CHAPTER 4

Changing Food Consumption Pattern and Demand for Agri-based Industrial Products in China: Implications for Southeast Asia's Agricultural Trade

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1. Introduction

China's economy has experienced remarkable growth since reforms were initiated in 1978 and pushed forward by a number of subsequent policy initiatives. The household responsibility reform that distributed lands to individual households increased farmers' incentives and agricultural productivity by about 50 percent in early 1980s (Lin 1989; Huang and Rozelle 1996; Jin et al. 2002). Other reforms that boosted China's economic growth since the mid-1980s include the development of rural township and village-owned enterprises, measures to provide a better market environment through domestic market reform, fiscal and financial initiatives, the devaluation of the exchange rate, trade liberalization, the expansion of special economic zones to attract foreign direct investment (FDI), reform in state-owned enterprises (SOE), agricultural trade liberalization, and many other policy efforts . As a result, the average annual growth rate of gross domestic product (GDP) between 1979 and 2009 was about 10 percent (NSBC 2010). Real GDP in 2010 was

nearly 20 times that in 1978 (figure 1). Per capita GDP in nominal US dollars increased from US$224 in 1978 to US$4,230 in 2010.

Rising income, together with urbanization, population growth, and other dynamics of the economy, has brought about enormous changes in demand and consumption patterns and had significant effects on China's economic structure. Over time, while food expenditure went up, its share in total expenditure fell from 67.7 percent in 1978 to 41 percent in 2009 (food expenditure in rural areas) and from 57.5 percent to 36.5 percent in the same period (food expenditure in urban areas) (NSBC 2010 and 2009). The rising demand for nonfood commodities and services, in turn, formed part of the driving force that stimulated structural changes in the economy. Accompanied by rapid growth in demand for nonfood products, industrial and service sectors expanded faster than agriculture. The share of agriculture in GDP declined from about 40 percent in 1970 to 10 percent in 2009. Share of agriculture in employment also declined from 81 percent to 38 percent in the same period (table 1). Despite the overall increase in demand, export expansion always surpassed import expansion. The percentage of exports to GDP reached 34 percent in 2005 compared to imports, the percentage of which was only 30 percent (table 1). The decrease in imports and exports in 2009 reflects the impact of the global financial crisis.

Within the agricultural sector, considerable structural adjustments have also been observed as a result of changes in the demand and food consumption pattern. The Chinese consumed more meats and fewer food grains (Huang and Bouis 1996; Fan et al. 1997; Gao et al. 2000; Gould and Villarreal 2006). Consequently, the livestock and fishery sectors expanded rapidly. The shares of these two sectors increased from 16 (14+2) percent in 1970 to 44 (34+10) percent in 2009 (table 2). As Chinese consumers have been also increasing their consumption of fruits, vegetables, and edible oils (Gould and Villarreal 2006; Huang et al. 2010), the horticulture sector has also expanded rapidly (NSBC 2010) and soybean imports increased from nearly zero in the late 1990s to more than 50 million tons in 2010. On the other hand, more consumers are choosing food on the basis of quality, safety, and other factors in addition to price, which rapidly boosts increasing demand for food away from home and processed food products (Min et al. 2004; Ma et al. 2006; Wang et al. 2008; Yu and Abler 2009; Bai et al., 2010; Zhang et al. 2010). China's consumer base for nontraditional products (e.g., dairy products and wine) also widened (Fuller, et al. 2006; Ma et al. 2006). China's rapidly growing middle class, which is approximately as large as the

total population of the United States, and its changing tastes have created challenges in China's domestic agricultural production but also significant opportunities for food exporters from major trade partners in the world.

While past changes in China's food economy have been wrenching for both China and the rest of world, these changes are expected to continue in the future. In some cases, the rate of these changes is expected to pick up speed. Continued growth, urbanization, and dynamism in China's economy will affect all segments of the economy and all regions of the nation. Because of China's size, continued growth, urbanization, and marketization are likely to have profound impact on the rest of the world. This raises several questions. How has the food consumption pattern changed over time in China? What have been the driving forces of these changes? Will these factors continue to drive food consumption changes in the future? Can China meet the growing demand? What happened in the past and what is likely to happen in the future? What are the implications of China's food economy and Southeast Asia's agricultural trade on the rest of world?

This paper is aimed at providing some answers to these questions. The overall goal of this paper is to identify major changes in China's food consumption pattern and demand for agri-based industrial products and their implications on Southeast Asia's agricultural trade. In order to achieve these goals, this paper has been organized as follows: (1) the second section discusses the changing food consumption patterns and major drivers of demand changes; (2) the third section presents the major drivers of agricultural supply, including domestic production and trade; (3) the fourth section describes a framework used to predict changes in supply and demand and trade and measured the implications on China, Southeast Asia, and the rest of world; and (4) the final section presents the conclusion.

2. Changing Food Consumption Patterns

As income increased, the consumption patterns in China showed significant changes after the mid-1990s. Between 1980 and 1995, per capita income and expenditure more than doubled but the average rural consumer spent about 55 percent to 60 percent of total expenditure on food consumption. This means that the rate of food expenditure increased nearly as fast as that of income (table 3). Similarly, the average urban consumer also spent more than 50

percent of expenditure on food consumption. Changes in the share of food expenditure (i.e., Engle coefficient) were gradual and moderate before 1990s. However, as income and total expenditure doubled after the mid-1990s, the share of food expenditure decreased at a faster rate. By 2009, the shares of food expenditure fell to 41 percent in rural areas and 37 percent in urban areas (last row, table 3).

2.1 Changing food consumption patterns and major driving forces in the past

Food consumption patterns in China have undergone significant changes since the early 1980s (Fan et al. 1995). These changes occurred at the national aggregate level as the urban sector expanded along with the share of the urban population (Huang and Bouis 1996). The changes were also noted in rural and urban areas as income went up and demand factors increased (Huang and Rozelle 1998; Halbrendt et al. 1994). Increasing income, urbanization, and market expansion have been identified as the major driving forces of the changes in China's food consumption patterns (Huang et al. 2010).

At the national aggregate level, the per capita consumption of rice and wheat, the two most important cereals in China, fluctuated wildly over the past three decades. For example, as income increased, the per capita consumption of rice increased from about 80 kg in 1980 to 96.1 kg in 1990 (first row, table 4). However, after reaching its peak in 1990, rice consumption has been on a downward trend. This reflects a negative income elasticity of the demand for rice in recent years. In 2009, the average consumer in China consumed only 72.4 kg of rice, which was about 22 kg less than rice consumption in 1990. There is also a similar change in the consumption pattern for wheat. Per capita consumption of wheat rose in the early 1990s and fell by 22 kg between 1990 and 2009 (second row, table 4).

The trend in the changes in the other food items has been consistent over time. Maize, sweet potato, and other coarse grains, all once important in Chinese diet, recorded a decline in total consumption from 57.7 kg (27.4+8.8+21.5) in 1980 to only 13.1 kg (6.0+2.1+5.0) in 2009 (third and fifth row, table 4). Except for grains, the consumption of other foods such as edible oils, sugar, vegetables, fruits, meat, eggs, milk, and fish increased substantially. Consumption of said foods increased by about 3 times (e.g., potato and sugar) to more than 10 times (e.g., fruits, meat, and milk).

In rural areas, the food consumption pattern has also been changing. The per capita food consumption in these areas increased for all products, except for maize, other coarse grains, and sweet potato (table 5). The decline in the consumption of coarse grains and sweet potato over three decades was already expected as the income elasticities of demand for these commodities were negative. Per capita consumption of rice and wheat earned the highest points (106 kg for rice and 87 kg for wheat) in the early and late 1990s, respectively (table 5). But these have been falling gradually since mid-1990s. The consumption of pork and nonstaple foods also increased rapidly during the 1980s, 1990s, and 2000s. For example, per capita pork consumption in the rural areas was less than 10 kg in 1980 but reached more than 20 kg in early 2000s (table 5).

While the amount of consumption of other meats such as beef, mutton, poultry, and aquatic products was small, the annual growth rate of in the consumption of such meats were much larger than the growth rate in the consumption of pork over the past 23 years. The consumption of horticultural products has also been on the rise. For example, the increase in fruit consumption was dramatic, jumping from less than 3 kg in 1981 to 30 kg in 2009. Our previous studies (Huang and Rozelle 1998; Huang and Bouis 2001) showed that income growth and food market development in rural areas were the key driving forces that underlined these changes in food consumption.

However, there has been a different scenario in cities. In urban areas, per capita grain consumption has been on the decline since the late 1980s (table 6). At the same time, however, the consumption of meats and nonstaple foods has grown rapidly. The most significant increases in demand are in milk, meat, fish, and fruit. Traditionally, the Chinese consume more soymilk than animal milk. In 1980, per capita consumption of milk was less than 5 kg even in urban China (table 6). However, by 2009, per capita consumption of milk reached 50.5 kg. Per capita consumption of pork and poultry reached 40 kg and nearly 18 kg in 2009, respectively—much higher than the consumption of said products in rural areas. Per capita fruit consumption increased by more than five times over the past thirty years, reaching a record high of 109 kg in 2009 (table 6).

As countries across Asia modernized, the behavior of consumers in these countries changed dramatically (Huang and Bouis 2001; Huang and David 1993). Urban dwellers consumed less grain and demanded more meats, milk products, fish, and fruits than their rural

counterparts even after the difference in income and prices were accounted for. These behavioral patterns are also clearly evident in the comparison of per capita food consumption between rural and urban areas in China (tables 5 and 6). Tables 5 and 6 show that urbanization could lead to a substantial decline in direct food consumption of grains. But on the other hand, demand for meat (and feed grain) and other nonstaple foods is also likely to rise significantly with the increase in the ratio of the urban population in China's total population.

The ratio of China's urban population to its rural population is changing fast. Urban population, which made up 19 percent of the total population in 1980, increased to 26 percent in 1990, 38 percent in 2000, and 47 percent in 2009 (NSBC 2010 and table 1). The impacts of this population shift on food consumption patterns have been documented (Huang and Bouis 1996 and 2001) and shown in tables 5 and 6.

Modernization through expansion occurred not only in the urban areas but also within the rural sector. One such approach to modernization is the development of the rural food market. Table 7 shows how the development of the food market is related to food consumption in rural China. The development of the food market is proxied by the percentage of food consumed by rural households that is purchased from the rural market. Table 7 shows that the consumption of grains and vegetables, which are largely home-produced commodities, decreased with the development of the food market development while consumption of other foods increased with the expansion of food markets in rural areas.

The food consumption pattern has undergone rapid changes, thanks to increasing food consumption away from home (FAFH). Ma et al. (2006) and Bai et al. (2010) have shown that FAFH accounted for most of the increased consumption in recent years. The results of our recent survey in Beijing also show that FAFH has become an important part of Chinese diet. Figure 2 shows the share of food consumption at home (FAH) and FAFH in Beijing (measured in quantity). In the case of meats, urban consumers in Beijing in 2007 accounted for about 45 percent of total meat consumption through FAFH. Beijing FAFH consumers also accounted for a significant amount of drinks, beans, and fish (figure 2).

2.2 Major driving forces in the future

Despite the global economic crisis, China maintained an annual GDP growth of nearly 10 percent from 2008 to 2010 (NSBC 2011). Moreover, most analysts believe that China will continue to post an annual GDP growth of between 8 and 10 percent between 2011 and 2015 and more than 7 percent between 2016 and 2020. If this happens, the economy of China will grow by two to three times over the coming decade.

The trend in urbanization is expected to continue. An increasing number of people have moved to the cities over the thirty-year period between 1980 and 2010. By 2010, nearly 48 percent of China's population lived in cities, and this percentage is expected to increase even more within the next two years or so. It will come to the point where half of China's population will already be living in cities. By 2020, between 56 and 58 percent of the population is expected to be living in urban areas.

The rise in income and the movement of the nation's population from the countryside to urban areas have resulted in significant changes in China's consumption patterns. These changes are expected to continue with the sustained rise in income and urbanization. Specifically, rising incomes and urban expansion have boosted the demand for meats, fruits, and other nonstaple food items and have had a defining effect on the agricultural economy as producers shifted their production to meet demands. For example, the share of livestock output value rose 2.5 times from 14 percent to 35 percent between 1970 and 2005 (table 2). One of the most significant signs of structural changes in the agricultural sector is that the share of crops in total agricultural output fell from 82 percent in 1970 to almost half of agricultural output value in the late 2000s.

As for the crop sector, the share of the three major crops (rice, wheat, and maize) in total crop areas began to change The share of these three major grains in total crop areas has gradually declined from 57 percent in 1990 to about half by the later 2000s (NSBC 2010). The decrease is mostly attributed to the shrinking number of lands allotted for growing rice and wheat. In contrast, the number of lands for cultivating maize, China's main feed grain, has been on the rise, mainly due to the rapid expansion of the nation's livestock production during the same period. In addition to maize, the number of lands allotted for cash crops such as vegetables and fruits, edible oil, sugar, and tobacco have also expanded.

Interestingly, although the size of China's population makes China (in part) an important player in the international scene, population growth is expected to play an increasingly lesser role in the demand trend. The main reason for this is that population growth rates are falling fast. In recent years, the rate of population growth fell to about half of 1 percent. In the coming years, it is expected to fall further and approach zero by around 2030.

3. Changes in Agricultural Production and Trade

3.1 Agricultural production

Although the demand for food has grown rapidly in the past, China's agriculture has also recorded significant growth in the past three decades. After 1978, decollectivization, price hikes, and the relaxation of domestic trade restrictions on most agricultural products triggered the takeoff of China's food economy and allowed China's producers to meet the shifts in consumer demand (see discussion on this in the previous section). Between 1978 and 1984, grain production increased by 4.7 percent yearly while fruit production rose by 7.2 percent (table 8). The highest annual growth rates (between 1978 and 1984) were posted by cotton, edible oil, livestock, and the aquatic commodity sectors. Growth in these sectors was recorded at 8 percent to 19 percent. Consistent with the changes in demand, growth remained remarkable for all agricultural products, except for grain and cotton, during the period 1985 to 2000. Fishery production experienced the fastest growth among all agricultural commodities from 1985 to 2000, posting annual growth rates of 13.7 percent from 1985 to 1995 and 10.2 percent from 1996 to 2000 (table 8). Although the annual growth rate of the fishery sector fell between 2001 and 2005, it still posted a relatively high growth of 3.6 percent during that time (table 8). The annual growth rates of some agricultural products have declined in recent years but these growth rates are still significant at about 2 percent to 6 percent from 2006—2009. One major exception was soybeans, which posted growth of negative 1 percent because of the surge in the importation of soybeans.

Past studies have already demonstrated that there are a number of factors that simultaneously contributed to the growth in agricultural production during the reform period. The earliest empirical efforts focused on measuring the contribution of the implementation of the household responsibility system (HRS), a policy that gave individual farmers control and

income rights in agriculture. These studies concluded that most of the rise in productivity in the early reform years resulted from institutional innovations, particularly the HRS (Fan 1991; Lin 1992). More recent studies show that since the HRS was completed in 1984, technological changes have been the primary engines of agricultural growth (Huang and Rozelle 1996; Fan 1997; Fan and Pardey 1997; Jin et al. 2002). In examining the sources of technological advancements, Jin et al. (2002) empirically demonstrate that the cross-province differences in government-initiated research and development (R&D) projects have had the largest effects on technological improvements. Between 1990 and 2005, investment in R&D nearly tripled. The growth in R&D investment increased further since the mid-2000s. China is the only country in the world where agricultural R&D expenditures as a share of agricultural GDP are increasing.

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Transportation and market infrastructure have also remarkably improved since the early 1990s, and this served to boost farmers' income at the farmgate. Huang and Rozelle (2006) report that China's food markets have become highly integrated since the late 1990s. Not only do integration measures show that prices in one region are highly linked to prices in other regions, the efficiency of moving commodities across the nation has also improved. In fact, when it comes to efficiency in terms of the percentage change in price for every 1,000 km from port (between 4 percent and 7 percent), China's agricultural marketing is comparable with that of the United States'.

Irrigation played a critical role in establishing the highly productive agronomic systems in China (Wang 2000). The number of cultivated areas under irrigation increased from 18 percent in 1952 to a level at which about half of all cultivated land had been irrigated after the early 1990s (NSBC 2001). However, the rising demand for water for domestic and industrial use poses a serious constraint to irrigated agriculture, and increasing water scarcity has become a major challenge to future food security and to the well-being of people, especially in the northern region.

Beginning 2004, China launched a new strategy for development. Instead of taxing farmers and charging them fees for basic services in their homes, the government took a decisive action to eliminate almost all taxes and fees. In addition, the government began to subsidize farmers at increasing rates, handing out CNY 14.52 billion in 2004. In 2009, the amount climbed to CNY 127.45 billion (or US$18.74 billion), which accounted for about 3.6 percent

of agricultural GDP. According to a recent study by Huang et al. (2010), most of China's agricultural subsidies were decoupled and therefore cause little market distortion. Therefore, we did not include subsidies in our empirical analysis of the effect of policy on the agricultural supply, demand, or trade in China or the rest of the world.

3.2 Agricultural trade

The structure of China's trade in general and agricultural trade in particular has changed over the past decades. Between 1985 and 2009, trade (both exports and imports) grew dramatically. Specifically, exports of food products during the period increased more than tenfold (table 9). For example, exports of fish products grew by a factor of 66. Exports of fruits and vegetables rose by a factor of 28 (table 9). Total imports from 1985 to 2009 posted a substantial growth, rising by a factor of 25. Imports of some products were also noteworthy. For example, import of oilseeds (mainly soybean) grew by a factor of 175, making China the largest importer of oilseeds in the world. In addition, imports of agricultural fibers also increased, rising by a factor of 5 (which is significant, since it grew from a substantial initial base in 1985).

Agricultural trade significantly improved after the accession of China to the World Trade Organization (WTO). As shown in figure 3, both the growth rates of agricultural imports and exports grew much faster after China's accession to the WTO. The annual growth rate of agricultural exports increased from 3.7 percent for the period 1990 to 2001 to 11.8 percent for the period 2001 to 2009. Meanwhile, the annual growth rate of agricultural imports rose from 2.9 percent to 20.4 percent. As imports grew faster than exports, China's net agricultural trade status changed from surplus to deficit. In 2009, the agricultural deficit was about US$13.6 billion. However, this trade deficit is still small—the volume of agricultural net trade deficit in 2009 was only 0.5 percent of China's total exports.

The agricultural trade between China and Southeast Asia significantly increased after the China and ASEAN Free Trade Agreement (FTA) was signed in 2002. The bilateral agricultural trade grew rapidly from $3.7 billion in 2002 to $13.2 billion in 2009, with an annual growth rate of nearly 20 percent (UNCOMTRADE 2010). However, the highest trade

posted was that of China's imports from Southeast Asia (figure 4).[1] The main commodities exported from Southeast Asia to China were palm oil and tropical horticultural products. In 2008, these two commodities accounted for nearly 80 percent of total agricultural exports from Southeast Asia to China (panel A, figure 4). Horticultural commodities and processed food are the two important commodities in China's exports to Southeast Asia, accounting for 45 percent and 41 percent, respectively, in China's total exports to Southeast Asia in 2008 (panel B, figure 4). Although China imports from, and exports to, Southeast Asia large quantities of horticultural commodities, the specific commodities that make up this category are quite different. China mainly exports temperate fruits and vegetables to Southeast Asia and imports tropical fruits and vegetables.

4. Prospects of China's Agriculture and Food Economy in the Coming Decade

4.1 Scenarios and major assumptions

Based on the preceding discussions, this subsection outlines prospects for China's economic growth in the second decade of the twenty-first century. While our prospects are focused on the most likely growth scenario (baseline—average of 8 percent annual growth in 2010—2020), we also formulated an alternative higher-growth scenario (or high-growth scenario where we assume the annual GDP growth rate will increase by 10 percent compared to that under the baseline scenario, which is 8.8 percent) because one of the objectives of this study is to examine the implications of China's rapid economic growth (table 9).

The results of analyses presented in this section are based on the Global Trade Analysis Project (GTAP). GTAP, a well-known multicountry, multisector computable general equilibrium model, is often used for international trade analysis (Hertel 1997). The recursive dynamic method is used to project China's economy and the world economy up to 2020. Such a method has been used for many similar researches (Walmsley et al. 2000; Tongeren et

[1]Free trade agreement (FTA) in agriculture was forged between China and the ASEAN member countries for political and economic reasons. The ASEAN economies had been weakened by the global economic crisis; thus, the process of integration within the regional and global context (Chirathivat 2002; Wang 2002) was started. Meanwhile, the bilateral trade agreement between China and the ASEAN grew much faster than those of other regions. In 2000, ASEAN became China's fifth-biggest trading partner and China became the sixth-largest trade partner of ASEAN. Both sides recognized the great interest and huge potential to enhance bilateral trade (Chirathivat 2002; Yang et al. 2007). Moreover, many national leaders and researchers on both sides believed in the complementarities in agriculture and mutual benefits brought by free trade (Lu 2001; Zhao and Liu 2002). As a result, the FTA in agriculture was signed quickly and implemented earlier than the FTAs for other sectors.

al. 2004; Yang et al. 2010). As the benchmark of the latest GTAP database (version 7) is 2004, three periods (2004—10, 2011—15, and 2016—20) were considered to construct the baseline and various macro assumptions (i.e., growth of GDP, labor supply, population, and capital) were made for different regions. These assumptions were based mainly on information from world development index (WDI), the world labor organization (WLO), outlook of the World Bank (WB) and the International Monetary Fund (IMF), and various other researches (Tongeren et al. 2004; Yang et al. 2010). Moreover, in order to reflect the changes in consumer preference in China, we made calibrated improvements on income elasticities in GTAP based on the econometrically estimated parameters in the Chinese Agricultural Policy Simulation and Projection Model (CAPSiM). The technology improvements (e.g., Total Factor Productivity) in different countries/regions, including China, are calibrated by given GDP growth rates. Such a method has been popularly used by many other similar researches (Tongeren et al. 2004; Yang et al. 2010). The main macro assumptions for different countries/regions during the research period are shown in appendix table 1.

4.2 Major results from the baseline scenario

In the presentation of the simulation results, the first item taken up was the prospects for China's food economy toward 2020 based on the baseline and the high-growth scenarios. The implications of China's rapid economic growth on domestic agriculture and food economy as well as on sustainable economic growth are examined through several key indicators (e.g., production, self-sufficiency, imports, exports, and net exports).

Baseline projections show that self-sufficiency in all land-intensive crops (except rice) will wane, but this will be very moderate for most commodities in the coming decade. This is expected as many land-intensive crops in China have less comparative advantage in the world market.

Under the baseline scenario, the most significant increase in imports will be in oilseeds. Oilseed self-sufficiency will fall further from 54 percent in 2010 to 47 percent by 2020. The increase in the importation of oilseeds will be mainly due to the rising domestic demand for both edible oils and feeds. This is not surprising, given China's experience in soybean importation in the past ten years. After China liberalized its soybean trade by eliminating

nearly all its trade distortions (both tariff and nontariff measures), its annual import of soybean surged from virtually zero in the late 1990s to more than 42.5 million metric tons in 2009 (NSBC 2010) and is projected to reach 54.8 million metric tons in 2010.

The production of cotton and other plant-based fibers is also projected to expand over time mainly through productivity growth, but it will also fall behind domestic demand. Fiber imports will rise as a result of gradually falling self-sufficiency levels, just like other crops. Increasing the importation of fibers is required to meet the demand from China's rapidly expanding textile and apparel sector, which has created, and will continue to generate, employment for millions of people from rural areas.

Among cereals, feed grains will take the biggest slice in the imports pie (panel A, figure 5). By 2020, China will import about 14 percent of its coarse grains requirement (mainly maize) to meet increasing demand resulting from the expansion of the domestic livestock sector. Wheat imports will be minimal because per capita demand for wheat is projected to fall in the near future. Rice, the only cereal whose exportation will grow, will remain a net export commodity in the period 2010—20. However, rice exports are projected to be only moderate, accounting for about 1 percent to 2 percent of annual production in the coming years.

Meanwhile, China will export relatively labor-intensive products such as vegetables, fruits, fish, and processed foods. The largest exports will be processed foods (panel B, figure 5). While China may import a large volume of horticultural products, its exports will still exceed its imports.

In a nutshell, China's economic growth and trade liberalization will spur changes in the domestic agricultural structure. China's agriculture will gradually shift from land-intensive sectors with less comparative advantage to labor-intensive sectors with more comparative advantage. While China's self-sufficiency in many commodities will fall with economic growth under a more liberalized trade environment, self-sufficiency in food grains (excluding feed grains) and overall food self-sufficiency will remain high.

4.3 Major results from China's high-GDP growthscenario

The simulations show that a higher growth in China's economy will have moderate impact on the food and agricultural sectors. A higher growth is associated with a lower rate of self-sufficiency in nearly all agricultural and food commodities. An additional 0.8 percent annual growth in the period 2011—20 will generate about one-percentage-point decrease in self-sufficiency for all food commodities (table 11). An additional 1 percent increase in domestic food consumption will mean an increase in the importation of food commodities. However, the rate of domestic demand resulting from additional income growth in the future will be lower than what occurred in the past. Food income elasticities have been falling and will continue to fall with the rapid growth of China's economy.

With higher GDP or income growth, China will further restructure its agricultural and food economy in favor of commodities with a greater comparative advantage. For example, the export shares of land-intensive food and feed crops sectors in the world trade will decline and their import shares will rise (table 12). The high GDP growth scenario reduces the export share of animal products (1.9 percent in high GDP growth scenario compared to 2.2 percent in the baseline) because of their positive income elasticities. As a whole, the net export (or net import) of food and feeds will decline (increase) by about US$3.8 billion compared to the baseline in 2020.

5. Implications for Agriculture Production and Trade in Southeast Asia and the Rest of World

5.1 The baseline

Chinese economy has been increasingly integrated into the world economy since economic reforms were implemented. The integration has occurred in both commodity trade and FDI between China and the rest of the world. This section tackles the future impacts and implications of China's economic growth on Southeast Asia and rest of the world. The discussion will first focus on the implications of China's rapid growth on the economies of Southeast Asia and rest of the world based on our baseline analysis. The discussion will then take on the implications of higher GDP growth scenarios.

The main conclusions on the implications of China's rapid economic growth based on our baseline analysis are that China's growth will provide more opportunities than challenges to the rest of the world and that the world will, in general, gain from China's economic expansion. With regard to food and agriculture, China's economic growth under a more liberalized global economy will help countries with a comparative advantage in land-intensive agricultural products to expand their production and export of agricultural products to the Chinese market. China's economic growth will not affect the world's food security.

Our projection shows that bilateral trade will continue to expand to exploit the comparative advantage of both economies. As shown in figure 6, under baseline, China will continue to maintain its agricultural trade deficit with Southeast Asia if we do not consider processed foods. Rising exports from Southeast Asia will come mainly from tropical fruits and vegetable oils (mainly palm oil). Meanwhile, China's exports of temperate fruits and processed foods to Southeast Asia will expand rapidly.

5.2 The high-growth scenario

Under the high-GDP growth scenario, China will generate greater trade, and nearly all countries or regions will gain from the faster growth of China's economy. The signs and sizes of gains for each region from China's increased growth will depend on the nature of China's economic structure. Countries that are largely complementary to China's economy will gain more from such growth. In contrast, a country with a similar economic structure to China will have difficulty in benefitting directly from this growth. Detailed comparisons of the impact on output, trade, and corresponding welfare due to China's higher economic growth (compared to the baseline) are presented in tables 13 and 14.

Table 13 shows that all regions will gain in terms of food and feed production from China's rapid growth. The net export (or net import) of all agricultural commodities will fall (or rise; figure 7) if there is a 10 percent increase in the annual growth rate of China's GDP (e.g., from 8 percent to 8.8 percent) and if all other factors remain constant. China's net export (or net import) of food and feeds will increase (decline) by about US$3.8 billion in 2020 (not shown in figure 7). China's rising imports will push world prices upward and increase production of foods and feeds in all countries, particularly exporting countries (table 13).

Theagricultural sector in Southeast Asia will also benefit from China's higher economic growth. As shown in figure 8, China's imports of agricultural commodities from Southeast Asia will rise and exports will fall. The net export of agricultural commodities from Southeast Asia will increase by more than US$1 billion in 2020 in a high-growth scenario (compared with the baseline scenario). Increased agricultural exports from Southeast Asia will continue to be dominated by palm oil and tropical fruits.

While higher economic growth in China will generate increased domestic demand for final consumer goods, it will also result in increased export and import of textile and apparel products. The prices of these commodities on the world market are projected to fall accordingly. Consumers in large importing countries or regions (i.e., the United States, European Union, Japan, and Korea) will gain from lower world prices. Production in countries or regions that export manufactured products to China (e.g., Japan and Korea) will rise (table 13). However, countries with the same export structure as China may be hurt by lower prices. This may explain why South Asian countries will experience slightly negative effects from China's higher economic growth.

Our simulations also show that the production structure in other countries will adjust accordingly as China's economic growth accelerates. This is reflected in the differences of production changes across sectors in each region (table 13). Whether a country or region can reap gains from China's economic expansion as discussed in this section will depend on how flexible and efficient their economies are in responding to world market changes triggered by China's economic growth.

Welfare analysis was applied to gain a better understanding of the overall impact of China's rapid economic growth on the rest of the world. Table 6 shows that global welfare will increase by about US$296 billion in 2020 under China's high-growth scenario (compared to the baseline), of which approximately US$254 billion (85.8 percent) occurs in China and nearly US$42 billion in the rest of world (14.2 percent). In terms of GDP, the rest of world (whole world, excluding China) will have additional annual growth of 0.16 percent by 2020 (compared to the baseline). Therefore, rapid economic growth in China is an important engine in world economic development.

Table 14 also shows that nearly all regions, including Southeast Asia, can gain from China's economic expansion. The changes in welfare indicate that regions that are complementary with China will gain more from China's higher economic growth. For example, the social welfare of Australia and New Zealand will increase by US$3 billion (about 1.4 percent), which is higher than those of other countries, and that is because China's robust economy will stimulate increased importation of energy and minerals as well as many agricultural products. Exporting countries will gain from increases in both price and volume associated with China's commodities. This will further expand welfare gains by raising the return of endowments, enhancing efficiency of allocation, etc. South Asian nations are an exception. These countries are major exporters of textiles and apparel. Moreover, manufactured products exported from Asian countries have a high degree of substitutability with those from China. Therefore, these countries will encounter increasing competition from China in the world market in the coming years.

Southeast Asia will largely benefit from China's high economic growth. However, some sectors may have to face certain challenges. As shown in table 13, the production of all industries will increase except for the textile and apparel sector. Compared to baseline, the GDP of Southeast Asia will rise by 0.17 percent in China's high economic growth scenario. Meanwhile, the total social welfare will also gain about US$1 billion in 2020 (table 14).

6. Concluding Remarks

China has become one of the fastest-growing economies in the world since late 1970s. GDP grew at about 10 percent annually over the past thirty years. Over the course of the reform period, both rural and urban incomes increased noticeably. The rapid economic growth has brought about rapid urbanization and market liberalization.

Rising income, urbanization, and market liberalization have significantly changed Chinese diet and consumption patterns. While the demand for cereals and other grain as food has declined in recent years, per capita consumption of vegetables, fruits, edible oil, sugar, meat, milk, and fish in both rural and urban areas has increased steadily as income increased over the past three decades. Urbanization further stimulates the national average consumption of these commodities. Rising demand and changes in food consumption pattern have resulted in

significant changes in domestic agricultural production. China's experience shows that the importance of both domestic and external policies in achieving sustainable growth. China's experience also shows that institutional innovation (particularly land tenure), technological changes, market reform, and infrastructure development are critical to meeting its growing demand and the improvement of the nation's food security.

However, despite an almost equal growth of domestic production and consumption, China has shifted from being a net food exporter to being a net food importer in recent years. This study shows that China's agricultural imports will continue to rise with income growth. China is expected to increase imports of land-intensive products (e.g., feeds, cotton, edible oils, sugar, dairy products, etc.), but it will also continue to be a major exporter of labor- and capital-intensive products (e.g., vegetables, fruits, some livestock products, fisheries, and processed foods).

The results from this study provide significant policy implications for many countries and regions (including Southeast Asia) that are currently China's major trade partners or those seeking greater economic and trade relations with China. China's growth will provide more opportunities than challenges for the rest of the world. Overall, the rest of the world will gain from China's economic expansion. However, this general conclusion may not hold true for all countries. China is set to play an increasing role in international trade, which should benefit both developed and developing countries.

For those countries whose economic structures are complementary to China, there will be emerging opportunities offered by China's increasing imports due to its rapid growth and integration into the world economy. On the other hand, countries with similar export structure to China's and are competing for the same export markets will have to put in extra effort to restructure their economies and invest more in domestic infrastructure to lower production and marketing costs.

Southeast Asia has recently emerged as one of China's important trade partners. It has also expected gains from the changes in China's food consumption patterns and China's economic expansion. Bilateral trade between China and Southeast Asia has been increasing rapidly and is expected to continue to rise significantly in future. As for agriculture, while Southeast Asia might not benefit much from China's rising imports of many land-intensive products, the

region can gain significantly from China's increased demand for palm oils and tropical horticultural products. Under China's high economic growth scenario, China will provide even more opportunities for Southeast Asian countries to export their products to China.

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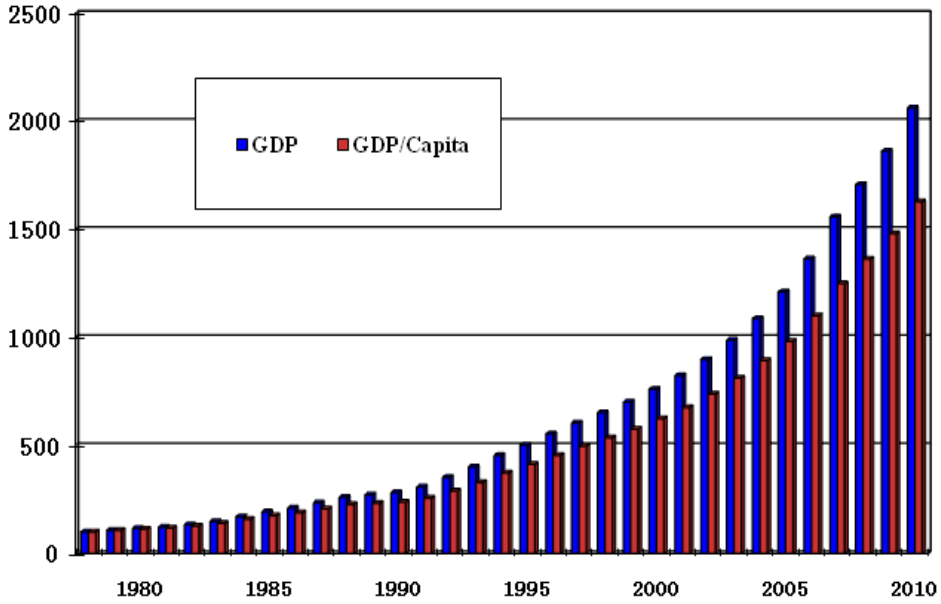
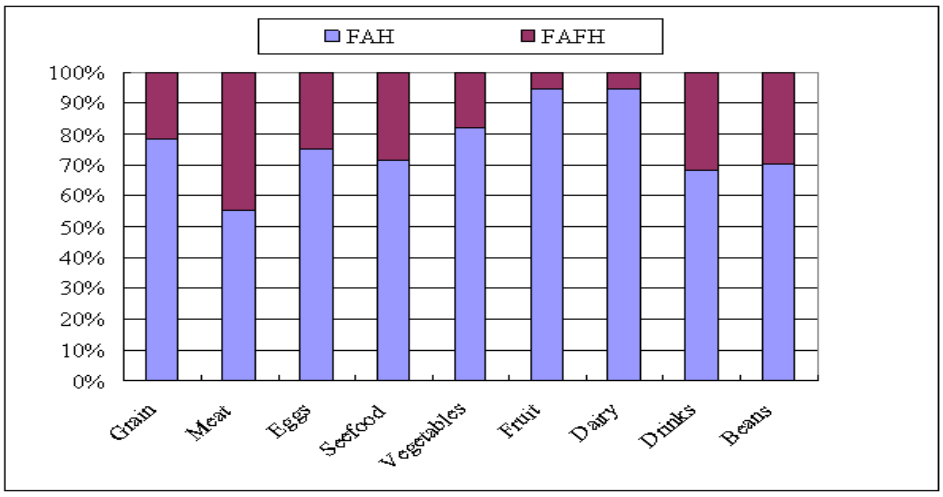
Tables and Figures

Figure 1. Trends of GDP and per capita GDP in China, 1978—2010 (real GDP and per capita GDP in 1978 = 100)



***Source*:** NSBC (2010).

Figure 2. Share (%) of food consumption at home (FAH) and food consumption away from home (FAFH) in Beijing, 2007 (measured in quantity)



***Source*:** CCAP, CCAP's urban consumer survey in Beijing, July 2007.

Figure 3. Agricultural export and import (billion US$), 1983--2009

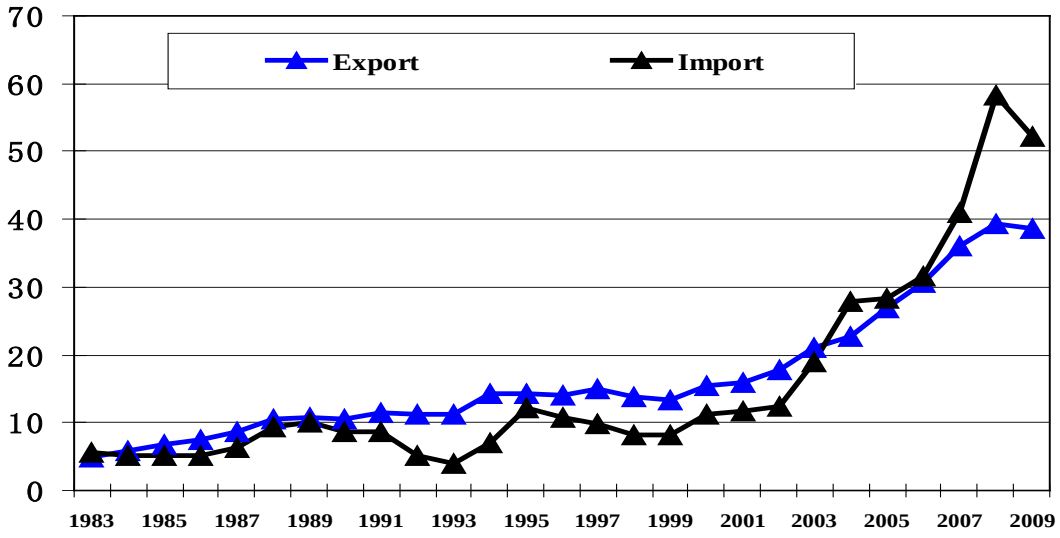
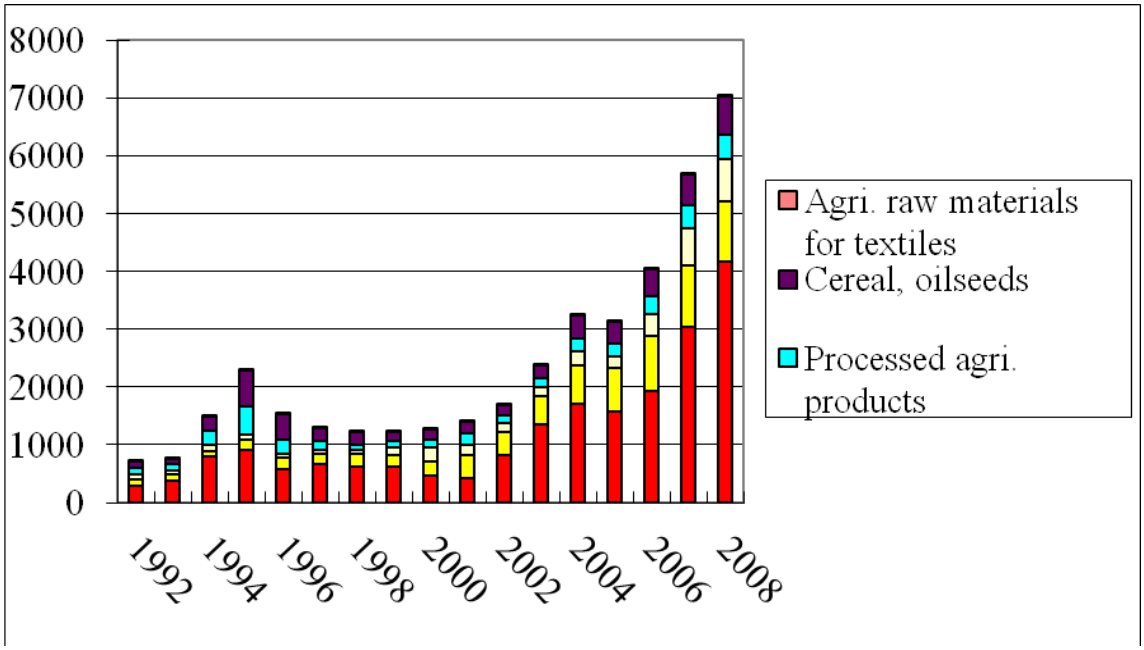
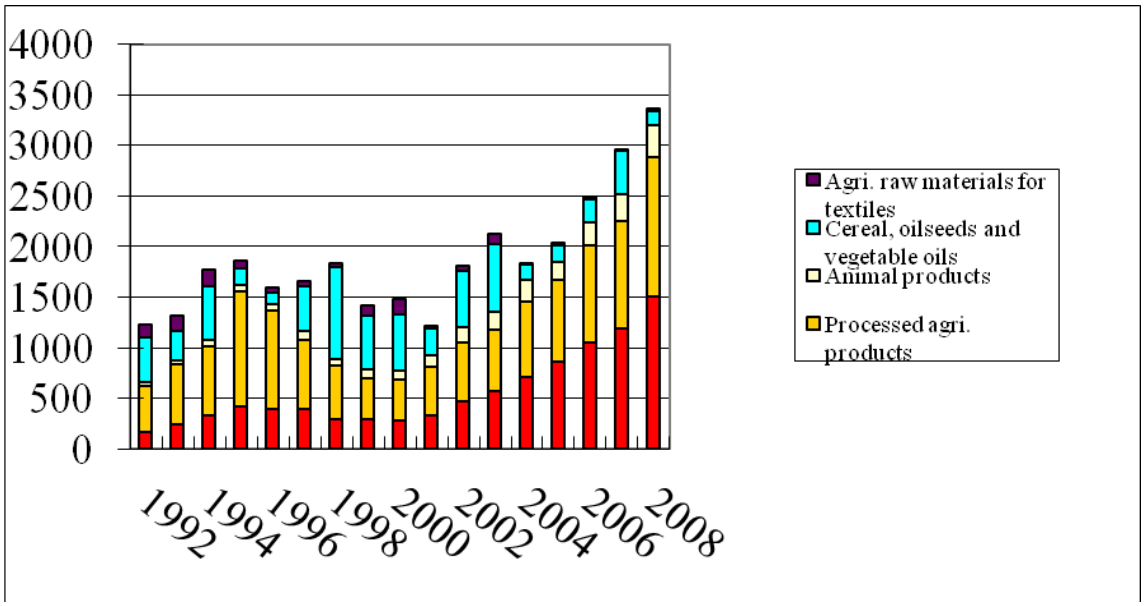


Figure 4. China's agricultural trade (US$ million, in 2000 prices) with Southeast Asia, by commodity, 1992—2008

Panel A: China's imports from Southeast Asia



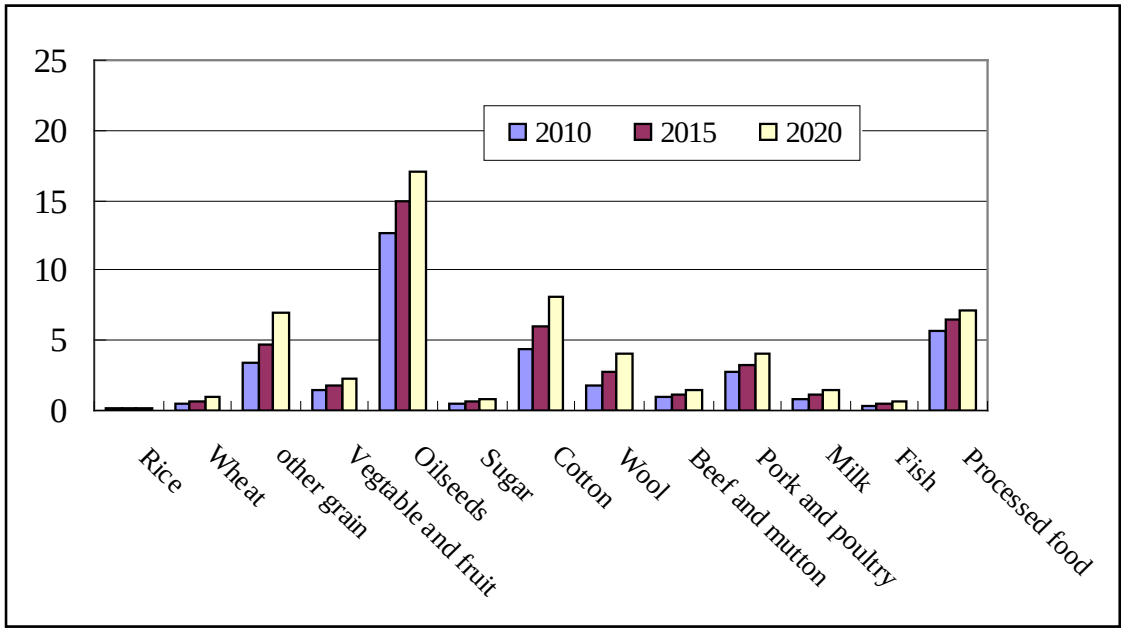
Panel B: China's exports to Southeast Asia



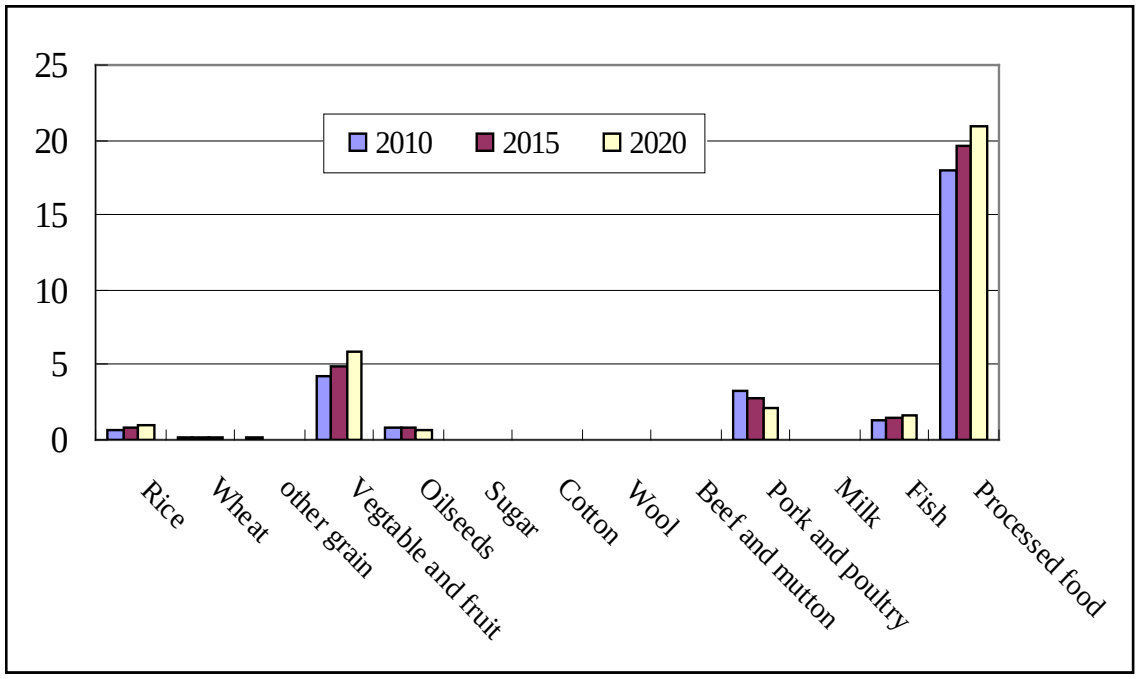
***Source*:** UNCOMTRADE

Figure 5. China's agriculture and food trade (US$ billion) under baseline, 2010—2020

Panel A: Imports



Panel B: Exports



Panel C: Net exports

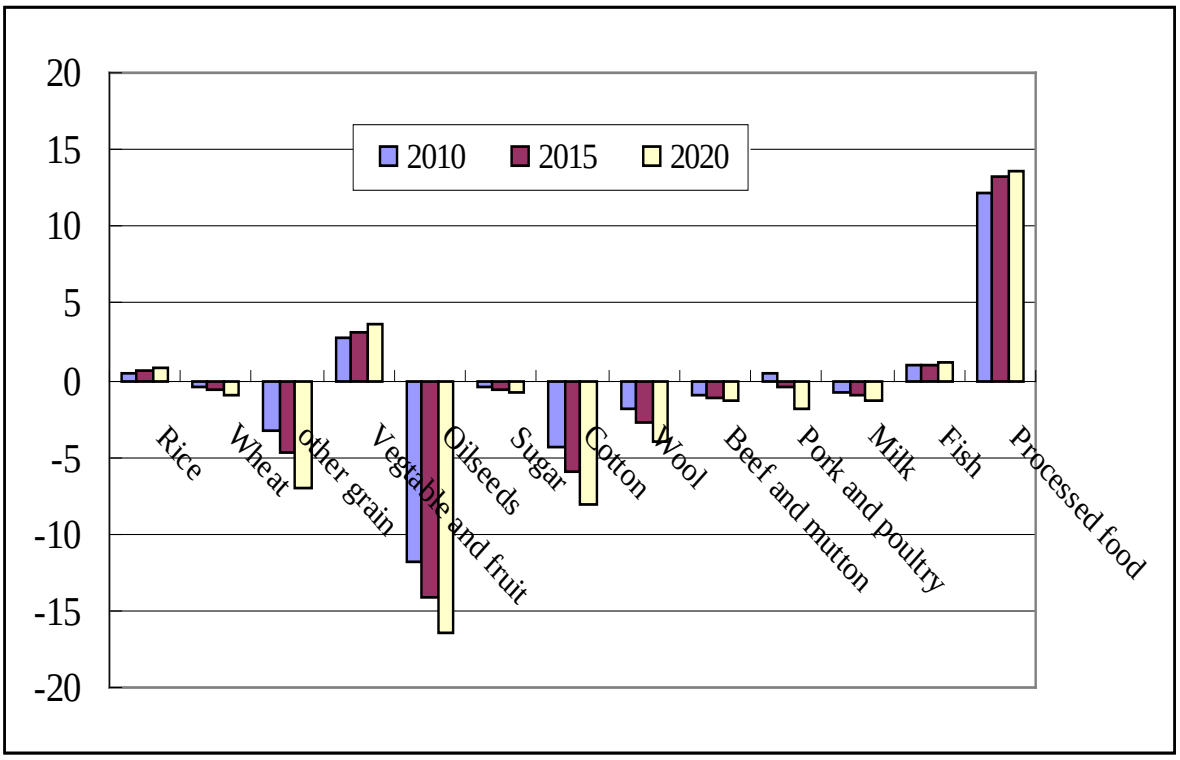
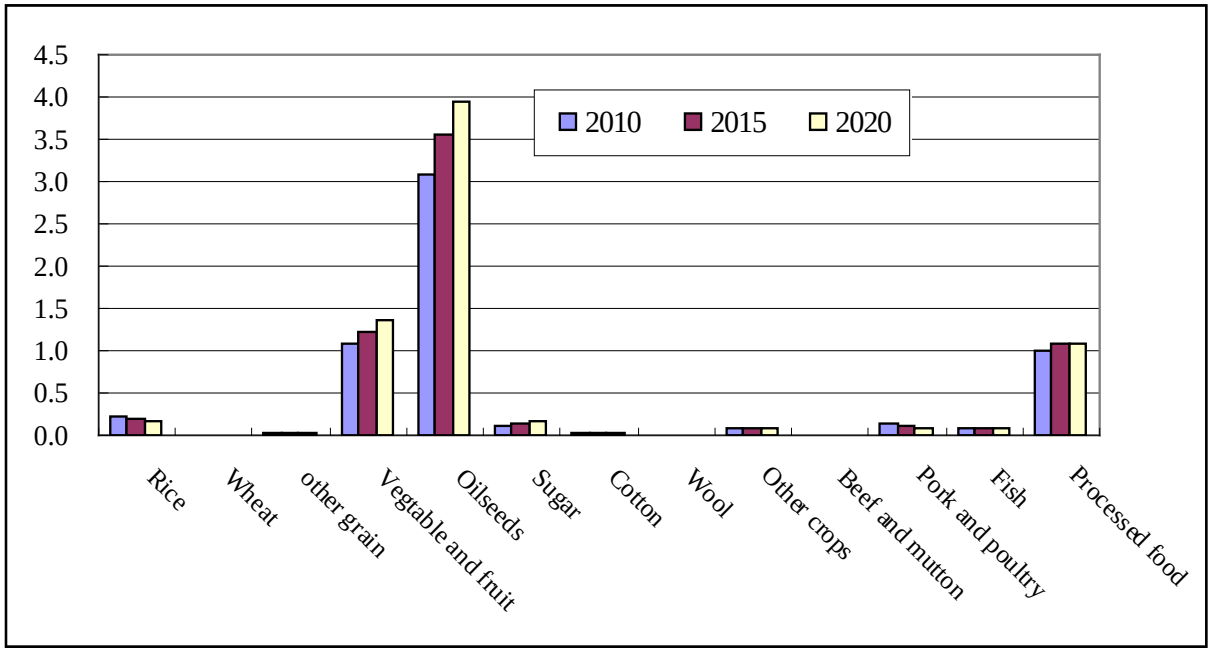
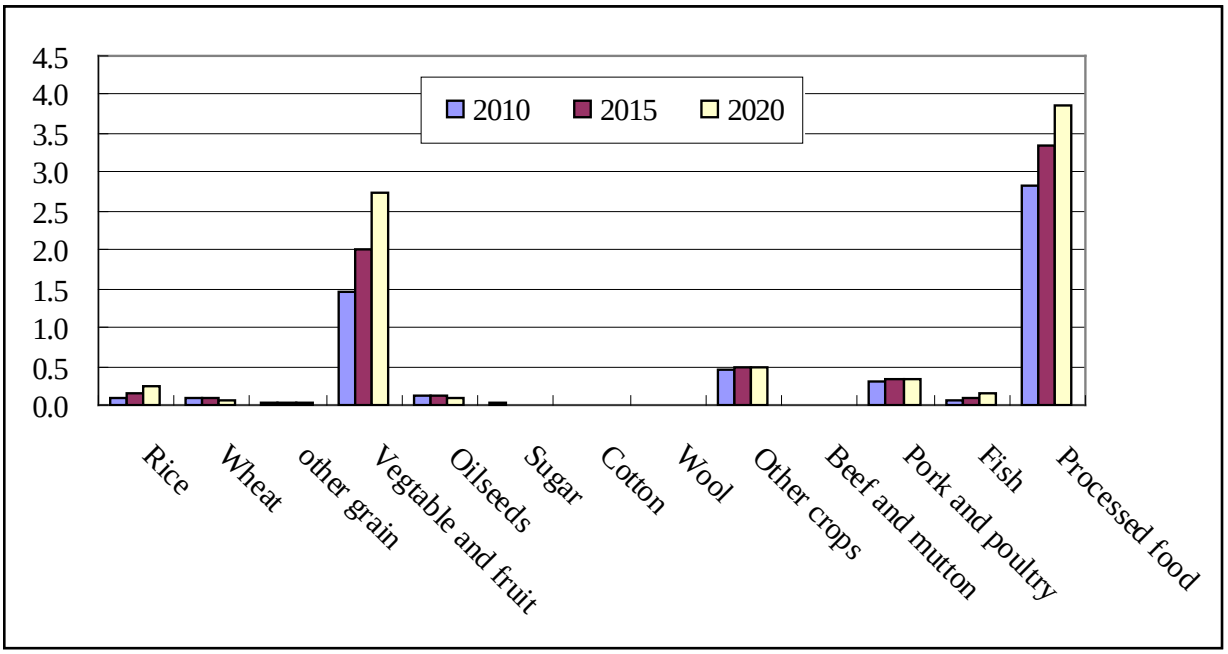


Figure 6. China's agriculture and food trade with Southeast Asia under baseline from 2010—2020, (US$ billion)

Panel A: Imports from Southeast Asia



Panel B: Exports to Southeast Asia



Panel C: Net exports to Southeast Asia

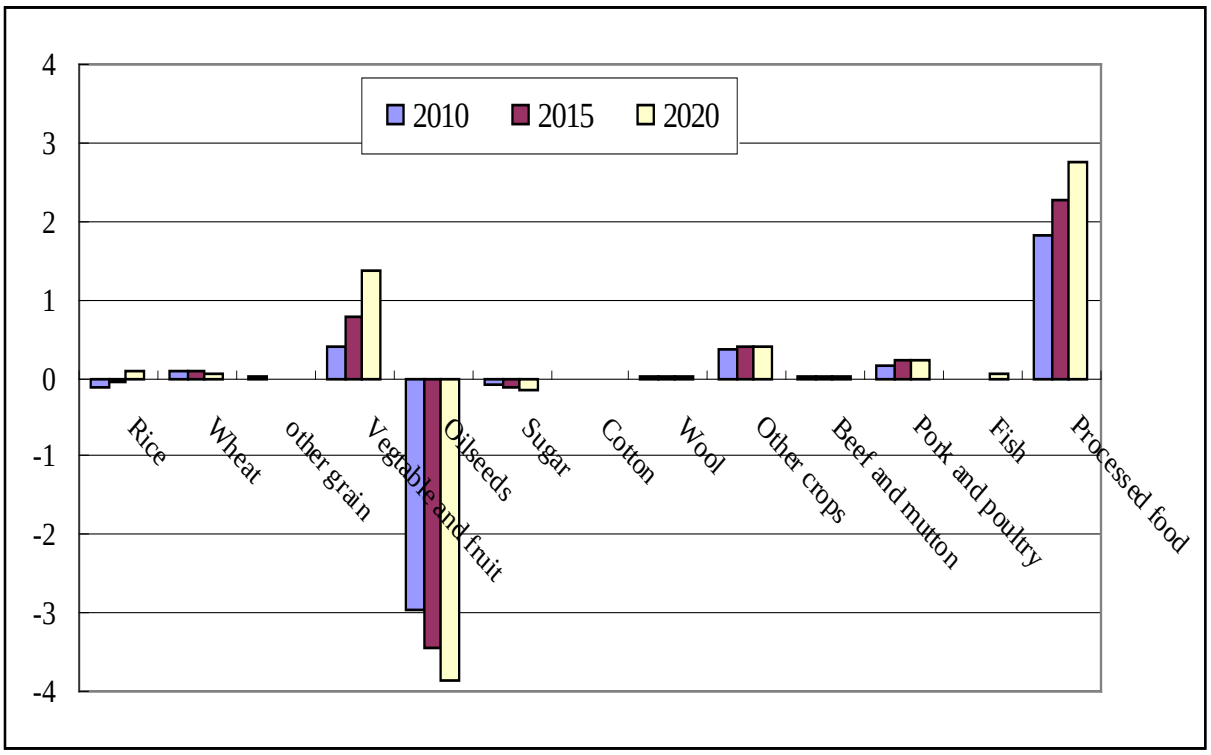


Figure 7. China's net export of agriculture and food under baseline and high GDP growth scenarios in 2020 (US$ billion)

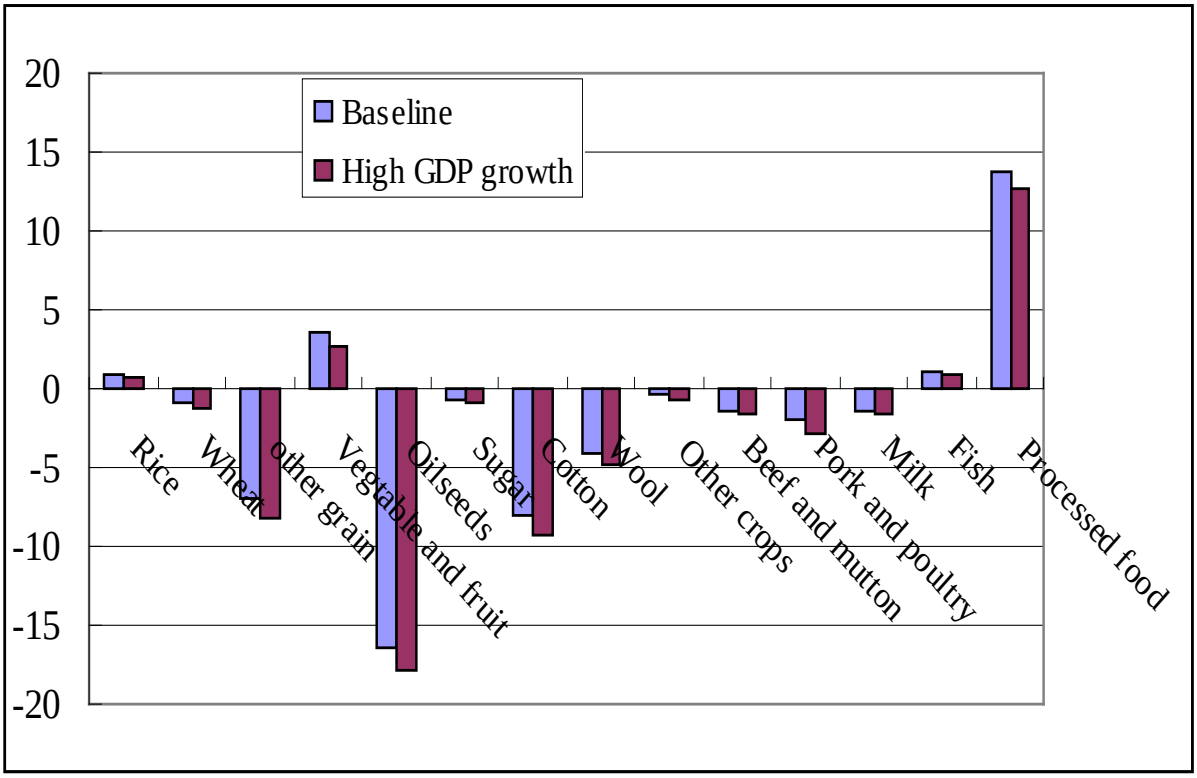
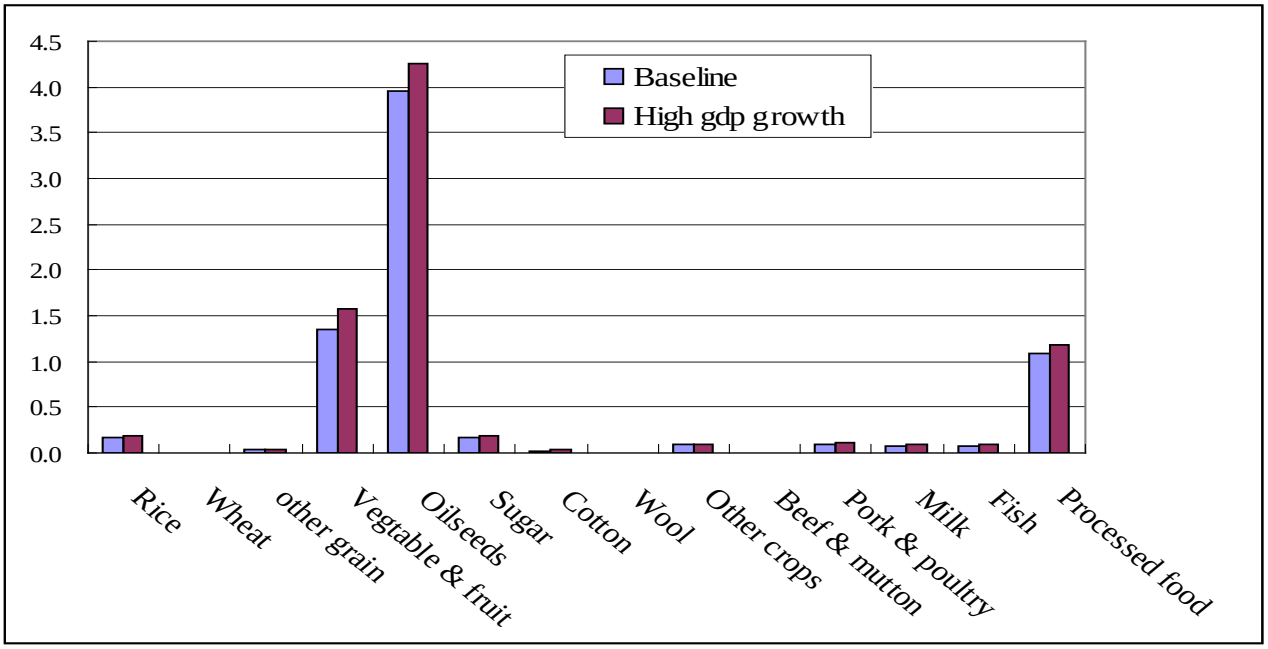


Figure 8. China's agriculture and food trade with Southeast Asia under baseline and high economic growth scenarios in 2020 (US$ billion)

Panel A: Imports from Southeast Asia



Panel B: Export to Southeast Asia

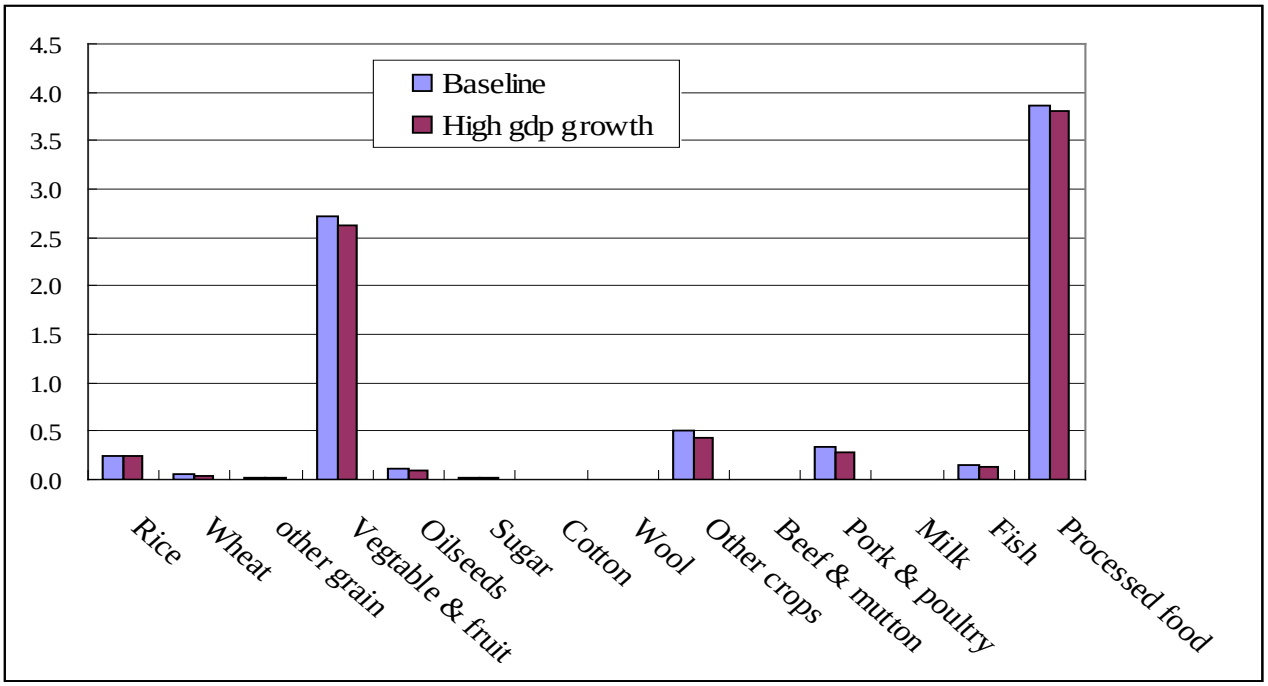


Table 1. Changes in Structure (%) of China's Economy, 1970--2009

	1970	1980	1985	1990	1995	2000	2005	2009
Share in GDP								
Agriculture	40	30	28	27	20	15	12	10.3
Industry	46	49	43	41	47	46	47	46.3
Services	13	21	29	32	33	39	41	43.4
Share in employment								
Agriculture	81	69	62	60	52	50	45	38
Industry	10	18	21	21	23	22	24	28
Services	9	13	17	19	25	28	31	34
Trade to GDP ratio	n/a	12	23	30	40	44	64	44
Export/GDP	n/a	6	9	16	21	23	34	24
Import/GDP	n/a	6	14	14	19	21	30	20
Share of rural population	83	81	76	74	71	64	57	53

***Source*:** National Statistical Bureau, China Statistical Yearbook(various issues), and China Rural Statistical Yearbook(various issues)

***Note*:** n/a = not applicable

Table 2. Share (%) in Agricultural Output (%) of China's Agricultural Economy, 1970--2009

	1970	1980	1985	1990	1995	2000	2005	2009
Crop	82	76	69	65	58	56	51	53
Livestock	14	18	22	26	30	30	35	34
Fishery	2	2	3	5	8	11	10	10
Forestry	2	4	5	4	3	4	4	5

***Source*:** NSBC, Chinas' Statistical Yearbook(various issues), and China Rural Statistical Yearbook (various issues)

Table 3. Per Capita Income, Expenditure (in real 2009 prices), and Share of Food Consumption in Rural and Urban China, 1980--2009

	Income (yuan)		Expenditure (yuan)		Engle coefficient or share of food expenditure (%)	
Year	Rural	Urban	Rural	Urban	Rural	Urban
1980	883	2436	749	2103	62	57
1981	1007	2490	860	2273	60	57
1982	1195	2613	974	2299	61	59
1983	1350	2702	1082	2421	59	59
1984	1506	3037	1161	2605	59	58
1985	1549	3075	1236	2801	58	53
1986	1556	3503	1311	3107	56	52
1987	1599	3582	1377	3162	56	54
1988	1603	3496	1402	3270	54	51
1989	1484	3500	1321	3085	55	55
1990	1619	3799	1379	3215	59	54
1991	1634	4070	1429	3480	58	54
1992	1727	4466	1452	3684	58	53
1993	1786	4892	1492	4006	58	50
1994	1918	5308	1597	4329	59	50
1995	2109	5567	1752	4598	59	50
1996	2386	5781	1948	4683	56	49
1997	2526	5979	1954	4850	55	47
1998	2639	6324	1941	5050	53	45
1999	2739	6914	1955	5494	53	42
2000	2795	7358	2072	5856	49	39
2001	2912	7982	2143	6177	48	38
2002	3059	9053	2267	7087	46	38
2003	3190	9868	2364	7584	46	37

2004	3408	10624	2536	8099	47	38
2005	3696	11646	2902	8816	46	37
2006	4014	12860	3165	9511	43	36
2007	4395	14427	3422	10462	43	36
2008	4746	15638	3649	11141	44	38
2009	5153	17175	3993	12265	41	37

***Source*:** National Bureau of Statistics of China(various issues)

Table 4. Per Capita Food Consumption (kg/person) in China, 1980--2009

Foods	1980	1985	1990	1995	2000	2005	2009
Rice	79.5	93.5	96.1	93.4	86.4	77.5	72.4
Wheat	50.9	71.2	77.5	74.3	71.2	60.3	56.5
Maize	27.4	14.6	14.8	11.3	8.1	6.2	6.0
Sweet potato	8.8	6.1	3.6	3.1	2.9	2.7	2.1
Other coarse grain	21.5	15.8	12.9	11.3	9.3	7.0	5.0
Potato	2.2	3.0	3.5	5.7	7.0	7.8	7.4
Edible oil	2.0	4.0	5.3	6.7	8.5	10.9	13.7
Sugar	1.6	2.2	2.3	2.4	3.1	4.0	5.2
Vegetables	n/a	n/a	n/a	139.1	157.7	166.6	178.5
Fruits	6.3	10.5	18.4	27.2	45.1	51.0	63.2
Pork	10.8	14.4	16.5	17.5	22.0	29.2	30.5
Beef	0.3	0.6	1.0	1.4	2.1	2.8	3.0
Mutton	0.4	0.6	1.0	0.9	1.4	2.0	2.1
Poultry	1.1	1.8	2.3	4.0	6.5	9.3	12.0
Eggs	1.8	3.6	4.4	6.4	9.3	9.9	12.2
Milk	1.3	2.8	3.6	4.6	7.3	19.4	26.7
Fish	2.0	3.7	5.3	7.1	9.2	13.5	17.5

***Source*:** Database of CAPSiM, CCAP, CAS.

Note: n/a = not applicable

Table 5. Per Capita Food Consumption (kg/person) in Rural China, 1980--2009

Foods	1980	1985	1990	1995	2000	2005	2009
Rice	80.5	100.2	106.5	104.5	100.9	95.6	88.1
Wheat	49.1	75.6	84.2	87.4	87.7	76.3	67.4
Maize	33.1	18.4	19.1	14.7	11.2	9.0	8.5
Sweet potato	10.1	7.3	4.5	3.6	2.8	2.0	1.7
Other coarse grain	25.4	19.6	16.4	14.5	12.8	10.5	7.4
Potato	1.9	2.2	2.8	3.7	4.7	5.1	3.6
Edible oil	1.8	3.3	4.5	5.7	7.4	8.1	10.6
Sugar	1.2	1.8	2	1.9	2.2	2.3	2.6
Vegetables	n/a	n/a	n/a	134.1	155.5	155.0	160.8
Fruits	2.9	3.7	6.8	15.7	24.1	24	30.1
Pork	9.9	12	13	13.9	18.7	23.7	22.5
Beef	0.2	0.4	0.5	0.7	0.9	1.2	1.3
Mutton	0.4	0.4	0.5	0.5	1.0	1.4	1.6
Poultry	0.7	1.1	1.6	2.4	4.1	5.6	7.2
Eggs	1.3	2.3	2.8	3.9	6.0	6.3	8.0
Milk	0.6	0.9	1.8	2.4	3.2	5.1	7.2
Fish	1.5	2.1	3.1	4.2	5.2	6.9	8.3

***Source*:** Database of CAPSiM, CCAP, CAS

Note: n/a = not applicable

Table 6. Per Capita Food Consumption (kg/person) in Urban China, 1980--2009

Foods	1980	1985	1990	1995	2000	2005	2009
Rice	74.9	71.8	67.1	65.8	60.1	52.9	53.1
Wheat	58.6	57	58.7	42	41.1	38.6	43.1
Maize	3.3	3.0	2.6	3.0	2.6	2.4	2.4
Sweet potato	3.4	2.1	1.3	1.9	3.0	3.6	2.5
Other coarse grain	5.3	3.4	3.1	3.5	3.0	2.1	2.2
Potato	3.3	5.5	5.5	10.7	11.2	11.4	11.9
Edible oil	2.8	6.6	7.7	9.0	10.5	14.8	17.6
Sugar	3.4	3.4	3.0	3.5	4.6	6.5	8.4
Vegetables	n/a	n/a	n/a	151.3	161.6	182.4	200.1
Fruits	20.2	32.4	50.9	55.6	83.3	87.8	108.8
Pork	14.5	22.2	26.4	26.5	27.9	36.6	40.2
Beef	0.6	1.5	2.5	3.3	4.3	4.9	5.1
Mutton	0.8	1.1	2.4	1.9	2.3	2.7	2.8
Poultry	2.4	3.9	4.4	7.9	10.9	14.2	17.7
Eggs	4.0	8.0	8.8	12.5	15.1	14.9	17.4
Milk	4.5	9	8.8	10.2	14.8	39	50.5
Fish	4.19	8.85	11.31	14.0	16.3	22.4	28.7

***Source*:** Database of CAPSiM, CCAP, CAS

Note: n/a = not applicable

Table 7. Market Development and Per Capita Food Consumption (kg) in Rural China, 1997--2001

	Percentage of food purchased from market (percent)			
Per capita consumption (kg)	<30	30-45	45-60	>60
Grain (unprocessed)	276.2	265.6	249.4	211.3
Edible oils	6.6	6.8	7.0	7.5
Meat	22.3	21.5	23.0	29.0
Aquatic products	1.8	3.1	4.2	8.5
Vegetable	131.0	119.6	111.5	102.2
Sugar	1.2	1.7	2.0	2.3
Fruits	14.5	18.0	22.0	28.6

***Source*:** Huang and Rozelle 1989.

Table 8. The Annual Growth Rates (%) of Agricultural Economy, 1970--2009

	Pre-reform	Reform Period				
	1970--78	1979--84	1985--95	1996--00	2001--05	2006--09
Agricultural GDP	2.7	7.1	4.0	3.4	3.9	4.5
Production						
Grain	2.8	4.7	1.7	-0.7	1.1	2.4
Cotton	-0.4	19.3	-0.3	-1.9	5.3	2.1
Soybean	-2.3	5.2	2.8	2.6	1.4	-1.0
Oil crops	2.1	14.9	4.4	5.6	0.8	1.6
Fruits	6.6	7.2	12.7	8.6	21.0	5.9
Meats	4.4	9.1	8.8	6.5	4.9	2.2
Fishery	5.0	7.9	13.7	10.2	3.6	3.6
Planted area						
Vegetables	2.4	5.4	6.8	6.8	3.1	2.0
Orchards (fruits)	8.1	4.5	10.4	1.5	2.4	2.7

***Sources*:** NSBC 1985--2010 and MOA 1985—2010.

***Note*:** Growth rates are computed using regression method. Growth rates of individual and groups of commodities are based on production data.

Table 9. China's Food, Feed, Fiber, and Nonagriculture Trade, 1985--2009 (US$ million)

	SITC	1985	1990	1995	2000	2005	2009
Exports							
Food and feed		3183	7515	10900	12804	23420	33299
Live animals and meat	00-01	429	1221	1822	1619	2234	2324
Dairy products	02	34	79	75	104	180	215
Fish	03	154	1370	2875	3661	7527	10233
Grains	04	917	614	281	1812	1836	1291
Fruit and vegetable	05	433	1760	3401	3362	7431	12352
Sugar	06	65	318	321	257	502	895
Coffee and tea	07	312	534	512	545	1061	1567
Animal feeds	08	225	758	351	303	497	1784
Other foods	09	62	82	286	608	1182	1903
Oilseeds and vegetable oils	22	552	780	975	533	971	735
Fiber	26	892	1096	753	1085	1186	1544
Nonagriculture		21557	53481	137126	235314	737347	1166804
Imports							
Food and feed		1437	4460	8825	8648	20747	35486
Live animals and meat	00-01	24	68	115	667	691	1820
Dairy products	02	29	81	63	217	461	1041
Fish	03	41	102	609	1217	2904	3653
Grains	04	829	2353	3631	662	1640	1893
Fruit and vegetable	05	16	83	185	516	1349	3131
Sugar	06	262	389	935	177	451	480
Coffee and tea	07	18	30	73	94	222	365
Animal feeds	08	79	305	423	909	1307	1861
Other foods	09	21	46	88	283	354	559
Oilseeds and vegetable oils	22, 04	118	1003	2702	3906	11368	20683
Fiber	26	1023	1975	4108	2846	6854	5590
Nonagriculture		37335	46911	119150	213599	632352	964479
Net export							
Food and feed		1746	3055	2075	4156	2673	-2187
Live animals and meat	00-01	405	1153	1707	952	1543	504
Dairy products	02	5	-2	12	-113	-281	-826
Fish	03	113	1268	2266	2444	4623	6580
Grains	04	88	-1739	-3350	1150	196	-602
Fruit and vegetable	05	417	1677	3216	2846	6082	9221
Sugar	06	-197	-71	-614	80	51	415
Coffee and tea	07	294	504	439	451	839	1202
Animal feeds	08	146	453	-72	-606	-810	-77
Other foods	09	41	36	198	325	828	1344
Oilseeds and vegetable oils	22, 04	434	-223	-1727	-3373	-10397	-19948
Fiber	26	-131	-879	-3355	-1761	-5668	-4046
Nonagriculture		-15778	6570	17976	21714	104996	202325

***Source*:** UNCOMTRADE

Table 10. Past and Projected Annual Growth Rate (%) of China's Economy, 1985--2020

	1985--95	1996--00	2001--05	2006--10	2011--15	2016--20
Baseline						
GDP	9.7	8.2	9.9	11.2	8.0	8.0
Per capita GDP	8.3	7.2	9.1	10.6	7.6	7.6
High growth						
GDP	9.7	8.2	9.9	11.2	8.8	8.8
Per capita GDP	8.3	7.2	9.1	10.6	8.4	8.4

Table 11. Self-Sufficiency Level (%) in Different Scenarios in 2020

	Baseline	High GDP
Rice	102	101
Wheat	95	94
Coarse grains	87	86
Oilseeds	48	46
Sugar	78	77
Fiber	67	65
Horticulture	102	101
Beef and mutton	93	92
Pork and poultry	99	98
Milk	81	80
Fish	102	101
Processed food	106	105

Table 12. China's Trade Shares (%) in the World under Different Scenarios in 2020

	Export share		Import share		Net export share	
	Baseline	High GDP	Baseline	High GDP	Baseline	High GDP
Food + feed crops	2.6	2.3	12.3	13.6	-9.7	-11.3
Processed food	6.7	6.6	2.3	2.5	4.4	4.1
Animal products	2.2	1.9	4.2	4.8	-2.0	-2.9
Fiber	0.1	0.0	32.2	35.4	-32.1	-35.3
Energy/Mineral	0.1	0.1	19.9	22.6	-19.8	-22.5
Textile/apparel	39.8	41.0	6.5	6.7	33.3	34.4
Manufacture	13.1	14.2	9.3	9.7	3.7	4.5
Service	2.8	3.0	5.8	6.0	-3.0	-3.0
TOTAL	11.0	11.7	9.3	9.9	1.7	1.8

Table 13. Percentage Output Changes in Different Regions in 2020 (high GDP growth vis-a-vis baseline)

	Australia + New Zealand	Southeast Asia	Japan + Korea	South Asia	USA	EU	ROW
Food+feed crops	2.4	1.1	0.4	0.5	1.1	0.5	0.9
Processed food	0.5	0.4	0.1	0.8	0.3	0.1	0.4
Animal products	0.8	0.5	0.5	0.2	0.4	0.3	0.6
Fibre	1.9	1.0	0.2	0.8	3.8	1.0	1.9
Energy/mineral	6.4	6.3	7.9	6.1	7.0	6.2	5.8
Textile and Apparel	-1.6	-1.4	-0.9	-0.3	-1.8	-1.0	-1.3
Manufacture	-0.9	0.1	0.1	-0.4	-0.1	0.0	-0.6
Service	0.2	0.0	0.1	-0.8	0.2	0.1	0.3
TOTAL	0.4	0.2	0.2	-0.4	0.2	0.1	0.5

Table 14. Welfare Changes in Different Regions in 2020 (high GDP growth vis-a-vis baseline)

	Aggregate Welfare Effect (EV) US$ billion	Change in Welfare (%)
China	254	10.5
Rest of the World	42	0.3
Australia + New Zealand	3	1.4
Southeast Asia	1	0.3
Japan + Korea	6	0.4
South Asia	-7	-1.2
USA	4	0.1
EU	-5	-0.2
ROW	52	1.1
China	254	10.5
TOTAL	296	1.7

Appendix Table 1. Annual Growth Rates of Different Macro Variables in Different Countries/Regions Under Baseline, 2010--2010 (%)

	GDP	Population	Unskilled labor	Skilled labor	Capital
China	8.0	0.6	3.5	0.3	8.4
Australia + New Zealand	3.4	0.8	-0.4	0.7	4.0
ASEAN	5.4	1.3	3.6	1.2	5.2
Japan + Korea	2.7	0.3	-0.3	-0.6	2.3
South Asia	4.9	1.4	3.5	1.6	5.3
USA	2.7	0.7	-0.4	0.5	2.2
EU27	2.7	0.0	-1.0	-0.1	3.1
ROW	4.3	1.7	2.2	1.8	4.3

***Source*:** Estimated by authors based on researches by Walmsley et al. 2000, Tongeren et al. 2004, and Yang et al. 2010 and other information obtained from the world development index (WDI), world labor organization (WLO), outlook of the World Bank (WB), and the International Monetary Fund (IMF).