's Republic of China: 2012 Article IV Consultation*, International Monetary Fund, *IMF Country Report* No. 12/195, Washington DC.

Li Guoxiang (2013), *Major Livestock Products Supply, Demand and Price Variation in China*, manuscript submitted for FAO Technical Co-operation Project TCP/CPR/3304 "Strengthening of China's Capacity in Agricultural Market Monitoring and Agricultural Outlook".

OECD (2012), *China in Focus: Lessons and Challenges*, Paris.

OECD (2013), *Agricultural Policy Monitoring and Evaluation 2013: OECD Countries and Emerging Economies*, Paris 2013.

Sheldon I, (ed.) (2007), *China's Agricultural Trade: Issues and Prospects*, Papers presented at an IATRC International Symposium, Beijing, 8-9 July 2007.

Wu Laping, (2013), *Chinese Grain Supply Demand and Projection: Regional Perspective*, manuscript submitted for FAO Technical Co-operation Project TCP/CPR/3304 "Strengthening of China's Capacity in Agricultural Market Monitoring and Agricultural Outlook".

Wu Laping (2013), *How Open is the Chinese Agricultural Sector*, manuscript submitted for FAO Technical Co-operation Project TCP/CPR/3304 "Strengthening of China's Capacity in Agricultural Market Monitoring and Agricultural Outlook".

Xu Shiwei, Li Ganqiong, Wu Jianzhai (2013), *Achievements of the agriculture and rural economy in China*, manuscript submitted for FAO Technical Co-operation Project TCP/CPR/3304 "Strengthening of China's Capacity in Agricultural Market Monitoring and Agricultural Outlook".

Zhu Xinkai, (2013), *China's Current Agricultural Policy Review and Applications of the Aglink-Cosimo model under Chinese Circumstances*, manuscript submitted for FAO Technical Co-operation Project TCP/CPR/3304 "Strengthening of China's Capacity in Agricultural Market Monitoring and Agricultural Outlook".