Implications of Growth in China for the U.S. and Other Countries

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Abstract

We investigate the effects of China's economic growth on various sectors in the United States and other countries and regions, using a multi-region Global Trade Analysis Project (GTAP) model. The results indicate that all countries and regions, except South Korea and South Asian countries, would benefit from China's rapid economic growth. The welfare gain varies significantly across the countries and regions. Hong Kong and Taiwan would benefit the most from mainland China's economic growth in terms of per capita welfare gains. U.S. bilateral trade balance with China would improve in the sectors of grain and other primary agricultural products, but it would deteriorate in the sectors of textiles and high-tech manufacturing products.

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1. Introduction

Since its reform and opening up to the outside world in 1978, China has been rapidly industrializing. From the industrialization experience of Japan, South Korea, and Taiwan, Lester Brown (1995) observed that if a country becomes densely populated before it industrializes, the country inevitably suffers a heavy loss of cropland and becomes a large importer of grains. In his book titled "*Who Will Feed China?"* in 1995, Brown argued that China might soon emerge as an importer of massive quantities of grain, drain the international markets of food, and inflate world food prices. He projected that China would have to import at least 200 to 369 million tons of grain by 2030. According to USDA, the world total exports of corn, rice, and wheat combined was about 217 million tons in recent years (Figure 1).

Brown's notion has also aroused controversy over the effects of China's rapid economic development on the rest of the world. While many studies (Rozelle and Huang 1996, Huang 1998, Wang and Davis 1998, Geng et al 1998) forecasted that China would become an important importer for grains, other studies (Song 1997, Lin 1998, IOSC 1996) argued that China would still remain self-sufficient. Segal (1999) argued that China is a small market that matters relatively little to the world, especially outside Asia. Harris (2003) and Thirlwell (2005) argued that China matters not just regionally but globally in economic terms. They argued that China's emergence as a major economic power participating in the workings of international economic institutions already influenced the global economic system. McKibbin and Huang (1996) argued that rapid economic growth in China would not

only increase Chinese demand for foreign goods but also affect foreign production as capital is reallocated from less productive uses outside China into sectors within China with higher rates of return. Arndt et al (1997) showed that China's growth would have an adverse effect on non-OECD countries if one simply looks at net trade positions. However, most countries and regions would benefit from China's growth if one looks at the entire set of effects, including changes in region-specific export and import prices, resource allocation, and endowment effects.

The objective of this study is to examine the effects of China's economic growth on various sectors in other countries and regions, using a general equilibrium model. We aggregate the 57 commodities and industries and 87 countries and regions covered in the GTAP Version-6 database into 11 sectors and 10 countries and regions. The results for the welfare changes indicate that all the non-mainland China countries and regions except South Korea and the South Asian countries, would benefit from China's rapid economic growth. The welfare gain varies significantly across the countries and regions. The ROW would gain the most, followed by the United States. Hong Kong and Taiwan would gain the most in terms of per capita welfare gain. U.S. bilateral trade balance with China would improve in the sectors of grain and other primary agricultural products, but it would deteriorate in the sectors of textiles and high-tech manufacturing products.

The paper is organized as follows. Section two gives an overview of China's economic development since 1978. Section three discusses the data and model used for this study. Section four presents the simulation results and discusses our findings. Finally, section five summarizes and concludes the paper.

2. An Overview of China's General Economic Statistics

2.1. – GDP

Table 1 summarizes both nominal and real GDP statistics in China over the time period from 1978 to 2004. China's GDP in nominal terms have grown sharply over time. Total GDP jumped from $215.3 billion (U.S. dollars) in 1978 to $1653.7 billion in 2004. The average annual growth rates for total GDP during the 1979-1990, 1990-2000, and 2000-2004 periods are 5.6%, 9.0%, and 10.8%, respectively. GDP in the agricultural sector has increased relatively slow. The average annual growth rates for agricultural GDP during the above same three periods are 5.4%, 4.8%, and 7.7%, respectively. GDP in the manufacturing (or industrial) sector has increased at a faster pace. The average annual growth rates for industrial GDP during the above three periods are 4.4%, 10.9%, and 12.4%, respectively. GDP in the services sector has increased more rapidly in the early years. The average annual growth rates for GDP in the services sector during the above three periods are 8.1%, 9.5%, and 10.1%, respectively. Per capita GDP in China has also increased rapidly, jumping from $225.1 in 1978 to $1275.9 in 2004. The average annual growth rates for per capita GDP during the above three periods are 4.1%, 7.9%, and 10.1%, respectively.

China's real GDP growth rates are much smaller prior to 2000, but the growth rates are generally very high in recent years. For total GDP, the average annual growth rates during the above three periods are 0.05%, 2.4%, and 8.0%, respectively. In real terms, agricultural GDP even decreased by an average rate of 1.7% during the period from 1990 to 2000. The real GDP growth rate in the industrial sector was negative (-1.1%) in 1979 – 1990, but the growth rate increased to 4.0% in 1990 – 2000, and jumped to 9.5% in recent years. The real GDP in the services sector has grown at less than 3.1% prior to 2000 and at 7.3%

after 2000. Per capita real GDP in China decreased at an average annual rate of 1.4% in 1979 – 1990, and grew slowly (1.3%) in 1990- 2000. However, per capita real GDP has grown at an average of 7.3% after 2000.

2.2. – Population, Labor Force, and Capital Investment

China's population has grown at a decreasing rate over time. The average annual population growth rates in the 1979 – 1990, 1990 – 2000, and 2000 – 2004 periods were 1.4%, 1.1%, and 0.7%, respectively. If China's population growth rate would remain at 0.7% from 2004 throughout 2030, China's population would reach 1.56 billion by 2030. This is quite similar to the previous projections. For example, Bos et al (1994) projected that China's population would reach 1.5 billion by 2030 while Song (1998) argued that China's population would reach its peak at 1.60 billion by 2030.

Similar to the growth pattern for population, while China's labor force has grown steadily over time, the growth rate has decreased constantly. China's total labor force was 401.5 million in 1978, and jumped to 752.0 million in 2004. The average annual growth rate of labor force was about 4.1% prior to 1990, and decreased to 2.5% in 1990 – 2000, and further declined to about 1.0% in recent years.

Skilled labor force increased constantly from 118.4 million in 1978 to 399.3 million in 2004. The average annual growth rate of skilled labor force was 6.8%, 4.6%, and 2.3% during the above three time periods. By contrast, unskilled labor force in China has increased at a much lower rate. As a matter of fact, the unskilled labor force has decreased since 1991. As a result, the ratio of skilled labor to unskilled labor has increased constantly over time, increasing from 0.42 in 1978 to 1.13 in 2004.

China's capital investment has increased significantly over time. The capital investment at current prices was only $48.6 billion in 1978, but jumped to $851.5 billion in 2004. The average annual growth rate was 6.4%, 13.5%, and 19.0% during the above three periods. In real terms, however, China's capital investment prior to 1990 decreased at an average rate of 0.2%. The capital investment has increased sharply in recent years both in nominal (19.0%) and real terms (17.6%). Foreign direct investment (FDI) in China has grown rapidly over time, particularly after 1991. FDI jumped from $4.67 billion in 1991 to $11.29 billion in 1992, and then increased rapidly to $64.04 billion in 2004. In recent years, FDI in China has increased at an average annual rate of 8.8% (or 7.6% at 2000 constant prices).

2.3. – Per Capita Income and Consumption of Foods in China

Per capita income for both rural and urban households has increased steadily over time. Per capita income for urban household is much higher than that for rural household, and the gap still tends to increase. In 1978, per capita income for rural and urban household was 133.6 and 343.4 Chinese Yuan, respectively, with a gap of 209.8 Yuan. In 2004, per capita income for rural and urban household reached 2936.4 and 9421.6, respectively. The gap increased to 6485.2 Yuan. As Figure 3 shows, per capita income for urban household has grown much faster than that for rural household since 1990, particularly in recent years. Per capita income has grown at an average rate of 5.9% for rural residents and 10.0% for urban residents in 2000 – 2004. National per capita income (population weighted average income) in China has grown at 13.2% in 1979-1990, 13.8% in 1990-2000, and 7.3% in 2000-2004. In real terms, national per capita income has grown at an average rate of 6.1% during the above three time periods.

As shown in Table 3, prior to 1990, per capita consumption for wheat and rice in China increased at an average annual rate of 4.4% and 1.3%, respectively. By contrast, per capita consumption for corn decreased by 3.8% annually during the same period. This is because people tend to consume more fine grain and less coarse grain as their income increases. In fact, per capita consumption for wheat, rice, and corn has tended to be quite stable since 1985. Per capita consumption for wheat averaged at 83.8 kilograms with a standard deviation of 4.3 kilograms in 1985- 2004. Per capita consumption for rice and corn averaged at 106.5 kilograms (with a standard deviation of 2.4 kilograms) and 22.5 kilograms (with a standard deviation of 1.1 kilograms) during the same period. Since the early 1990s, per capita consumption of wheat and rice has tended to decrease over time (Figure 4). This is because consumers in China have increased consumption of meat products as the income increases.

As shown in Figure 5, per capita consumption of meat products in China has grown constantly since 1978. Per capita consumption for pork, beef, and poultry meat in 1978 was only 8.0, 0.3, and 1.3 kilograms, respectively. In 2004, per capita consumption for pork, beef, and poultry meat jumped to 35.9, 5.2, and 11.3 kilograms, respectively. While per capita consumption for pork has grown slowly, by 2.5% in recent years, per capita consumption for beef and poultry meat has continued to grow at relatively higher rates, by 5.3% and 4.0%, respectively.

3. Data and Model

There are two economic approaches to evaluate the effects of China's economic growth on the economies of other countries: partial equilibrium and general equilibrium

models. The partial equilibrium models are relatively simple and typically focus on only a few sectors of the entire economy. By contrast, general equilibrium models are complex and may capture the complicated interplay of effects in the entire economy. Since China's economic growth is expected to have effects on various sectors in the entire economies of other countries and regions. A general equilibrium model would excel a partial equilibrium model in this instance.

In this study, we use a multi-region Global Trade Analysis Project (GTAP) model to accomplish our research objectives. The GTAP model is a static general equilibrium model, and thus simulation results are comparative static in nature (Hertel 1997; DeRosa and Gilbert 2005). The assumptions for the GTAP model include constant return to scale and perfect competition. These are similar to basic trade models and theories, including the Ricardian model, the Hechscher-Ohlin model, and the Stolper-Sammuelson theorem. Also, resources are assumed to be fully employed and input factors such as labor and capital are assumed to be mobile across the various sectors in a country. Bilateral demand for trade is based on the Armington (1969) assumption, which states that internationally traded products are differentiated by country of origin.

The 87 countries and regions covered in the GTAP Version-6 database are aggregated into 10 countries and regions: ASEAN[1], China (mainland), The EU (the European Union 15), HKTW (Hong Kong and Taiwan), Japan, South Korea, SAsia (South Asian countries including Bangladesh, India, and Sri Lanka, etc.), SAmerica (South America), USA, and the rest of world (ROW). The 57 industries and commodities covered in the database are aggregated into 11 sectors: Grain, Other Primary Agriculture (OAgri), processed food

[1] Indonesia, Malaysia, Philippines, Singapore, Thailand, and Viet Nam

(Pfood), gas and oil (Gasoil), natural resource based industries (NRes), textiles and wearing apparel (Texiles), light manufactures (Lmnfcs), heavy manufactures (Hmnfcs), transportation, machinery, and equipment (High-tech)[2], utilities, housing, construction services (UHCS), and other services (Services). For details of data aggregation, please refer Appendix.

This study uses the standard general equilibrium (GE) closure, which classifies the variables in the model as either endogenous or exogenous. In the standard GE closure, the variables for population, capital, skilled labor, and unskilled labor are exogenous variables, and thus can be readily shocked to examine the effects of the changes of these exogenous variables on the endogenous variables. However, variables for GDP (gross domestic product) and output of capital goods (CGDS) are endogenous variables. Since our analysis is focused on the effects of China's economic growth on the selected countries and regions, China's GDP and quantity of capital goods are among the shocking list of exogenous variables. Therefore, the standard GE closure is modified accordingly so that the variables for GDP and output of capital goods in China are exogenous.

As discussed in the previous section, the five growth rates for GDP, population, capital investment, skilled, and unskilled labor force in China during 2000-2004 averaged at 8.0%, 17.6%, 0.7%, 2.3%, and -0.3%, respectively. In our simulation, we assume that China would grow at the above rates. The output of capital goods is assumed to increase at 8.0% (the same as GDP growth rate). These variables in all other countries and regions are assumed to remain constant. These growth rates are shocked simultaneously in our multiple-region GTAP model. While these assumptions may have limitations, the simulation results should provide some insights as regard to the effects of China's economic growth on other

[2] The products of transportation, machinery, and equipment are high-technology manufacturing products.

countries and regions in the world. Previous studies used cumulative growth rates for many years in their simulation. We would argue that it is implausible to use cumulative growth rates since it would exaggerate too much the growth in China relative to other countries.

4. Results and Discussion

4.1. Changes in GDP, Welfare, and Terms of Trade

Table 4 summarizes the changes in GDP, national welfare, and the terms of trade across the selected countries and regions. China's GDP would increase by $81.3 billion (U.S. dollars) or 7.02%. While GDP in ASEAN countries, Hong Kong and Taiwan, South American countries, and ROW would increase slightly, GDP in the European Union, Japan, South Korea, South Asian countries, and the United States would decrease slightly. Note that China's GDP is assumed to have an increase of 8.0% from the base year 2001. The change in value of GDP in Table 3 is 7.02%, which is smaller than our assumption because the GDP price index is decreased by 0.91% after the simulation. The slight increase (decrease) in GDP for other countries and regions is due to the increase (decrease) of GDP price index in those countries and regions.

Welfare (measured by Equivalent Variation in income[3]) of the world would increase by $74.3 billion US dollars. China would gain the most, with an increase of $69.5 billion in welfare, which accounts for 93.5% of the total welfare increase in the world. This is not surprising since we assume China's macroeconomic variables (GDP, population, labor force,

[3] Equivalent Variation in income is the amount of money that would have to be taken away from the consumer before the price change to leave him/her as well off as he/she would be after the price change. In other words, it measures the maximum amount of income the consumer is willing to pay to avoid the price change.

and capital investment) have increased, while these variables remain unchanged for all other countries and regions.

All other countries and regions, except South Korea and South Asian countries, would benefit from China's rapid economic growth. The welfare gain varies significantly across the countries and regions. While the welfare in United States and ROW would increase by $1.17 and $1.95 billion, respectively, the welfare in ASEAN countries and the EU would only increase by $0.21 and $0.27 billion, respectively. By contrast, the welfare in South Korea and South Asian countries would decrease slightly, by $0.07 and $0.08 billion, respectively. While per capita welfare gain in Hong Kong and Taiwan would increase by 0.16%, per capita welfare gain in the EU countries would be negligible. Hong Kong and Taiwan would benefit the most from mainland China's economic growth in terms of per capita welfare gains, reflecting their close economic interdependency with mainland China. Hong Kong and Taiwan are most close to mainland China both geographically and culturally. This enforces the economic linkage among the two regions and mainland China. For example, the lion share of foreign direct investment in mainland China is from the two regions.

While the terms of trade in China would decrease by about 1.38%, the terms of trade would increase for all other countries and regions, except the South Asia region. The terms of trade would increase the most for Hong Kong and Taiwan, by 0.31%, followed by South America (0.15%) and Japan (0.13%).

The terms of trade effect can be attributed to three effects: world price, export price, and import price effects. Table 5 shows that the export price effects are positive for all countries and regions except mainland China. This means the export prices for those

countries and regions rise relative to world average prices. This is because that the rapid economic growth in China would lead to lower export prices for Chinese products, which drives down the average world prices. It is clear that export price effect dominates import price and world price effects for all selected countries and regions, except HKTW region and the ROW. Note that the major commodities that drive the export price effect must vary across the regions (which are not illustrated in this paper) since each region has its comparative advantages.

Table 5 also indicates that the world price effect is positive for some countries (e.g., South America, the United States, and the ROW) while it is negative for other countries (e.g., Japan, South Korea, and the EU). This is because South America, the United States, and the ROW are important producing countries in grain and other primary agricultural products. The ROW and South America also are important petroleum oil exporting regions. They benefit from the increased world prices for agricultural goods and gas and oil. In contrast, Japan, South Korea, and the EU are relatively scarce with land and natural resources and are net importers of gas and oil, and thus the increased world prices for gas and oil generate negative effects on their terms of trade.

4.2. Changes in Trade Balances

Table 6 summarizes the changes of trade balances in various sectors across the countries and regions. While the total trade balance (all sectors combined) in China would increase by $16.08 billion, the total trade balance in all other countries and regions would decrease with different amount, ranging from $0.20 billion in South Asian countries to $4.61

billion in the EU. This result is qualitatively consistent with the previous findings by Arndt et al (1997).

For grain and other primary agriculture commodities, China's net exports would decrease by $0.21 and $2.06 billion, respectively. By contrast, major net exporting countries such as the United States and the ROW would increase their trade balances in grain and other primary agricultural products. The increase in China's import demand for grain and other primary agricultural goods would drive up the world prices of the corresponding goods, inducing net exporting countries to increase their exports and produce more. For processed foods, China's trade balance would decrease by $0.72 billion, while trade balances in the EU, the United States, and ROW would increase by $0.31, $0.18, and $0.18 billion, respectively.

For gas and oil, the trade balances in all countries and regions would decrease except the ASEAN countries, South American countries, and the ROW because these regions including major petroleum exporting countries. China's trade balance in the sector would decrease the most (by $1.16 billion), followed by the EU ($0.25 billion), and Japan ($0.16 billion). The increased import demand for gas and oil would drive up the world gas and oil prices. For other natural-based industry products (NRes), trade the balance in China would decrease by $0.36 billion while trade balances in all other countries and regions except the United States and HKTW region would increase with different magnitude.

For textile products and the light manufacturing goods, trade balances in China would increase sharply by $1.97 and $6.85 billion, respectively. By contrast, trade balances in all other countries and regions would decrease with different amounts. This is because China is a labor-abundant country and we assume that China's labor force increases while keep labor force in all other countries constant. For the heavy manufacturing sector, trade balance in

China would increase by $0.68 billion, while that for the EU and the United States would decrease by $0.37 and $0.14 billion, respectively.

Chinese trade balance in the sector of high-technology manufacturing products would increase dramatically by $11.79 billion, while trade balances for all other countries and regions would decrease. The EU would decrease the most ($3.28 billion), followed by Japan ($3.20) and the United States ($2.61 billion). China has both great market potential (with huge population and increased per capita income) and abundant skilled and cheap labor force. This makes China a very attractive host country for foreign direct investment and other foreign capital loans, which in turn further enhances its competitiveness in the high-technology manufacturing goods. The last column of Table 6 shows that U.S. trade balance with China in the high-tech sector would deteriorate the most (by $4.38 billion). According to Koo and Zhuang (2007), the increased U.S. huge trade deficit with China in recent years is mainly due to the rapid increase in Chinese exports of high-tech manufacturing goods to the United States. Trade balances in the utilities sector are minor for all countries and regions. While the trade balance in the services sector would decrease by $0.69 billion for China, the trade balances would increase essentially for all other countries and regions.

4.3. Changes in Domestic Production

The changes of industrial output across the countries and regions are summarized in Table 7. For China, the output would increase dramatically for all sectors. In particular, the output in the sector of high-technology manufacturing products would increase the most (with an increase of 11.36%) while grain output would increase the least (with an increase of 2.52%).

Although China's output volume in the sectors of grain and other primary agricultural products would increase by 2.52% and 3.22%, respectively, its domestic demand would increase more, resulting in an increase in net import demand for these commodities. The increased import demand by China would drive up the world prices of these goods, which in turn would induce other countries to produce and export more. For example, the United States would increase its production in grain and other primary agricultural products by 0.24% and 0.31%, respectively. For the sectors of processed food, gas and oil, UHCS, and services, the change patterns in output volume are similar to the sectors of grain and other primary agricultural products. While China's output volume would increase, the output volume in those sectors would also increase essentially for all other countries and regions.

For the sectors of textile products, light manufacturing goods, heavy manufacturing goods, and high-technology manufacturing products, China would increase its output volume and net exports dramatically, pulling down the world prices, which in turn would induce other countries and regions to import more and produce less. For example, the output volume of textile products, light manufacturing goods, and heavy manufacturing goods, and high-technology manufacturing products in the United States would decrease by 0.21%, 0.25%, 0.10%, and 0.15%, respectively.

5. Summary and Conclusions

In this study, we have used a multi-region GTAP model (a general equilibrium approach) to examine the effects of China's rapid economic growth on various sectors in selected countries and regions. China's growth rates for GDP, output of capital goods, population, capital investment, skilled, and unskilled labor force are assumed to be 8.0%,

8.0%, 0.7%, 17.6% , 2.3%, and -0.3%, respectively, while all things for the non-mainland China regions remain constant.

Welfare of the world would increase by $74.3 billion US dollars. China would gain $69.5 billion or 93.5% of the total welfare increase in the world. All other countries and regions, except South Korea and the South Asia region, would benefit from China's rapid economic growth. However, the welfare gain varies significantly across the countries and regions. While the welfare in United States and ROW would increase by $1.17 and $1.95 billion, respectively, the welfare in the ASEAN and EU countries would only increase by $0.21 and $0.27 billion, respectively. By contrast, the welfare in South Korea and South Asian countries would decrease slightly by $0.07 and $0.08 billion, respectively. Hong Kong and Taiwan would benefit the most from mainland China's economic growth in terms of per capita welfare gains.

While China's trade balances for grain, other primary agricultural commodities, processed food, gas and oil, natural resource-based industries, utilities, and services, would decrease by different amounts, its trade balances for textiles, light manufacturing goods, heavy manufacturing goods, and high-technology manufacturing products would increase dramatically. As a result, China's total trade balance (all sectors combined) would increase by $16.08 billion. The total trade balance in all other countries and regions would decrease with different amount, ranging from $0.20 billion in South Asian countries to $4.61 billion in the EU. U.S. trade balance with China would improve in the sectors of grain, other primary agriculture, processed food, and gas and oil. However, U.S. trade balance with China in the sectors of textile products, light manufacturing goods, and high-technology manufacturing

products would deteriorate by a larger magnitude. As a result, total U.S. trade balance with China would deteriorate by $7.69 billion.

The output volume would increase for all sectors in China thanks to its rapid economic growth. However, due to the land scarcity (on per capita basis) in China, the production of grain and other agricultural products would increase by relatively smaller amount than other sectors. In general, the pattern of production changes follows the Hecksher-Ohlin theorem. For example, the United States would increase its production of agricultural products (land-intensive products), while China would dramatically increase its production of textile products.

The limitations of the study may include the following two aspects: (1) the data are based on the year 2001. There are some major changes over the past five years across the sectors in the economies throughout the world, particularly in the high-technology sector. (2) Assumptions in the GTAP model such as constant return to scale regardless of sectors, perfect competition, and perfect mobility of labor and capital across the sectors may not be plausible. For example, it is widely believed that the high-technology sector may experience an increasing return to scale.

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Table 1 – Changes in Total GDP, GDP by Sector, and Per Capita GDP in China, 1978 – 2004

	Total GDP	DGP-agri	GDP-manu	GDP-Serv	Per-Capita GDP	Total GDP	DGP-agri	GDP-manu	GDP-Serv	Per-Capita GDP
	In Norminal Terms (current prices)					In Real Terms (GDP deflator 2000 = 100)				
1978	215.3	60.5	103.7	51.1	225.1	775.8	218.0	373.6	184.2	811.3
1979	259.7	80.9	123.0	55.7	268.1	887.2	276.6	420.4	190.2	916.1
1980	301.5	90.7	146.3	64.5	307.0	989.5	297.7	480.1	211.7	1007.5
1981	285.2	90.7	132.3	62.3	286.8	902.8	287.0	418.8	197.1	907.9
1982	279.8	93.1	125.9	60.8	277.4	865.6	288.0	389.6	188.0	858.3
1983	300.4	99.2	133.9	67.2	293.6	926.8	306.2	413.3	207.3	905.8
1984	309.1	98.9	133.9	76.3	298.3	932.3	298.4	403.8	230.1	899.7
1985	305.2	86.5	131.7	87.0	290.4	843.0	239.0	363.6	240.4	802.1
1986	295.5	80.0	130.1	85.3	276.9	767.3	207.9	337.9	221.5	719.0
1987	321.4	86.1	141.1	94.2	296.6	797.1	213.5	349.9	233.6	735.6
1988	401.1	102.9	177.0	121.2	364.1	883.0	226.6	389.6	266.8	801.5
1989	449.1	112.3	193.3	143.5	401.6	914.6	228.7	393.7	292.3	817.9
1990	387.8	104.9	161.3	121.5	341.6	733.7	198.5	305.3	230.0	646.4
1991	406.1	99.3	171.0	135.8	353.0	719.0	175.9	302.7	240.4	624.9
1992	483.0	105.2	212.2	165.7	414.7	800.2	174.2	351.5	274.5	687.0
1993	601.1	119.4	285.1	196.5	510.1	846.7	168.2	401.6	276.8	718.5
1994	542.5	109.7	259.6	173.2	455.2	635.7	128.6	304.2	203.0	533.3
1995	700.2	143.6	341.7	214.9	581.2	723.0	148.3	352.8	221.9	600.1
1996	816.5	166.5	404.3	245.7	670.7	790.6	161.2	391.5	237.9	649.4
1997	898.2	171.4	449.0	277.8	730.3	863.2	164.8	431.5	267.0	701.8
1998	946.3	175.8	466.5	304.1	761.9	925.4	171.9	456.2	297.4	745.1
1999	991.4	174.8	489.9	326.6	791.4	992.7	175.0	490.6	327.0	792.4
2000	1080.7	176.7	542.8	361.2	855.9	1080.7	176.7	542.8	361.2	855.9
2001	1175.7	186.2	589.0	400.5	924.4	1153.9	182.7	578.0	393.1	907.2
2002	1270.7	194.7	640.1	435.8	992.4	1231.8	188.8	620.5	422.5	962.0
2003	1418.3	204.5	740.3	473.5	1100.8	1334.7	192.5	696.7	445.6	1035.9
2004	1653.7	250.9	874.6	528.2	1275.9	1457.9	221.2	771.0	465.7	1124.9
Average annual growth rates										
1979-1990	5.6	5.4	4.4	8.1	4.1	0.05	-0.1	-1.1	2.4	-1.4
1990-2000	9.0	4.8	10.9	9.5	7.9	2.4	-1.7	4.0	2.9	1.3
2000-2004	10.8	7.7	12.4	10.1	10.1	8.0	4.9	9.5	7.3	7.3

Source: Various issues of *China Statistical Yearbook* of the National Bureau of Statistics of China. Data for GDP deflator are obtained from the International Monetary Fund International Financial Statistics (IFS) online database.

Table 2 – Population, Labor Force, and Capital Investment Statistics in China, 1978 – 2004

	POP (million)	Labor (million)	Skilled labor (million)	Unskilled labor (million)	Ratio of Skilled to Unskilled Labor	Captial Investment	Capital Investment at 2000 Prices	FDI	FDI at 2000 Prices
1978	972.1	401.5	118.4	283.2	0.42	48.6	211.1	0.19	0.82
1979	985.5	410.3	123.9	286.3	0.43	55.5	236.6	0.26	1.11
1980	998.9	423.6	132.4	291.2	0.45	60.8	241.0	0.36	1.41
1981	1012.4	437.3	139.5	297.8	0.47	56.4	218.0	0.49	1.89
1982	1026.0	453.0	144.4	308.6	0.47	65.0	246.5	0.67	2.54
1983	1040.0	464.4	152.9	311.5	0.49	72.4	269.1	0.92	3.40
1984	1054.6	482.0	173.3	308.7	0.56	79.0	285.9	1.42	5.14
1985	1070.2	498.7	187.4	311.3	0.60	86.6	286.8	2.25	7.46
1986	1086.8	512.8	200.3	312.5	0.64	90.4	281.0	2.24	6.98
1987	1104.3	527.8	211.2	316.6	0.67	101.9	295.2	2.65	7.67
1988	1122.1	543.3	220.9	322.5	0.68	127.7	311.5	3.74	9.12
1989	1127.0	553.3	221.1	332.3	0.67	117.1	242.1	3.77	7.80
1990	1143.3	647.5	258.4	389.1	0.66	94.4	189.3	3.76	7.53
1991	1158.2	654.9	263.9	391.0	0.68	105.1	203.8	4.67	9.05
1992	1171.7	661.5	274.5	387.0	0.71	146.5	267.0	11.29	20.58
1993	1185.2	668.1	291.3	376.8	0.77	226.9	360.5	27.77	44.12
1994	1198.5	674.6	308.3	366.3	0.84	197.7	253.2	33.95	43.46
1995	1211.2	680.7	325.4	355.3	0.92	239.7	262.1	37.81	41.33
1996	1223.9	689.5	341.3	348.2	0.98	275.6	278.2	42.14	42.54
1997	1236.3	698.2	349.8	348.4	1.00	300.9	295.5	52.39	51.45
1998	1247.6	706.4	354.6	351.8	1.01	343.1	339.7	47.56	47.08
1999	1257.9	713.9	356.3	357.7	1.00	360.6	362.1	42.45	42.62
2000	1267.4	720.9	360.4	360.4	1.00	397.6	397.6	49.36	49.36
2001	1276.3	730.3	365.1	365.1	1.00	449.6	446.5	49.67	49.33
2002	1284.5	737.4	368.7	368.7	1.00	525.6	525.9	55.01	55.05
2003	1292.3	744.3	378.9	365.5	1.04	671.3	664.1	56.15	55.55
2004	1299.9	752.0	399.3	352.7	1.13	851.5	810.7	64.07	61.00
Average growth Rate (%)									
1979-1990	1.4	4.1	6.8	2.8		6.4	-0.2	29.8	22.1
1990-2000	1.1	2.5	4.6	0.9		13.5	6.3	34.3	24.9
2000-2004	0.7	1.0	2.3	-0.3		19.0	17.6	8.8	7.6

Source: Various issues of *China Statistical Yearbook* of the National Bureau of Statistics of China. Unskilled labor refers to the labor in the agricultural sector, and skilled labor refers to the labor either in the industry and services sectors.

Table 3 – Per Capita Income and Per Capita Consumption of Major Agricultural Goods in China, 1978 – 2004. (Income in Yuan, consumption in kilo-grams)

	Rural Residents	Urban Residents	National Per capita Income	National per capita real income	Wheat	Rice	Corn	Pork	Beef	Poultry Meat
1978	133.6	343.4	310.2	1347.0	53.2	92.4	37.8	8.0	0.3	1.3
1979	160.7	410.5	369.0	1572.6	66.1	98.0	36.0	10.0	0.2	1.3
1980	191.3	477.6	428.9	1700.0	74.5	98.7	34.7	11.2	0.3	1.3
1981	223.4	529.9	475.3	1838.0	76.2	99.8	32.1	11.6	0.2	1.4
1982	270.1	582.2	525.9	1993.9	75.8	100.7	29.3	12.2	0.2	1.4
1983	309.8	634.5	575.2	2138.1	78.1	101.2	27.6	12.4	0.3	1.4
1984	355.3	686.8	622.9	2254.6	82.5	104.7	24.4	13.4	0.3	1.4
1985	397.6	739.1	669.8	2218.0	86.8	104.6	21.0	15.2	0.4	1.5
1986	423.8	899.6	805.7	2505.0	87.3	103.7	21.6	16.3	0.5	1.7
1987	462.6	1002.2	895.6	2595.2	87.4	105.0	22.0	16.4	0.7	2.0
1988	544.9	1181.4	1051.9	2565.8	88.4	105.7	21.4	17.8	0.8	2.5
1989	601.5	1375.7	1215.2	2511.8	88.5	107.2	23.2	18.7	0.9	2.5
1990	686.3	1510.2	1338.1	2682.7	87.4	108.4	23.2	19.7	1.0	2.8
1991	708.6	1700.6	1489.1	2887.4	86.7	109.5	23.1	20.9	1.1	3.4
1992	784.0	2026.6	1758.3	3204.3	86.7	109.4	22.9	22.4	1.5	3.9
1993	921.6	2577.4	2209.3	3510.2	86.6	109.1	22.7	24.0	1.8	4.9
1994	1221.0	3496.2	2971.5	3804.4	85.4	108.6	21.7	26.6	2.5	5.4
1995	1577.7	4283.0	3645.0	3985.2	85.3	108.4	21.6	30.0	3.3	6.6
1996	1926.1	4838.9	4137.8	4177.2	85.2	107.8	21.9	25.7	2.8	6.8
1997	2090.1	5160.3	4410.0	4330.7	84.3	107.3	21.8	29.0	3.5	7.9
1998	2162.0	5425.1	4622.1	4575.6	82.8	107.5	22.0	31.0	3.8	8.4
1999	2210.3	5854.0	4733.1	4752.1	81.8	106.7	22.1	31.8	4.0	9.3
2000	2253.4	6280.0	4815.6	4815.6	79.1	106.0	22.3	31.9	4.2	9.9
2001	2366.4	6860.0	5167.7	5131.8	78.2	107.0	22.8	32.8	4.3	9.7
2002	2475.6	7702.8	5659.5	5663.5	76.8	105.6	23.3	33.7	4.5	10.5
2003	2622.2	8472.2	6101.2	6035.7	76.2	102.2	24.3	34.9	4.9	11.0
2004	2936.4	9421.6	6713.4	6392.0	75.4	100.2	25.4	35.9	5.2	11.3
Average annual growth rates										
1979-1990	14.7	13.2	13.0	6.1	4.4	1.3	-3.8	8.0	10.9	7.0
1990-2000	13.2	15.2	13.8	6.1	-1.0	-0.1	-0.4	5.3	16.0	13.4
2000-2004	5.9	10.0	7.3	6.1	-1.6	-1.2	2.8	2.5	5.3	4.0

Source: Data for income are obtained from various issues of *China Statistical Yearbook* of the National Bureau of Statistics of China. National per capita income is population weighted average income. Data for consumption of wheat, rice, corn, pork, and beef are obtained from USDA PS&D database, and consumption for poultry meat is from FAOSTAT database.

Table 4 - Changes in GDP, Welfare, and Terms of Trade across Countries and Regions

Country and Region	GDP (billion U.S.$)	GDP (%)	GDP Price Index	Welfare (billion U.S.$)	Per Capita Welfare (%)	TOT (%)
ASEAN	0.07	0.01	0.01	0.21	0.04	0.06
China	81.3	7.02	-0.91	69.5	5.87	-1.38
EU	-4.20	-0.05	-0.06	0.27	0.004	0.02
HKTW	0.53	0.12	0.13	0.66	0.16	0.31
Japan	-0.53	-0.01	-0.01	0.33	0.01	0.13
Korea	-0.01	-0.002	0.02	-0.07	-0.02	0.03
SAsia	-0.40	-0.06	-0.06	-0.08	-0.01	-0.03
SAmerica	0.77	0.06	0.06	0.37	0.03	0.15
USA	-4.23	-0.04	-0.04	1.17	0.01	0.11
ROW	0.90	0.02	0.01	1.95	0.05	0.12

Table 5 – Decomposition of Terms of Trade Effects (billion U.S. dollars)

Countries and Regions	World Price Effect	Export Price Effect	Import Price Effect	Terms of Trade Effect
ASEAN	-0.06	0.28	0.02	0.25
China	-0.29	-4.88	-0.34	-5.52
EU	-0.46	1.62	-0.70	0.46
HKTW	-0.03	0.31	0.45	0.73
Japan	-0.37	0.51	0.43	0.57
Korea	-0.19	0.20	0.06	0.07
SAsia	-0.09	0.06	0.002	-0.03
SAmerica	0.18	0.21	-0.07	0.32
USA	0.04	0.76	0.43	1.23
ROW	1.21	1.14	-0.45	1.89

Table 6 – Change of Trade Balances by Sector across the Countries (billion U.S. dollars)

	ASEAN	China	EU	HKTW	Japan	Korea	SAsia	SAmerica	USA	ROW	U.S. Trade Balance with China
Grain	-0.001	-0.21	0.03	-0.004	0.004	-0.03	0.02	0.01	0.05	0.13	0.01
OAgri	0.13	-2.06	0.31	0.001	0.04	-0.02	0.07	0.32	0.49	0.70	0.42
Pfood	0.02	-0.72	0.32	-0.01	0.07	-0.05	0.04	-0.02	0.18	0.18	0.08
Gasoil	0.07	-1.16	-0.25	-0.02	-0.16	-0.08	-0.03	0.10	-0.16	1.63	0.02
NRes	0.02	-0.36	0.04	-0.01	0.03	0.04	0.02	0.003	-0.05	0.15	-0.06
Textiles	-0.20	1.97	-0.49	-0.15	-0.14	-0.02	-0.20	-0.14	-0.24	-0.46	-0.37
Lmnfcs	-0.38	6.85	-1.96	-0.30	-0.53	-0.09	-0.15	-0.30	-1.55	-1.95	-3.05
Hmnfcs	0.06	0.68	-0.37	0.08	-0.04	0.17	0.01	-0.17	-0.14	-0.43	-0.38
High-tech	-0.07	11.79	-3.28	-0.22	-2.61	-0.24	-0.05	-0.35	-3.20	-2.22	-4.38
UHCS	-0.001	-0.01	0.04	-0.01	-0.01	0.000	0.001	-0.01	0.01	-0.01	0.005
Services	0.13	-0.69	0.98	0.31	0.10	0.06	0.06	-0.07	0.17	0.16	0.02
Total	-0.22	16.08	-4.61	-0.32	-3.26	-0.26	-0.20	-0.63	-4.45	-2.13	-7.69

Note: U.S. trade balance with China is the difference between the changes in U.S. exports to China and Chinese exports to the U.S.

Table 7 – Changes in Domestic Production by Sector across Countries and Regions (percent)

	ASEAN	China	EU	HKTW	Japan	Korea	SAsia	SAmerica	USA	ROW
Grain	0.06	2.52	0.32	-0.04	0.12	0.57	0.06	0.04	0.24	0.22
OAgri	0.24	3.22	0.25	0.26	0.29	-0.03	0.04	0.28	0.31	0.22
Pfood	0.00	4.23	0.06	0.05	0.03	-0.28	0.06	-0.01	0.04	0.06
Gasoil	0.24	3.24	0.21	0.26	0.18	0.19	0.20	0.16	0.18	0.22
NRes	-0.04	7.23	0.05	-0.02	0.06	0.10	0.02	-0.04	-0.01	-0.02
Textiles	-0.73	6.58	-0.41	-0.59	-0.37	-0.23	-0.38	-0.44	-0.21	-0.47
Lmnfcs	-0.60	8.31	-0.25	-1.13	-0.16	-0.33	-0.25	-0.35	-0.25	-0.47
Hmnfcs	-0.12	9.16	-0.12	-0.28	-0.11	0.14	-0.09	-0.28	-0.10	-0.23
High-tech	-0.04	11.36	-0.16	-0.30	-0.29	-0.16	-0.04	-0.31	-0.15	-0.35
UHCS	0.14	7.46	0.18	0.28	0.22	0.16	0.08	0.17	0.13	0.12
Services	0.05	7.24	0.02	0.09	0.02	0.01	0.00	0.01	0.02	0.04

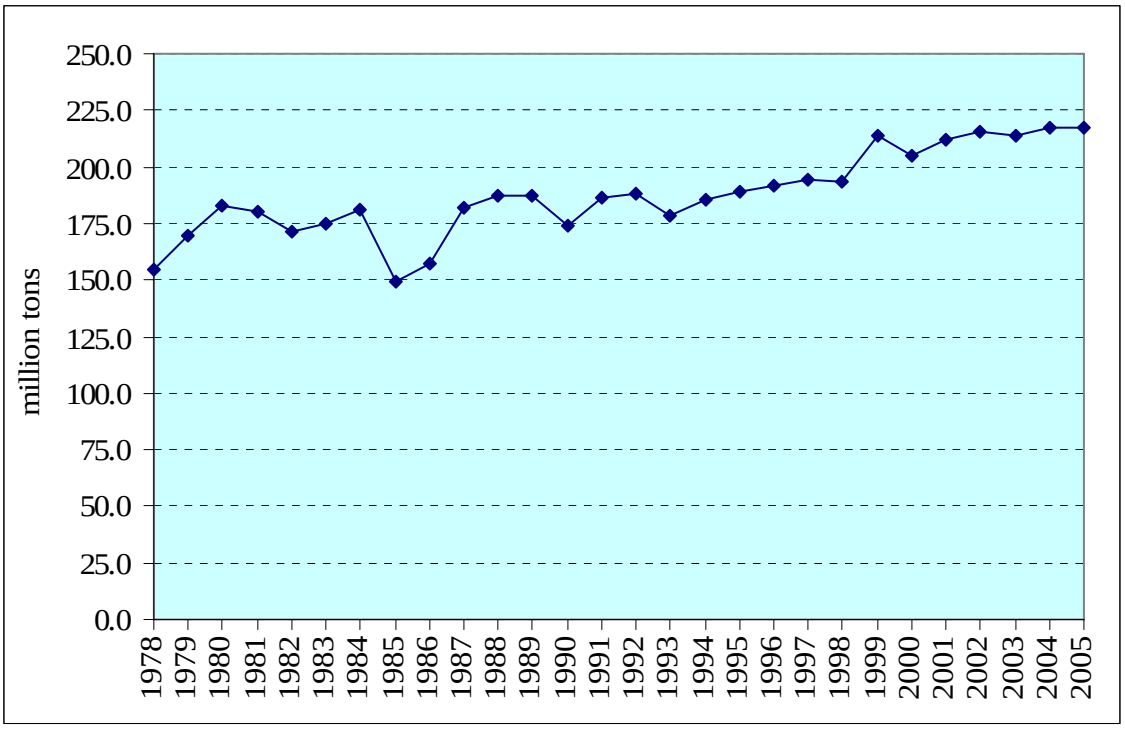

Figure 1. World Total Grain (wheat, rice, and corn combined) Exports, 1978-2005

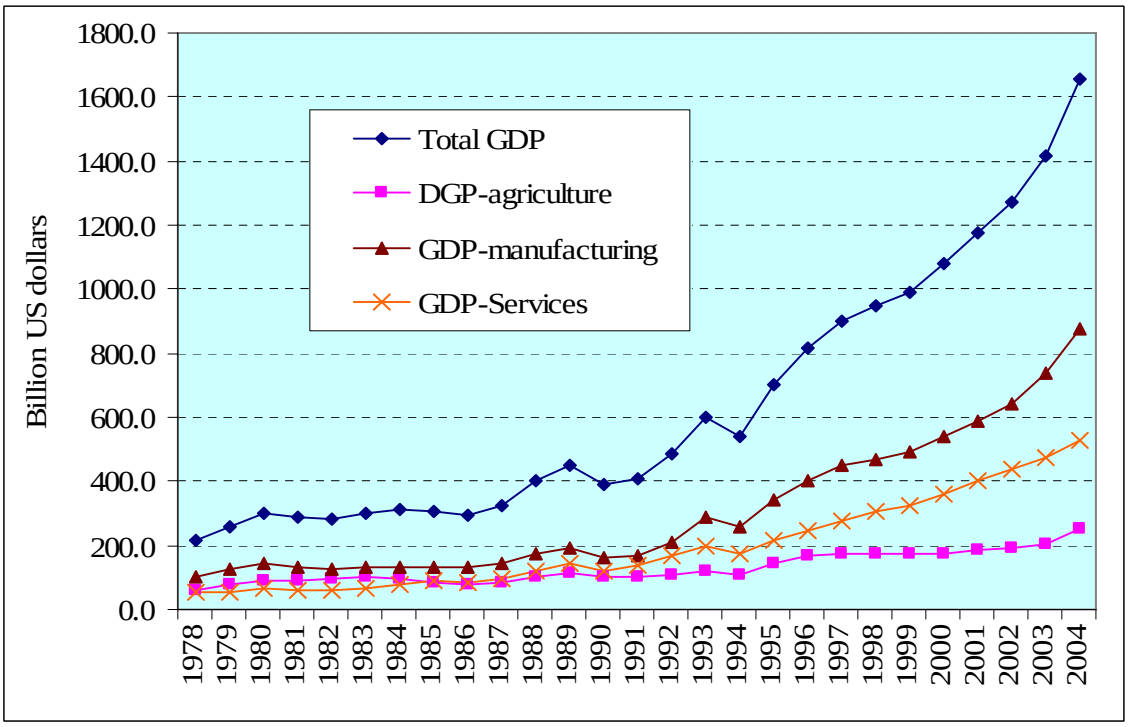

Figure 2. China's Total GDP and GDP by Sector, 1978 -2004

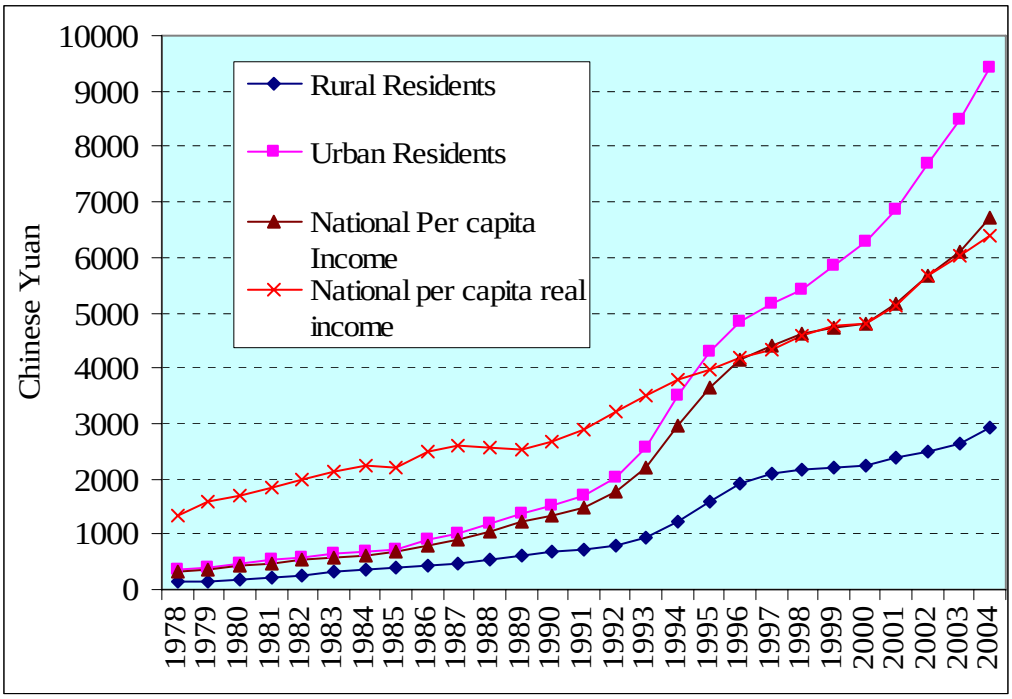

Figure 3. China's Per Capita Income, 1978 -2004

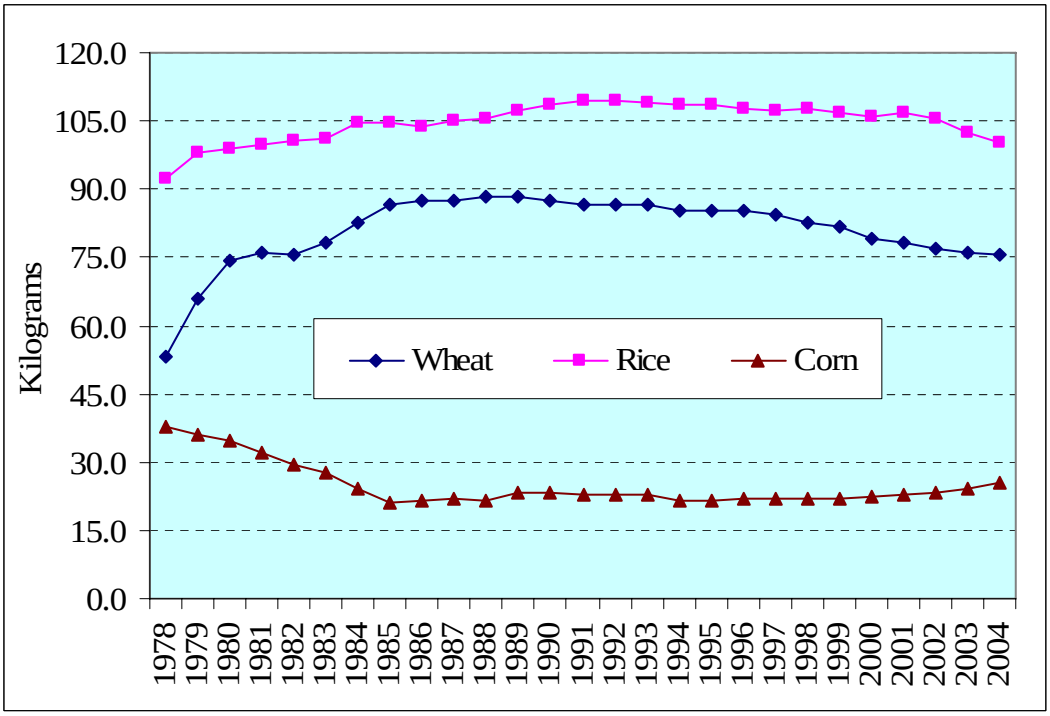

Figure 4. China's Per Capita Consumption of Wheat, Rice, and Corn, 1978 -2004

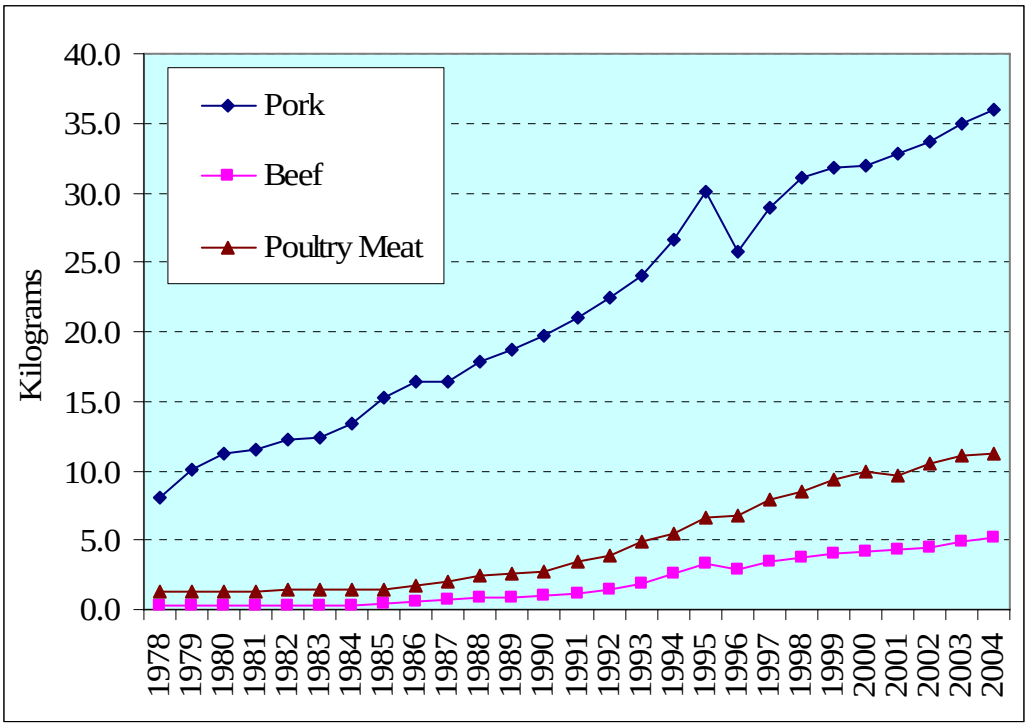

Figure 5. China's Per Capita Consumption of Pork, Beef, and Poultry Meat, 1978 -2004

Appendix - Eleven Sectors Aggregated Based on GTAP Version–6 Database

Sectors	Sector Description	Comprising Original Sectors
Grain	Grain crops	Paddy rice; Wheat; Cereal grains nec;
PAgr	Primary agriculture	Vegetables, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Plant-based fibers; Crops nec; Cattle,sheep,goats,horses; Animal products nec; Raw milk; Wool, silk-worm cocoons.
Pfood	Processed food	Fishing; Meat: cattle,sheep,goats,horse; Meat products nec; Vegetable oils and fats; Dairy products; Processed rice; Sugar; Food products nec; Beverages and tobacco products.
Gasoil	Gas and Oil	Oil; Gas
NRes	Natural resource based Indstries	Forestry; Coal; Minerals nec; Petroleum, coal products; Mineral products nec.
Textiles	Textiles and wearing apparel	Textiles; Wearing apparel.
Lmnfcs	Light manufactures	Leather products; Wood products; Paper products, publishing; Metal products; Manufactures nec.
Hmnfcs	Heavy manufactures	Chemical,rubber,plastic prods; Ferrous metals; Metals nec.
High-tech	Transportation, Machinery & Equipment	Motor vehicles and parts; Transport equipment nec; Electronic equipment; Machinery and equipment nec.
UHCS	Utilities, Housing & Construction Services	Electricity; Gas manufacture, distribution; Water; Construction.
Services	Other services	Trade; Transport nec; Sea transport; Air transport; Communication; Financial services nec; Insurance; Business services nec; Recreation and other services; PubAdmin/Defence/Health/Educat; Dwellings.

Note: The reference year of the GTAP version-6 database is 2001.