

Understanding China's Growth: Past, Present, and Future

Xiaodong Zhu

The pace and scale of China's economic transformation have no historical precedent. In 1978, China was one of the poorest countries in the world. The real per capita GDP in China was only one-fortieth of the U.S. level and one-tenth the Brazilian level. Since then, China's real per capita GDP has grown at an average rate exceeding 8 percent per year. As a result, China's real per capita GDP is now almost one-fifth the U.S. level and at the same level as Brazil. This rapid and sustained improvement in average living standard has occurred in a country with more than 20 percent of the world's population so that China is now the second-largest economy in the world.

To set the stage in this paper, I will begin by discussing briefly China's historical growth performance: that is, how China went from the world's leading economic power about 900 years ago to a situation in which it essentially missed the Industrial Revolution and had close-to-zero growth in per capita GDP from 1800 to 1950. I then present growth accounting results for the period from 1952 to 1978 and the period since 1978, using as my starting point a standard growth accounting exercise that decomposes the sources of growth into capital deepening, labor deepening, and productivity growth. For the period from 1952 to 1978, China's per capita GDP did rise by about 3 percent per year, but all of the growth was due to forced increases in government investment as well as a rise in education levels. Productivity actually regressed during this period, as China's economy went through the enormous disruptions of the famine in the late 1950s and the Cultural Revolution starting in the late 1960s. But the main focus of this paper will be to examine the sources of growth since 1978, the year when China started economic reform. Perhaps

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surprisingly, given China's well-documented sky-high rates of saving and investment, I will argue that China's rapid growth over the last three decades has been driven by productivity growth rather than by capital investment. The growth contributions made by human capital accumulation and an increase in labor participation are positive but modest. I will also examine the contributions of sector-level productivity growth, and of resource reallocation across sectors and across firms within a sector, to aggregate productivity growth. Overall, gradual and persistent institutional change and policy reforms that have reduced distortions and improved economic incentives are the main reasons for the productivity growth.

Despite the rapid growth of the last three decades, China's productivity is still only 13 percent of the U.S. level, which suggests that China still has plenty of room for productivity growth through further economic reforms. Even if China can replicate its extraordinary growth performance for another two decades, its productivity would still be only around 40 percent of the frontier productivity level.

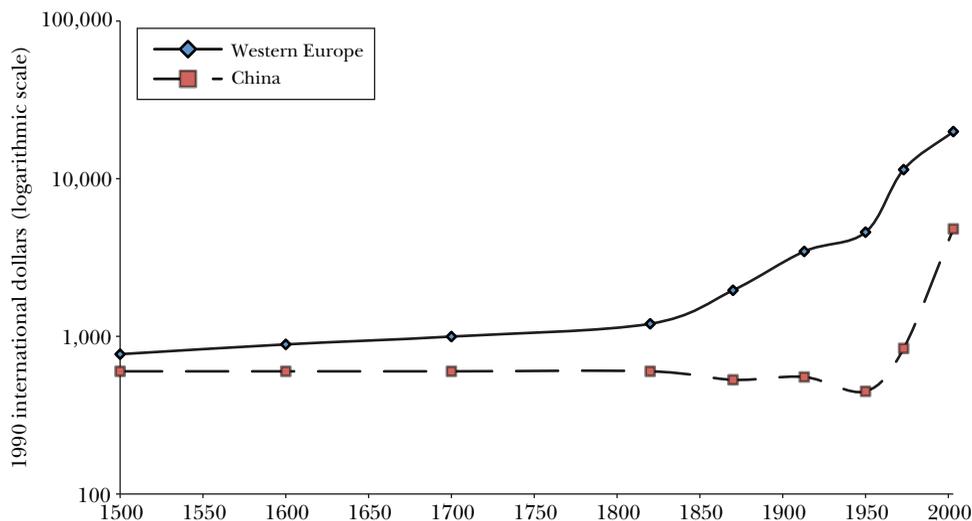
Before delving into the analysis, let me first mention the three main data sources that I use for this paper. For examining China's historical performance, I use the data constructed by Madison (2007); for comparing China with other countries, I use the purchasing power parity data from Penn World Table (PWT7.0); and for detailed growth accounting exercises, I mainly use the data series my coauthor and I constructed for Brandt and Zhu (2010), in which we made adjustments to China's official statistics by using alternative deflators and information from household surveys.

China's Historical Economic Performance

China was a world economic and technological leader in the "premodern" era. Many historians think that China's premodern economic performance reached a peak in the Song Dynasty (circa 1200) when China is thought to have had the most advanced technologies (Needham and Ronan 1978), the highest iron output (Hartwell 1962), the highest urbanization rate (Chao 1986), and the largest national economy (Madison 2007) in the world. However, sometime between 1500 and 1800, China lost its leadership position to Western Europe. Figure 1 plots Angus Madison's estimates of per capita GDP for China and Western Europe. According to his estimates, China's per capita GDP stagnated between 1500 and 1800 while Western Europe's per capita GDP increased steadily during the same period. These estimates suggest that, by the end of the fifteenth century, China had already started to fall behind Western Europe, well *before* the Industrial Revolution occurred in England. Some historians and economists attribute China's falling behind during this period to the more centralized and inward-looking political systems of the Ming (1368–1644) and Qing (1644–1911) dynasties that stifled innovation and commercial activities in China.

Not all economic historians agree with this explanation. Kenneth Pomeranz (2000) argues in *The Great Divergence* that in the eighteenth century, living standards and the degree of commercialization in China's Lower Yangzi region were comparable to those in the richest parts of Europe and that China only started

Figure 1
Per capita GDP of China and Western Europe

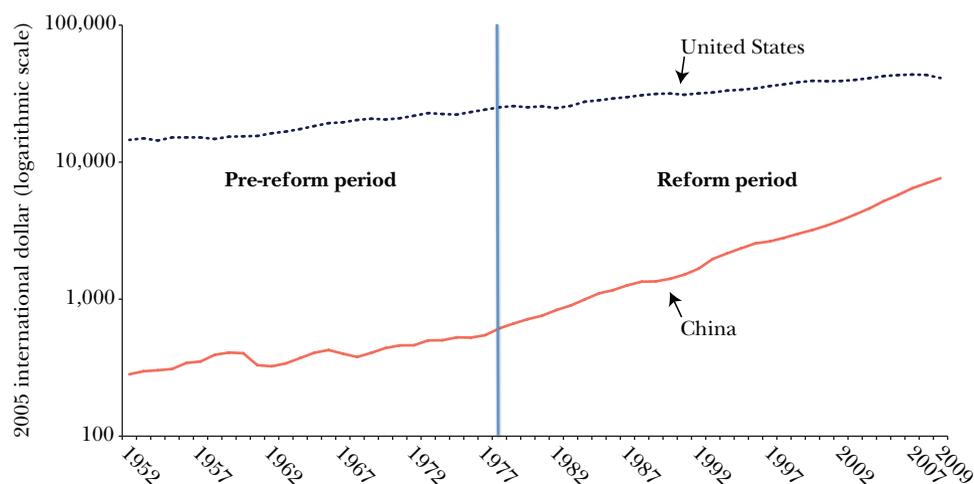


Source: Madison (2007).

to fall behind Western Europe *after* the Industrial Revolution in England. Shiue and Keller (2007) provide evidence that in the late eighteenth century, the degree of market integration was higher in the Lower Yangzi region than in continental Europe and only slightly lower than that in England. Instead of asking what went wrong in China, Pomeranz attributes the success of the Industrial Revolution to two lucky breaks for England: accesses to coal and colonies.

The questions of why China was not able to maintain its technological lead and the exact time when China started to fall behind Western Europe remain unresolved. There is no doubt, however, about the great divergence in economic performance between China and Western Europe in the nineteenth century and the first half of the twentieth century. Brandt, Ma, and Rawski (2012) review the debates over possible causes and the related literature. They argue that China's economic failure during this time period was due to an imperial political-institutional system that protected vested interests of elite groups—like imperial households, members of bureaucracy, and local gentry—who in turn were resistant to adoptions of new technologies. This imperial system was significantly weakened and eventually collapsed after two Opium Wars between China and Great Britain in the 1840s and 1850s and the Sino-Japanese War of 1894–95. The series of Chinese defeats was in effect a forced opening of China's borders, and it led to territories and treaty ports being conceded to the West and to Japan. These changes brought to China industrial technologies and factories, but continuous civil wars and World War II prevented the industrialization process from gaining much momentum in China until the 1950s. Indeed, industrialization had so little effect during this time that China's per capita GDP *declined* between 1800 and 1950.

Figure 2
GDP per capita of China and US: 1952–2009



A Growth Accounting Decomposition for Modern China

After the establishment of the People's Republic in October 1949, China finally started its industrialization process in the early 1950s. However, growth performance before and after 1978 differs significantly. Prior to 1978, the average growth rate of real per capita GDP was a modest 3 percent a year, not much different from the growth rate in the United States though starting from a much lower base. Since 1978, China's growth in per capita GDP has accelerated to a rate in excess of 8 percent per year, and Figure 2 shows (on a log scale) how China's per capita GDP has begun to close the gap with U.S. per capita GDP.

Why did China's growth performance differ so much before and after 1978? To answer this question, I begin in this section by using the standard growth accounting method to take a look at the sources of China's growth in both periods, which shows that capital accumulation was the main source of economic growth in the 1952–1978 period while productivity growth has been the main source of growth since then. In the next two sections, I offer more details on these two periods, including why the capital-investment-led growth of the 1952–1978 period was unsustainable and came at such a high cost to the country, and what has been underlying the rapid productivity growth since 1978.

Let the relationship between production inputs (physical capital, human capital, and labor) and GDP be represented by a standard Cobb–Douglas production function:

$$Y = AK^\alpha (hL)^{1-\alpha}.$$

Here Y is GDP, K is physical capital stock, L is labor (number of workers), h is the average level of human capital, A is total factor productivity (TFP), and α is the output elasticity of physical capital, which is usually measured by capital's share of national income. Hall and Jones (1999) show how to use this framework to calculate per capita GDP,¹ while Kehoe and Prescott (2002) note that in this framework the growth rate of per capita GDP can be decomposed as the sum of four terms:

$$\begin{aligned} \text{Growth rate of per capita GDP} &= \text{growth rate of labor participation rate} \\ &+ \alpha / (1 - \alpha) \text{ growth rate of the capital/output ratio} \\ &+ \text{growth rate of average human capital} \\ &+ 1 / (1 - \alpha) \text{ growth rate of total factor productivity.} \end{aligned}$$

Note that in this decomposition the contribution of total factor productivity growth is weighted by $1 / (1 - \alpha)$, taking into account both the direct contribution of total factor productivity and the indirect contribution through its impact on capital accumulation.

For Table 1, I will set the value of α to $1/2$ (as in Brandt, Hsieh, and Zhu 2008) to match China's average capital income share as reported in China's national accounts. With this assumption in place, Table 1 presents a decomposition of China's per capita GDP growth into contributions from growth of the labor participation rate, the capital/output ratio, average human capital, and total factor productivity.²

This decomposition reveals very different patterns of growth in the two periods. In the pre-1978 period, growth was mainly coming from increases in both physical and human capital rather than increases in productive efficiency. Total factor productivity actually deteriorated during this period, declining by 1.07 percent per year. Due to the increases in average schooling years, average human capital grew at 1.55 percent a year, partially offsetting the reduction in total factor productivity.

¹ Specifically, Hall and Jones (1999) show that in this Cobb–Douglas framework one can express the GDP per capita in the following way:

$$\frac{Y}{Pop} = \frac{L}{Pop} \left(\frac{K}{Y} \right)^{\frac{\alpha}{1-\alpha}} h A^{\frac{1}{1-\alpha}}.$$

In this formulation, Pop is the population. GDP per capita can thus be calculated as the product of four terms: the labor participation rate, the capital/output ratio raised to the power of $\alpha / (1 - \alpha)$, the average level of human capital, and total factor productivity raised to the power of $1 / (1 - \alpha)$. The other variables are defined in the text.

² The data on GDP per capita, GDP per worker, and labor participation rate are taken from the Penn World Table (PWT7.0). The Penn World Table contains two versions of data for China. I use version 1 because it is more consistent with the series we constructed for Brandt and Zhu (2010) using China's national accounts data, with adjustments made to deflators in a way that is similar to what Alwyn Young (2003) did for the data over a shorter period of time. The physical capital stock data are constructed using the real investment data from the PWT7.0 and the perpetual inventory method with a depreciation rate of 0.06. The initial capital stock in 1952 was set to $I_{52} / (0.06 + \ln(I_{57} / I_{52}) / 5)$, where I_t is the real investment in year t . The average level of human capital is constructed using the average schooling years reported in the Barro and Lee (2010) dataset and the method of Hall and Jones (1999).

Table 1
Decomposing China's Growth: 1952–2007

<i>Average annual growth rates (%)</i>					
<i>Period</i>	<i>GDP per capita</i>	<i>Labor participation rate</i>	<i>Capital/output ratio</i>	<i>Average human capital</i>	<i>TFP</i>
1952–1978	2.97	0.11	3.45	1.55	–1.07
1978–2007	8.12	0.57	0.04	1.18	3.16
<i>Contributions to per capita GDP growth</i>					
<i>Period</i>	<i>GDP per capita</i>	<i>Labor participation rate</i>	<i>Capital/output ratio</i>	<i>Average human capital</i>	<i>TFP</i>
1952–1978	100	3.63	116.15	52.25	–72.03
1978–2007	100	7.05	0.51	14.55	77.89

Source: Authors calculations. The data on GDP per capita, GDP per worker, and labor participation rate are taken from the Penn World Table (PWT7.0). The average level of human capital is constructed using the average schooling years reported in the Barro and Lee (2010) dataset. See footnote 2 for details.

Notes: Table 1 presents a decomposition of China's per capita GDP growth into contributions from growth of labor participation rate, capital/output ratio, average human capital, and total factor productivity. "TFP" is total factor productivity. See text for details.

The labor participation rate increased slightly, growing at 0.11 percent a year. The most important source of growth was increases in the physical capital/output ratio, which on average grew 3.45 percentage points a year and accounted for 116 percent of the per capita GDP growth.

After 1978, capital accumulation and total factor productivity growth reversed their roles. Between 1978 and 2007, the physical capital/output ratio remained roughly constant and the average human capital growth rate was lower than the growth rate in the pre-1978 period. The two sources combined contributed to around 15 percent of the growth in per capita GDP. Demographic factors played a very limited role. Partly due to the one child policy, the labor participation rate grew at 0.57 percent a year during this period, faster than in the pre-1978 period. But the contribution of the increases in labor participation rate was still modest, accounting for only about 7 percent of the growth. In contrast, total factor productivity grew rapidly at 3.16 percent a year. (Bosworth and Collins, 2008, in this journal, and Perkins and Rawski, 2008, report similar results in their growth accounting exercises.) Since the contribution of total factor productivity growth is weighted by $1/(1-\alpha)$ and α is 0.5, the growth contribution of total factor productivity growth is $2 \times 3.16 = 6.32$ percentage points, or 78 percent of the growth in GDP per capita.

The finding that aggregate productivity growth has been the most important source of China's growth since 1978 may seem surprising because it runs in the face of a popular view that China has followed an *investment-driven* growth model that relied heavily on capital-deepening for growth over the last three decades (for

example, Wolf 2011). But, although the share of annual GDP that flows to real fixed capital investment in China increased from 33 percent to 39 percent between 1978 and 2007, China's capital-to-output ratio barely increased during this time. China's capital investment since 1978 has been keeping up with its rapid rate of output growth but not leading it. Examining the data between 1978 and 1998, Young (2003) also comes to the conclusion that capital deepening was *not* the source of China's growth. As Solow (1956) taught us: persistent economic growth can only come from growth in total factor productivity. More than three decades of rapid economic growth in China would not have been possible without significant growth in aggregate total factor productivity.

Government-led Industrialization between 1952 and 1978

After the People's Republic of China was established in 1949, the Chinese Communist Party government, like governments of many other countries at the time, thought the most effective way to speed up the industrialization process was by increasing investment in heavy industries such as steel, concrete, and heavy machinery. China's government mobilized the resources for investment by limiting household consumption and setting low prices for agricultural goods so that forced savings and surpluses extracted from the agricultural sector could be used for investment in such industries.

This strategy of extensive growth based so heavily on capital accumulation was not sustainable and had grave welfare consequences. The big push towards industrialization during the Great Leap Forward years (1958–1960) not only failed to raise the GDP growth rate, it also had such disruptive effects on agricultural production that a severe famine occurred when China was hit by adverse weather shocks in 1959 (Li and Yang 2005). The Great Leap Forward became the Great Leap Famine of 1959–1961, when the official statistics admit to 15 million deaths and unofficial estimates suggest double that number or more.

Despite these disastrous results, the Chinese government continued its unbalanced growth strategy with only minor adjustments after the famine. Unfavorable terms of trade were set on farm products, which effectively imposed heavy taxes on farmers. The *hukou* or household registration system was implemented to keep heavily taxed farmers from leaving rural areas. Furthermore, farmers were prohibited from engaging in any nonfarm activities. These policies initially helped to ensure that the government could extract surpluses from the agricultural sector to support the capital accumulation in the industrial sector. However, they also created incentive problems that significantly reduced the productivity of farmers. As a result, agricultural output grew slowly. In the late 1970s, the agricultural sector included more than 70 percent of China's labor force but was not even able to provide China's population with 2,300 calories per capita per day (near the UN-established minimum). Emergency grain imports were frequently needed to meet food deficits (Huang, Otsuka, and Rozelle 2008). China's nonagricultural sector was little better. It was dominated by the state-owned enterprises in which resource allocation and production activities

were carried out according to government plan rather than market signals. Most of the state-owned enterprises at that time were inefficient, overflowing with redundant workers, and often producing output for which there was no market demand. At the same time, there were very few firms in the light industries like home appliances, furniture, and clothing, and there were constant shortages of consumer products.

Given this background, it may seem paradoxical that China's economy managed an average per capita GDP growth rate of even 3 percent from 1952 to 1978. The main reason for such a gain, as earlier emphasized earlier in Table 1, was the increases in physical and human capital, both of which were at very low levels in 1952. The capital/output ratio rose by about 140 percent during this time, from 0.91 in 1952 to 2.22 in 1978. In addition, average years of education rose from 0.74 in 1952 to 3.75 in 1978. Even with the substantial decline in aggregate productivity, these factors were sufficient to increase China's per capita GDP over this time.

In summary, the industrialization policies pursued by the Chinese government during this period from 1952 to 1978 created adverse incentives and gross misallocation of resources that resulted in declining aggregate productivity, recurring food crises, and relatively little improvement in living standards.

Sectoral Shifts and Productivity Growth Since 1978

When the Cultural Revolution ended after the death of the Communist Party chairman Mao Zedong in 1976, the Chinese government under the leadership of Deng Xiaoping sought to increase its legitimacy by improving aggregate economic performance and raising living standards. In December 1978, the government decided on a general policy of *Gaige Kaifang* or "reform and opening up." Xu (2011) reviews the institutional changes during the reform period in China. There was no grand design of systematic reform policies; instead, economic reforms have taken place in a gradual, experimental, and decentralized fashion. How did the reforms generate such impressive growth? Is the growth sustainable? As a starting point to answering this question, in this section, I look at productivity growth in different sectors and the reallocation of labor across sectors. In the following two sections, I then discuss the key economic reforms and institutional changes that were behind the sector-level productivity growth in agriculture and in the nonstate sector.

Table 2 presents total factor productivity growth rates of the aggregate economy, the agricultural sector, and the nonagricultural sector. Because of the importance of the state sector in the Chinese economy, the nonagricultural sector is divided into the state and the nonstate sectors. The "state sector" includes both state-owned enterprises and shareholding companies; and the "nonstate sector" includes domestic private firms, foreign-invested firms,³ and collective

³ In China, "foreign-invested" firm is a term used for any one of a number of legal entities with foreign stakeholders, including equity joint ventures, cooperative joint ventures, wholly-owned foreign enterprises, and foreign-invested companies limited by shares.

Table 2
Employment Share, GDP Share, and Total Factor Productivity Growth by Sector

<i>Average annual total factor productivity growth (%)</i>				
<i>Period</i>	<i>Nonagricultural sector</i>			<i>Aggregate</i>
	<i>Agriculture</i>	<i>Nonstate</i>	<i>State</i>	
1978–2007	4.01	3.91	1.68	3.61
1978–1988	2.79	5.87	–0.36	3.83
1988–1998	5.10	2.17	0.27	2.45
1998–2007	4.13	3.67	5.50	4.68
<i>Year</i>	<i>Employment share (%)</i>			
1978	69	15	16	100
2007	26	62	12	100
<i>Year</i>	<i>GDP share (%)</i>			
1978	28	27	45	100
2007	10	70	20	100

Source: Brandt and Zhu (2010).

Notes: Table 2 presents total factor productivity (TFP) growth rates of the aggregate economy, the agricultural sector, and the nonagricultural sector, with the nonagricultural sector divided into state and the nonstate sectors. See text for details on the categorization of firms and enterprises into sectors. Because the TFP growth rates reported in this table are based on China's national accounts data that use domestic prices, they are different from the TFP growth rates reported in Table 1, which are calculated from the Penn World Table data that use international prices.

firms in the nonagricultural sector. We include the shareholding companies in the state sector because many of them are former state-owned enterprises that were restructured into shareholding companies after the mid-1990s but are still controlled by the state. They continue to receive favorable treatment by the state, have easy access to bank credit, and are concentrated in protected industries such as energy and telecommunication. In contrast, the collective firms, including those that are controlled by lower-level governments, receive little support from the state and, like domestic private firms, have difficulties getting bank credit and entering into protected industries. Thus, we include them in the nonstate sector.

The growth rates are reported for the entire period of 1978–2007 and three subperiods. The productivity growth rates are calculated using China's official national accounts data on nominal output and fixed investment, the revised GDP and fixed investment deflators, the revised employment series that is consistent with

China's census data, and the schooling year data of Barro and Lee (2010). In Brandt and Zhu (2010), we offer details on the construction of the data series.⁴

Total factor productivity grew rapidly in both the agricultural and the nonstate sectors. For the overall period from 1978 to 2007, the average annual growth rates of total factor productivity in these two sectors is 4.01 and 3.91 percent, respectively. In contrast, the average growth rate of total factor productivity in the state sector is only 1.68 percent per year. Prior to 1998, in particular, the state sector had very low productivity growth rates. After 1998, though, total factor productivity in the state sector grew rapidly, averaging 5.5 percent annually.

The similarity of productivity growth rates in agriculture and in the nonstate sector are associated with very different movements of these two sectors' employment shares. As reported in Table 2, agriculture's share of total employment declined from 69 percent in 1978 to 26 percent in 2007. The high rate of productivity growth in agriculture helped to push workers away from jobs in agriculture. Conversely, the nonstate sector's share of employment increased from 15 percent in 1978 to 62 percent by 2007. The extraordinary increase in the number of workers in this sector was not sufficient to drive down their productivity. Instead, the growth of the nonstate sector represents the productivity benefits of a sectoral shift away from the agricultural sector to a sector of the economy that could absorb this labor and still generate rapid productivity growth.

The state sector's share of total employment remained remarkably constant at around 16–17 percent of the total labor force from 1978 until 1997. The restructuring of state enterprises circa 1998 led both to a rise in the rate of productivity growth for this sector and also to a decline in its share of China's labor to 12 percent in 2001—a level where it has remained since.

In the next section, I'll discuss the transformation in agriculture in more depth. In the following section, I'll delve more deeply into productivity growth for the nonstate and state producers in the nonagricultural sector.

Productivity Growth in Agriculture and Structural Transformation

Since China had experienced recurring food crises before 1978, it is not surprising that its economic reform started in the agricultural sector. There were two important reforms. First, the government increased prices for agricultural goods. Second, the previous "collective farming system" was shifted to the "household-responsibility system." Under the new system, each farm household was assigned a fixed quota of grains that the household had to sell to the government at

⁴ Because the national accounts use domestic prices rather than international prices, these growth rates are not the same as the growth rates calculated from the Penn World Tables. However, the differences are small. For the entire period of 1978–2007, the annual growth rates of GDP per worker and total factor productivity calculated using the Penn World Tables are 7.55 and 3.16 percent, respectively. The corresponding growth rates calculated using China's national accounts data are 7.58 and 3.61 percent.

official prices. However, any extra grain the household produced could be sold at market prices. The reforms were implemented gradually and completed in 1984. Between 1978 and 1984, total factor productivity in the agricultural sector grew 5.62 percent per year. Several studies argue that most of the productivity growth during this period can be attributed to the price and institutional reforms that generated strong positive incentive effects on farmers' efforts and input choices (for example, McMillan, Walley, and Zhu 1989; Lin 1992).

As a result of the productivity growth, China's agricultural output increased by 47 percent during this period. The increase in food availability alleviated China's subsistence food constraint and started a structural transformation that reallocated a large amount of labor from agriculture to industry. From 1978 to 1984, agriculture's share of total employment fell from 69 percent to 50 percent: that is, in just six years, 19 percent of China's labor force—more than 49 million workers—reallocated out of the agricultural sector. Most of the 49 million reallocated workers did not move to urban centers. Instead, they went to work in the rural industrial enterprises set up by township and village-level governments that are called "township and village enterprises" (TVEs).

For the first few years, the price and institutional reforms increased agricultural output mainly by improving incentives without much change in the production technologies being used. However, by about 1984 these static efficiency gains, from workers using the same technology with a much more rewarding set of incentives, were largely exhausted. Both agricultural productivity and structural transformation stagnated in the second half of the 1980s. Starting around 1990, markets for agricultural inputs and outputs were gradually liberalized and government interventions were significantly reduced. Huang, Otsuka, and Rozelle (2008) document extensive market liberalization in China's agricultural sector and state: "aside from restrictions on land ownership, China today may have one of the least distorted domestic agricultural economies in the World." As this market liberalization provided farmers with strong incentives to adopt new technologies, the average annual growth rate of total factor productivity in agriculture reached 5.10 percent between 1988 and 1998, and remained at 4.13 percent between 1998 and 2007. Most of agriculture's growth in total factor productivity after 1990 came from technological progress (Jin, Ma, Huang, Hu, and Rozelle 2010). Structural transformation also resumed after 1990. By 2007, agriculture's share of total employment had been reduced from 46 percent in 1991 to 26 percent in 2007.

How did productivity growth in agriculture contribute to the overall economic growth in China? Since T. W. Schultz (1953)'s pioneering work, economists have long emphasized the role of agriculture in economic development.⁵ The standard argument is that productivity growth in agriculture not only contributes to aggregate productivity growth directly, but also indirectly through structural transformation. When agricultural productivity increases, food demand can be met with a smaller

⁵ See, for example, Johnston and Mellor (1961), Jorgenson (1961), Schultz (1964), and Timmer (1988). See also Gollin, Parente, and Rogerson (2002), Restuccia, Yang, and Zhu (2008), and Yang and Zhu (2010) for some recent analyses.

number of workers in the agricultural sector than before. As a result, some workers can be reallocated to the nonagricultural sector. Because average labor productivity is generally higher in the nonagricultural sector than in the agricultural sector, the reallocation of workers from agriculture contributes positively to aggregate productivity growth. Indeed, in 1978, the average labor productivity in China's nonagricultural sector was six times as high as in the agricultural sector, and therefore one would expect a significant contribution from the labor reallocation. For this reason, Young (2003) suggests that the reforms in the agricultural sector may have been the most important source of China's growth during the first two decades of economic reform.

In Brandt and Zhu (2010), my coauthor and I use a multisector model to quantify this contribution during the period of 1978–2007. We find that, out of the 43 percentage points of the reduction in agriculture's share of employment between 1978 and 2007, total factor productivity growth in agriculture accounts for 39 percentage points or 91 percent of the total reduction. Taking both the direct and indirect effects into account, we find that the contribution of total factor productivity growth in agriculture to aggregate productivity growth is 1.5 percentage points a year for the entire period of 1978 and 2007. However, we also find that the role of agriculture's productivity growth diminishes over time, from a contribution of 2.1 percentage points per year between 1978 and 1988, to a contribution of only 0.6 percentage points per year for the period between 1998 and 2007. There are two reasons for the decline. First, as the economy grew, agriculture's share of value-added decreased, and therefore its direct contribution also diminished. Second, the marginal contribution of reallocation is a decreasing function of the agricultural productivity level. After 20 years of productivity growth, the gain from reallocation naturally declined in the later years. As agriculture's share of employment and value-added continue to decline, the contribution of productivity growth in agriculture to aggregate productivity growth will be even smaller in the future.

Growth outside Agriculture: A Tale of Two Sectors

Before economic reform started in 1978, resource allocation was centrally determined by the government's plan rather than by the market. The state sector dominated nonagricultural activity, accounting for 80 percent of the total urban employment and more than three-quarters of industrial output. The nonstate sector at that time mainly consisted of collective firms. Urban collectives were confined to producing a small number of consumer goods and providing neighborhood services. Rural collectives were only allowed to manufacture producer goods for the agricultural sector.

1978–1988: Rise of the Nonstate Sector

In the early 1980s, encouraged by the success of the rural reforms, the Chinese government started two market reforms in the nonagricultural sector. First, a dual-track system was introduced. State-owned enterprises were still given quotas

on both production inputs and output that transacted at official prices, but they were also allowed to buy inputs and sell output beyond quotas at market prices. Moreover, the non-state-owned enterprises, including collectives (as we discussed earlier), small-scale individual businesses, and foreign-invested firms in the special economic zones, were allowed to enter previously forbidden industries, buying and selling their inputs and outputs at market prices. Second, the central government also devolved economic decision-making powers to lower-level governments and provided them with fiscal incentives. Starting in 1980, a “fiscal contracting system” was implemented that effectively made local governments the “residual claimants” of the enterprises under their control (Qian 1999). As a result, provincial-, city-, and county-level governments controlled most of the state-owned enterprises while the township- and village-level governments controlled the group of rural collective enterprises that became known as the “township and village enterprises.”

Under these reforms, the township and village enterprises based on the old rural collectives flourished and led the way to an expansion of the nonstate sector, while the state-owned enterprises did not. The number of township and village enterprises increased from 1,520,000 in 1978 to 18,880,000 in 1988 (National Bureau of Statistics of China 1999). The success of the agricultural reforms made available to these enterprises a large number of local workers, and the dual-track system allowed them to gain access to capital and raw materials from the markets. Between 1978 and 1988, the share of total employment in nonstate enterprises increased from 15 percent to 39 percent. The expansion of employment in the nonstate sector was also accompanied by total factor productivity growth averaging 5.87 percent a year during this period.

The reforms did less for state-owned enterprises. Local governments at county level and above sought to improve the economic performance of the state-owned enterprises under their control by implementing a “managerial responsibility system” that linked managers and workers’ income to financial outcomes of the enterprises. The reforms did have some positive effect on productivity. Using a panel data set of 272 industrial state-owned enterprises collected by the Chinese Academy of Social Sciences, Li (1997) estimates that their total factor productivity on average grew at 4.68 percent per year between 1980 and 1989, and that most of the productivity growth could be attributed to stronger incentives, increased market competition, and better allocation of production inputs. Using the same data set, Groves, Naughton, Hong, and McMillan (1994) also report positive incentive effects of the managerial responsibility system on productivity.

While enterprise reforms made industrial state-owned enterprises more efficient, their productivity growth was slower than that of the nonstate enterprises and not fast enough to offset the rising real cost of material inputs. Using more aggregate data on industrial enterprises reported by China’s National Statistical Bureau, Jefferson, Rawski, and Zheng (1996) estimate that between 1980 and 1988, the average annual growth rate of total factor productivity was 2.96 percent for state-owned enterprises and 3.66 percent for the nonstate collective enterprises. However, these estimated rates of productivity growth are based on a production function that uses gross output rather than value-added. If the costs of real material

inputs are rising, using gross output rather than value-added may be misleading.⁶ In the pre-reform period, prices of material inputs were kept artificially low, and so during the reform period, market prices of material inputs rose significantly faster than output prices. Using the information reported in Jefferson, Rawski, and Zheng, I calculated the growth of total factor productivity for the state and collective industrial enterprises between 1980 and 1988 using value-added, rather than gross output. By this metric, the state-owned firms had annual productivity growth of -1.33 percent, while the nonstate collective enterprises had a growth rate of positive 3.11 percent per year. (There has been no comparable study for the specific state and nonstate enterprises in services because data for such a study are not available.)

In short, the basic lesson is that productivity growth of the nonagricultural sector during this period was mainly due to the rise of the nonstate sector. As Table 2 showed earlier for the 1978–1988 period, the state sector had an average annual growth rate of total factor productivity during this time of -0.36 percent, while the nonstate sectors had annual productivity growth of 5.87 percent.

1988–1998: From Reform without Losers to Inevitable Tradeoffs

The drastic difference in economic performances between the township and village enterprises and the state-owned enterprises may seem implausible; after all, both are enterprises under the control of local governments, albeit at different levels. One reason for the difference is that state-owned enterprises remained under the constraints of government planning for a longer time, unable to sell their products at market prices, although these restrictions diminished over time (Naughton 1995).

But the more important difference is the commitment made by the central government to support employment in the state sector. Remember that employment in the state-owned sector remained essentially constant at about 16 percent of the workforce from 1978 up through 1997. This stability reflected the central government strategy of letting the nonstate sector grow without downsizing the state sector. The strategy had the political benefit of minimizing social instability and reducing resistance to reform. Lau, Qian, and Roland (2000) call it “reform without losers.” To avoid laying off workers or shutting down factories, the government usually asked the state-owned banks to bail out loss-making state-owned enterprises. The possibility of bailout created a “soft budget constraint,” to use a term common in the literature on centrally planned economies, that further reduced the economic incentives of the state-owned enterprises (Kornai 1980; Qian and Roland 1998; Brandt and Zhu 2001). The lack of exit also eliminated market selection as an important mechanism for improving aggregate productivity in the state sector. In contrast, the central government had no commitment to support employment in the township and village enterprises. While the local governments that ran the township and village enterprises did have political incentives to minimize unemployment and maintain social stability in their communities, these local governments had only weak influence on

⁶ Specifically, let s_m be the share of material inputs in gross output, then $\Delta \ln(TFP_{\text{value-added}}) = [\Delta \ln(TFP_{\text{gross output}}) - s_m \Delta \ln(\text{real material input cost})] / (1 - s_m)$.

banks. For example, millions of township and village enterprises went bankrupt when there was a general tightening of credit in 1989 (Qian and Xu 1993). Thus, township and village enterprises faced a much tighter budget constraint and stronger market discipline than did the state-owned enterprises.

Unsurprisingly, at least to economists, a “reform without losers” strategy still poses tradeoffs. In the absence of hard budget constraints and market discipline, the state-owned enterprises continued to be outperformed by the nonstate sector. Between 1988 and 1998, the average annual growth rate of total factor productivity in the state sector was only 0.27 percent, while the comparable growth rate of the nonstate sector was 2.17 percent (as shown earlier in Table 2). Faced with increasing competition from the more efficient nonstate firms and without significant productivity growth, the financial condition of the state-owned firms deteriorated. The resources needed to support the state-owned enterprises increased steadily between 1986 and 1993. Nonperforming loans in the state banking system increased rapidly, and the creation of money to make these loans was leading to chronic high inflation (Brandt and Zhu 2000).

By 1994, it had become clear that the strategy of “reform without losers” could no longer be sustained. In 1995, the Chinese government reduced its commitment to stable employment in the state sector. Many small-scale state-owned enterprises were allowed to go bankrupt or be privatized through management buyouts. Between 1995 and 2001, the state sector’s share of total employment declined from 17 percent to 12 percent.⁷ More diversified ownership forms were also introduced within the state sector. Some of the large-scale state-owned enterprises were converted into shareholding companies, with a majority of shares controlled by the state.

1998–2007: Privatization and Trade Liberalization

The 15th Congress of the Chinese Communist Party held in 1997 was a milestone in China’s economic policies. The Congress formally sanctioned ownership reforms of the state-owned firms and also legalized the development of private enterprises. With the reduction of legal barriers, private enterprises grew rapidly. Collective enterprises such as township and village enterprises lost their edge, some were closed and many of them were privatized, also in the form of management buyouts. As part of the lead-up to China’s joining the World Trade Organization in 2001, China’s government also started to cut tariffs, broadened trade rights, and liberalized its regime for foreign direct investment (Branstetter and Lardy 2008). Between 1998 and 2007, the share of total urban employment in domestic private enterprises and foreign-invested enterprises increased from 8 to 24 percent. The increase in the manufacturing sector was even more pronounced. By 2007, domestic private enterprises alone accounted for 51 percent of total urban employment in the manufacturing sector (National Bureau of Statistics of China, 2008, tables 4–2,

⁷ China’s official employment statistics did not record a reduction in the employment of state-owned enterprises until 1998. The state-owned sector actually started to downsize and lay off workers a few years earlier in 1995.

4–6, 4–13). Song, Storesletten, and Ziliboti (2011) present a model that describes the transformation during this period.

The combination of privatization and trade liberalization had strong effects on productivity growth in both the state and nonstate sectors. Between 1998 and 2007, the average annual total factor productivity growth rates of the state and nonstate sectors were 5.50 percent and 3.67 percent, respectively (as shown in Table 2). After stagnating for much of the first two decades of reform, the state sector finally experienced productivity growth in the last decade.

In the manufacturing sector, productivity growth during this period is even higher. Using data of the China Annual Survey of Industries,⁸ Brandt, Van Biesebroeck, and Zhang (2012) estimate that, for the manufacturing sector, the total factor productivity growth rate is 13.4 percent a year. Because even state-owned enterprises were allowed to go bankrupt and exit during this period, reallocation through the process of entry and exit contributed significantly to productivity growth, accounting for 72 percent of the aggregate growth of total factor productivity in the manufacturing sector. Jefferson, Rawski, and Zhang (2008) report similar results. Using the same data, Hsieh and Klenow (2009) examine the contribution of capital and labor reallocation among existing firms to the aggregate total factor productivity growth in the manufacturing sector. They find that between 1998 and 2005, a more efficient allocation within four-digit-level manufacturing industries contributed 2 percentage points per year to aggregate total factor productivity growth in the manufacturing sector, with a significant portion of it coming from the reallocation from state-owned to nonstate enterprises. In short, privatization and trade liberalization reduced barriers to entry and exit, and increased competition, which in turn led to rapid productivity growth in the manufacturing sector by raising within-firm productivity and through reallocation along both the extensive and intensive margins.

However, China's nontradable sectors—primarily construction and services—have faced much less international competition. There have also been significant barriers to entry of private and foreign-invested firms into service industries, and significant barriers to exit of state-owned enterprises in services. In 2007, the state sector still accounted for 77 percent of total urban employment in services, in contrast to 15 percent in manufacturing. It is perhaps not surprising, then, that researchers have found that productivity growth in the nontradable sector lagged behind growth in the tradable sector (for example, He, Zhang, Han, and Wu 2012).

Sources of Aggregate Productivity Growth in China: A Summary

From 1978 to 2007, China's annual growth rate of total factor productivity was 3.61 percent per year. We can summarize the sources of aggregate productivity growth in China during the reform period as follows. In the agricultural sector, productivity

⁸ This firm-level survey has been conducted annually by China's National Bureau of Statistics. It covers all Chinese industrial firms (manufacturing, mining, and construction) with sales over 5 million renminbi yuan.

growth contributed 1.5 percentage points a year to aggregate productivity growth over the 1978–2007 period, both directly and indirectly through structural transformation. However, this source of growth diminished over time as agriculture's share of GDP diminished, and its contribution to China's future growth will be small. In the nonstate sector, productivity growth contributed 2.27 percentage points per year to aggregate productivity growth over the 1978–2007 period.⁹ This source of growth will continue to drive China's future growth as the nonstate sector's share of total nonagricultural employment has risen from 48 percent in 1978 to 84 percent in 2007 (more than 60 percent of total employment). Productivity stagnated in the state sector until the late 1990s, and for the 1978–2007 period as a whole this sector contributed essentially zero to aggregate growth in total factor productivity. However, since 1998, the state sector also experienced rapid productivity growth as a result of restructuring.

The proximate sources of productivity growth have shifted over time. For example, productivity growth in agriculture under the dual-track system led the way from 1978 up to about 1984; starting in the mid-1980s, the nonstate sector in the form of township and village enterprises under its own dual-track system led the way through much of the 1980s and 1990s; and from the late 1990s and into the 2000s, the nonstate sector in the form of privately-owned firms and a restructured state-owned sector led the way in an economic climate much friendlier to the private sector and with lots of entry, exit, and competitive pressures. Whenever the effect of one set of reforms on productivity seemed to be exhausted, the Chinese government found a way to initiate new reforms that reignite growth.

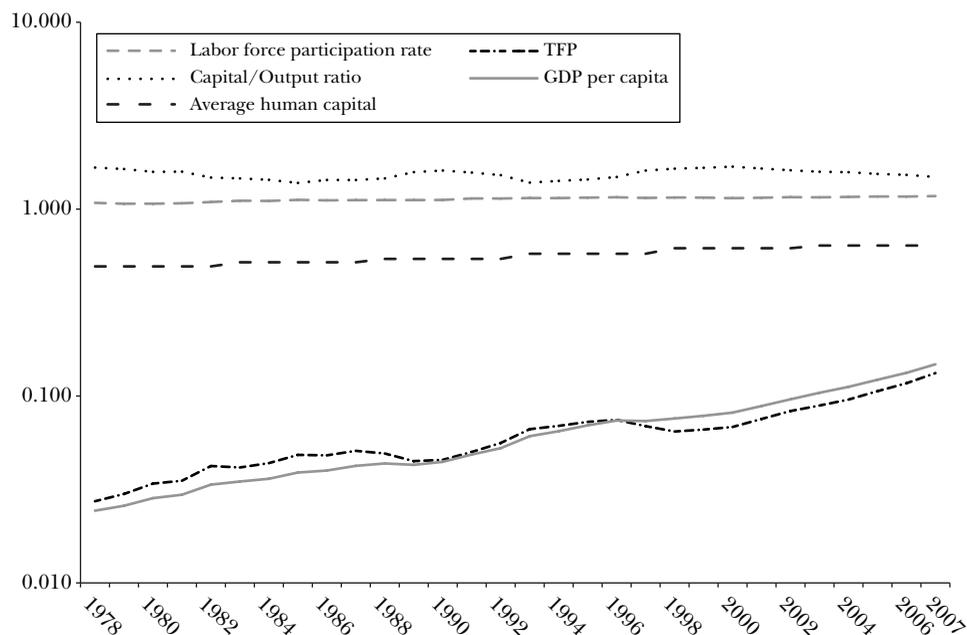
The Future of China's Economic Growth

Experiences from other economies, especially the East Asian economies such as Japan, Korea, and Taiwan, suggest that periods of extremely rapid growth eventually slow down and China's more than 8 percent a year per capita GDP growth rate will not last. China's per capita GDP is now around 20 percent of the U.S. level. Will China's per capita GDP level out at 40 percent of the U.S. level, or 80 percent, or 120 percent? Of course, any answer to this question will contain a large dose of speculation. But I will attempt to address this question by discussing what would be the key sources of China's growth in the future based on what we know about the sources of China's growth in the last three decades.

Following the earlier decomposition of the sources of economic growth, we can decompose China's GDP per capita relative to that of the United States into

⁹ In Brandt and Zhu (2010), we estimate that, if there were no total factor productivity growth in the nonstate sector, the productivity growth rate for the nonagricultural sector would have been close to zero for the entire period between 1978 and 2007 and during each of the three sub-periods. I should also note that productivity growth in different sectors may interact so that one cannot infer the contribution of productivity growth in the state sector by simply subtracting the contributions of agriculture and nonstate sector from the aggregate productivity growth.

Figure 3

China Relative to the United States

Note: "TFP" is total factor productivity.

four ingredients: relative labor participation rate, relative average human capital, relative capital/output ratio, and relative total factor productivity.¹⁰ Figure 3 plots these ratios for the period between 1978 and 2007. China's labor force participation and capital/output ratios are above U.S. levels, while China's relative level of human capital has risen somewhat over time (notice that Figure 3 is on a log scale). But clearly, the growth of China's relative GDP per capita is mainly driven by the growth of China's relative total factor productivity. To answer the question about China's future growth, then, one has to assess the future of China's relative productivity growth.

Although economic reforms have been crucial in generating productivity growth in China over the last three decades, many other economies in Eastern Europe and Latin America also had economic reforms, but their growth performances are nowhere near the performance achieved by China. What is special about China? One potential explanation is simply China's backwardness at the start of economic reform in 1978, which increased China's potential for catch-up growth.

¹⁰ To be precise, the last two ratios should be the relative capital/output ratio raised to the power of $\alpha/(1-\alpha)$, and relative total factor productivity raised to the power of $1/(1-\alpha)$. For simplicity, however, I will simply refer them as "relative capital/output ratio" and "relative total factor productivity."

When China started economic reform in 1978, its aggregate total factor productivity was less than 3 percent of the U.S. level, much lower than Mexico and the economies in Eastern Europe and South America. Because China was far away from the frontier, the impact of reforms in closing the productivity gap has been particularly large. Parente and Prescott (1994) present a model along these lines, and Kehoe and Ruhl (2010) suggest that this argument may explain why economic reforms have produced rapid growth in China, but less growth in Mexico.

Has China's productivity gap now been narrowed enough so that China will find it difficult to generate further productivity growth? Compare China's growth experience with three other East Asian economies that also had rapid and sustained reductions in their productivity gaps with the U.S. economy but eventually experienced significant slowdown in relative productivity growth: Japan, Korea, and Taiwan. In 1950, Japan's total factor productivity was 56 percent of the U.S. level; by 1975, Japan's was at 83 percent of the U.S. level. But since then, Japan's relative total factor productivity has somewhat fallen back. In 1965, Korea's total factor productivity was 43 percent of the U.S. level; by 1990, it had reached 63 percent of the U.S. level. After 1990, Korea's relative productivity has continued to converge with the U.S. level, but at a much slower rate of about 0.24 percent per year. In 1965, Taiwan's total factor productivity was 50 percent of the U.S. level; by 1990, it had reached 80 percent of that in the United States. Since then, Taiwan's relative total factor productivity has continued to converge, but (like Korea) at a much slower rate.

Back in 1978, China was starting at a far lower level of productivity than these comparison countries: indeed, from 1978 to 2007, after three decades of rapid productivity growth, China's total factor productivity had risen from 3 percent to 13 percent of the U.S. level. Even if China can replicate this extraordinary growth performance for another two decades, its productivity level would still be only 40 percent of the frontier U.S. level—still below the level of Japan in the 1950s or South Korea and Taiwan in the 1960s. In Japan, South Korea, and Taiwan, relative total factor productivity grew rapidly for a sustained period of time and did not slow down until after the relative productivity had reached 60 percent or higher.

China's economy still has large opportunities for raising productivity growth through reducing the still-existing distortions and inefficiencies in its production. For example, Hsieh and Klenow (2009) use firm-level data to estimate within-industry misallocation of capital and labor across existing firms in China's manufacturing industries. They find a reduction in distortions between 1998 and 2005, but they still estimate a potential total factor productivity gain of 30 percent for China's manufacturing sector if the distortions are reduced to the U.S. level. Song and Wu (2011) find a very similar gain using a different dataset and method. In Brandt, Tombe, and Zhu (2012), my coauthors and I take sector-level total factor productivity in each province as given and measure the potential productivity gain from eliminating factor market distortions across provinces and between the state and the nonstate sectors in China. We find the potential total factor productivity gain in China's nonagricultural economy to be

at least 20 percent in our estimates, in which half the gain comes from eliminating cross-province dispersion in returns to labor and the other half comes from eliminating within-province difference in returns to capital between the state and the nonstate sectors.

While these potential efficiency gains are substantial, many obstacles exist that may prevent these gains from being realized. Despite many years of financial sector reforms, China's banking sector is still dominated by the state-controlled banks that lend disproportionately to local government projects and to firms in the state sector. Protected by barriers to entry of private and foreign firms, state-controlled firms continue to enjoy substantial monopoly rights and profits in industries ranging from energy, transportation, and telecommunication to banking, entertainment, education, and health care. Further institutional change and policy reforms will be needed if China is to maintain its productivity growth by reducing these distortions.

In the last three and half decades, China's leaders have chosen to carry out economic reform without political reform or the establishment of rule of law. Instead, they have implemented institutional changes and policy reforms in a piecemeal fashion that usually provided benefits to key interest groups within the state sector. Giving monopoly rights to state-controlled or politically connected firms is one example. While this approach has helped to reduce political resistance to economic reform, it has also resulted in corruption and income inequality in addition to economic distortions. If reducing the state sector's monopoly rights in various industries is important for reducing distortions and solving associated social-political problems of corruption and income inequality, it remains to be seen if China's leadership will be flexible enough and strong enough to do so.

Finally, I conclude by noting that I have only considered the direct contributions of human capital accumulation and demographic factors on GDP growth. It is possible that the increases in average years of education and the decreases in the dependence ratio due to the one-child policy have also reduced the cost of migration, facilitated the reallocation of labor away from agriculture, and therefore contributed positively to aggregate total factor productivity growth. If that is the case, I may have underestimated the growth contribution of the demographic factors and human capital accumulation. However, given that the marginal gains from labor reallocation have been decreasing over time, the contributions of these factors to productivity growth should also decline in the future.

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