Can China's Growth be Sustained?

A Productivity Perspective

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Abstract

China's unorthodox approach to economic transition has implied sustained high growth, rapid structural change, established markets for most commodities, a huge influx of foreign direct investment, and an extraordinary expansion of foreign trade. However, in recent years, Chinese economists have increasingly referred to China's pattern of growth as being of the "extensive" type, generating growth mainly through the expansion of inputs and only marginally through rises in productivity. In our investigation of the accumulation and utilization of productive factors in the Chinese economy during the reform period, we note that China's reform measures have often resulted in one-time level effect on TFP. China now needs to adjust its reform program in order to sustain productivity performance. The establishment of market, ownership reform, foreign direct investment, and trade will only improve the situation under which Chinese firms operate to a certain extent, innovative institutional arrangements may be required to complete China's move to a viable market economy that promotes sustained productivity growth.

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1. Introduction

China has achieved tremendous economic progress in the last three decades. Since the economic reform process started in 1978 Chinese per capita incomes have increased eightfold. The reform strategy pursued by China has been characterized by piecemeal and gradual reforms, which has meant that market still does not permeate the whole economy. Property rights and institutions are far from the ideal textbook model. Key ingredients of the strategy have throughout been like in the East Asian NICs, high saving, export orientation, and education. A controversial aspect of the present strategy is also the attempt to preserve an undervalued currency as an export promotion measure.

While the unorthodox approach to economic transition has been successful in promoting rapid economic growth, in recent years economists are increasingly concerned with the Chinese growth pattern that has turned into an "extensive" type, a term often used to describe the Soviet growth during the Cold War period.[2] Its main characteristic is in generating growth mostly through the expansion of inputs and only marginally through rises in productivity (Ofer, 1987). During the years of late 1970s to early 1990s, once a noteworthy feature of China's growth was its higher dependence on productivity growth and lower dependence on volume increases in capital than other East Asian NICs at a comparable stage of their development. However, starting from the early 1990s, the reverse occurred. Growth in capital inputs exceeded GDP growth, often by a substantial margin, and some recent studies have reported a prolonged slowdown in total factor productivity growth since the early 1990s (e.g., Zheng and Hu 2004, and OECD 2005).

In fact, China's productivity growth in the past especially before the mid-1990s was driven mainly through one-time level effects of the dramatic improvements in policies. China is a fast grower not because its institutions are among the best but because it has improved its institutions so much in the last two decades. If it does not reform further, its per capita income growth might slowdown. Change in policies may only

[2] As a hotly debated public issue, the term, "extensive growth" has been widely used among Chinese economists, appeared in media, and adopted by official documents.

temporarily affect a country's growth rate; in other words, policies affect the level of a country's TFP, not its growth rate (Klenow, 2001).

There are two major aspects of China's recent economic development that have been particularly worrisome. At the macro level the growth has been mainly investment-driven, creating a series of imbalances in the economy.[3] Stabilization measures have to be taken to prevent rapid economic growth from becoming overheated. At the micro level, Chinese firms are troubled with poor financial performance, low efficiency, and lack of technological innovations. There is an expanding literature trying to explain this pattern of development, whether the existing pattern of extensive growth is sustainable, and what China's future development strategy should be. In this paper, we intend to contribute to the literature on the sustainability of China's recent growth pattern through a productivity perspective, which is an issue touched upon in several studies but it has yet to be fully explored.[4]

Although conventional wisdom has emphasized saving and investment as the central issue in the theory of economic development (Lewis, 1954), a growing body of research suggests that, even after physical and human capital accumulation are accounted for, total factor productivity (TFP) accounts for the bulk of cross-country differences in the level and growth rate of GDP per capita (Easterly and Levine, 2001).[5] Several studies have pointed out that differences in physical and intangible capital couldn't account for the large international income differences that characterize the world economy today. Savings rate differences are of limited importance. What is all-important is total factor productivity, and a theory of total factor productivity is needed to understand large international income differences (Prescott, 1998); economists should devote more effort toward modeling and quantifying TFP (Easterly and Levine, 2001), and TFP should be the focus of growth research (Klenow, 2001).[6]

[3] For an up-to-date description of the situation, see Lague and Greenlees (2006), and Bremner (2006). A comment on China's groth pattern can be found in Wu (2005).
[4] For example, Garnaut (2005).
[5] For critics to the traditional development economics, see Stiglitz (2001), Krugman (1999), Lucas (1990), and K.S. and Fine (2006).
[6] There is also another reason that we are interested in linking TFP growth with a currently runaway Chinese economy. TFP is not only important for long run growth, but also for shorter period concerns. Simulation studies of business cycles of industrialized countries as well as

The order of our discussion is as follows. We first characterize China's growth pattern by decomposing growth into factor accumulation and TFP growth and review the literature on Chinese TFP growth. We then examine the process in which productive factors are accumulated, analyze the determinants behind China's high rate of factor accumulation, and assess if productive factors are allocated and utilized efficiently. We then summarize our understanding of the reasons for the decline in total factor productivity growth and comment on policy options that may improve the allocation of productive recourses and the efficiency of factor utilization.

2. China's Growth Pattern

China has experienced three major waves of reform since 1978. The first was the reform of collective farming with the household responsibility system, which resulted in a rapid increase of agricultural output as well as in productivity growth for several years (Wen, 1993).[7] The second wave came in the middle of the 1980s and continued into the early 1990s during which management reforms were gradually introduced into the state owned enterprises to provide managers and workers greater incentives to improve efficiency, while at the same time township-village enterprises flourished and transferred a large number of rural labor force to industries (Goodhart and Xu, 1996). The third wave started in 1992 when Deng Xiaoping made his tour to Southern China. During this phase many state and collective firms were privatized, foreign direct investment poured in, and export growth accelerated. That China's growth rate has fluctuated significantly is shown in Figure 1.

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developing countries indicate that the TFP factor is very important in accounting for business cycle fluctuations and for understanding period of depression and prosperity. Examples are the lost decade of growth for Japan in the 1990s (Hayashi and Prescott, 2002), the great depression of Argentina in the 1980s (Kydland and Zarazaga, 2002), and the economic downturns and booms during the four decades up to 1990s in Ireland (Ahearne, Kydland, and Wynne, 2005). Currently, the consensus among economists is that China's growth will slow, and the most pessimistic prediction is that it could slow to five percent at the bottom of the economic cycle in 2007 (Lague and Greenlees, 2006). If these forecasts become realized, China could be another interesting case for business cycle studies from a productivity perspective. An extreme scenario of possible depression in China is Petrov (2004).

[7] New results at both regional and national levels suggest that factor productivity showed a sharp increase in the early 1980s, entered a period of stagnation or flux in the late 1980s followed by another period of productivity growth and slowdown in the 1990s (Mead, 2003). Fan (2002) found that the official data overstated the impact of rural reforms on both production and productivity, but both production and productivity still grew at respectable rates during the reform period (See also Xu, 1999).

A noteworthy feature of China's growth during 1978-1995 was its reliance on productivity growth (World Bank, 1997). Relative to other rapidly growing Asian economies at a comparable stage of development, China's growth during that period was less dependent on increases in inputs of capital and labor (Figure 1). In most East Asian countries, growth in capital inputs exceeded GDP growth, often by a substantial margin. In China the reverse was the case during this period, suggesting that factors other than capital accumulation were important determinants of GDP growth during the early reform years.

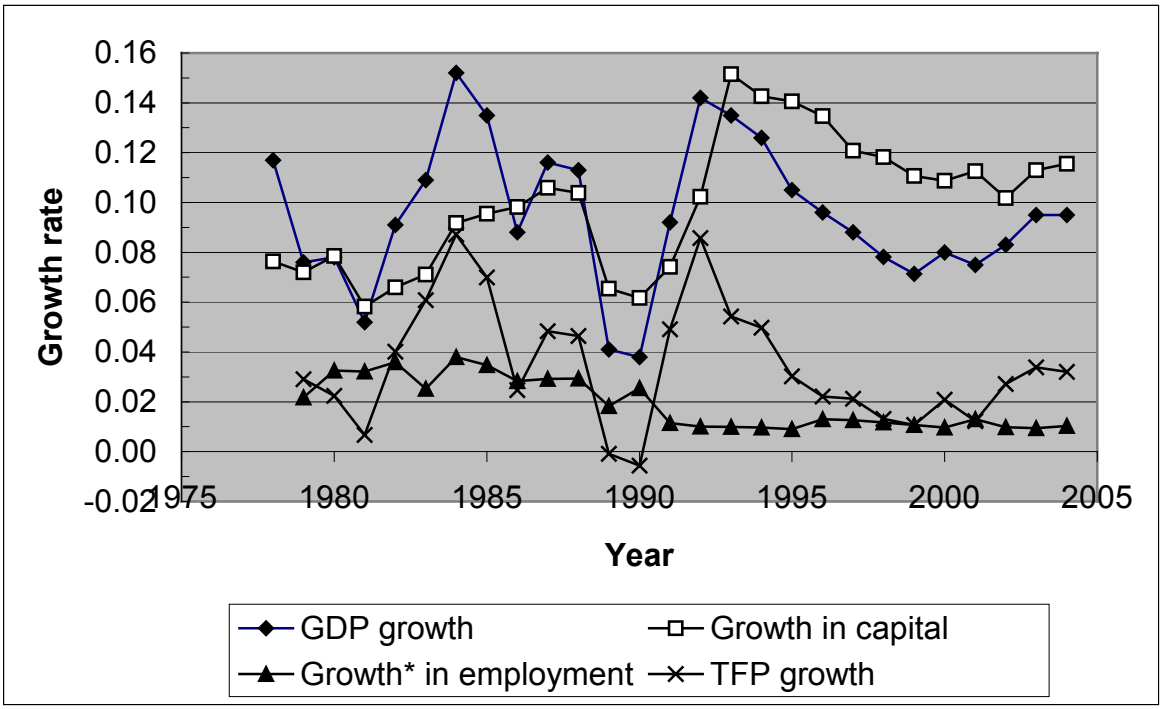

Figure 1 Growth in input, output, and TFP (1978-2004)[8]

Empirical estimates of China's total factor productivity growth differ, but most studies find that improvements in TFP accounted for 30 to 58 percent of the growth during the period of 1978-1995 (World Bank, 1997; Madisson, 1998). Hu and Khan (1997) found that the productivity growth rate of 3.9% explained more than 40% of China's aggregate economic growth during the early reform period. However, Krugman (1994) pointed out that it is difficult to account for China's growth because the quality of the numbers is poor. Also Young (2003) has questioned the Chinese growth performance during the economic reform period by focusing on the productivity performance of the nonagricultural sector. After making adjustments of

[8] See Appendix A for a description of data.

Chinese official data, he found that one can reduce the growth rate during the reform period to levels previously experienced by other rapidly growing economies, so that once one takes account of the rising labor force participation, the transfer of labor out of agriculture, and improvements in educational attainment, labor and total factor productivity growth in the nonagricultural economy are found to be 2.6% and 1.4% per year, respectively.

While the overall conclusion about Chinese productivity performance up to the early 1990s has been positive, reports of productivity slowdown started to emerge around the year 2000. Jefferson et al. (2000) investigated Chinese industrial productivity from 1980 to 1996. They found a long-term productivity increase, but with growth rates declining during the 1990s. Time series estimates of TFP growth by Zhang (2002) for the aggregate economy also showed a downward trend from 1993 to 1998. He also noted that it had become increasingly difficult to maintain the pace of output growth since the mid-1990s for a given increase in the investment rate. In a more recent study, Zheng and Hu (2004) found that TFP growth fell dramatically during 1995-2001, making up only 7.8% of total GDP growth during this period. While TFP was rising by between 3.18 and 4.52 per cent per year before 1995, it rose only between 0.64 and 2.76 per cent a year from then until 2001. Estimates by OECD (2005) indicate that over the 25 years to 2003 the annual growth in TFP averaged 3.7%, it slowed to 2.8% by the end of that period (Economist, 2005). This was due to a declining growth rate in total factor productivity from 1993 to 2003.

Although estimates of China's productivity growth during the reform period differ, several factors behind it can be identified. First, the success of the rural reform from the late 1970s to the early 1980s resulted in a surge in agricultural productivity thanks to the introduction of the household responsibility system and the upward price adjustment for some agricultural products. Second, industrial reforms provided individual firms, managers, and workers with greater incentives to improve efficiency, and especially township-village enterprises (TVEs) achieved higher TFP growth than state firms (e.g., Zheng, Liu, and Bigsten, 1998). Third, rising labor force participation rates, improvement in educational attainment, the transfer of labor out of agriculture, and later the narrowing technology gaps between China and developed economies also contributed to the TFP growth. However, some of these factors only

had a one-time level effect on productivity, so future productivity growth may not be able to match the levels witnessed in the past (Maddison 1998, Liu 2000, Heytens and Zebregs 2003).

If one divides the entire period of 1978-2004 into two sub periods as in Kuijs (2006), the change in growth pattern is clear when examining the aggregate time series. The average growth accounting results for the period 1978-1993 and 1993-2004 are shown in Table 1. We see that growth in capital stock exceeds growth in GDP by a substantial margin of 3 percent in the second period (also seen in Figure 1). The relative contribution of TFP growth to GDP growth declined, and that growth in the second period largely was driven by capital accumulation. Table 2 shows that the capital stock grew at the amazing rate of 12% per year in the second period. This increased the capital-labor ratio very fast, and this in turn led to an increase in labor productivity. The relative modest increase in labor productivity still reflects that the effect of capital deepening was counterbalanced by the slowdown of TFP growth. The variation in the rates of growth of GDP and the relevant ratios is shown in Figure 2.

The explanations of TFP estimates are often controversial, but the slowdown in recent years coincides with sluggish growth in rural area, widespread inefficiency in industries. Human capital, land, and other resources are under-employed, misallocated among economic sectors, and inefficiently used (OECD, 2002). The growth has increasingly relied on capital accumulation. The high investment rate has implied that the capital stock has grown faster than GDP in recent years and employment growth has declined as was shown in Figure 1. In spite of all these problems the economy has not shown any signs of slowing down. Instead the government has had to use a combination of economic and administrative measures to cool off the investment boom in 2004 and 2005.[9] To understand how the extensive pattern of growth in China has emerged and whether growth can be sustained, we need to analyze factor accumulation, factor allocation, and TFP growth. We start by discussing capital accumulation.

[9] In 2004, the Chinese authorities took a number of steps intended to moderate the pace of growth and achieve the soft-landing: these largely took the form of administrative controls, including on bank lending, but in late October they also announced a modest rise in interest rates (Krueger, 2005).

Table 1. China: Growth accounting 1978-93 and 1993-2004

	1978-93		1993-2005	
	pct per year		pct per year	
Average growth				
GDP	9.7		9.0	
Factors				
capital	8.6		12.0	
labor	2.5[a]		1.1	
$TFP^{0.6}$	3.54[b]		1.36	
$TFP^{0.5}$	4.15		2.45	
$TFP^{0.4}$	4.76		3.54	
		Share of total		Share of total
Contribution to GDP growth				
Total GDP	9.7		9.0	
Factors	5.55	0.57	6.55	0.68
Capital	4.3	0.44	6	0.62
Labor	1.25	0.13	0.55	0.06
$TFP^{0.5}$	4.15	0.43	2.45	0.25

Sources: NBS, and author estimates

a. Kuijs (2006).

b. $TFP^{0.6}$ refers to the estimates using 0.6 as capital share, and so on so forth.

Table 2. Growth in factor productivity and capital labor ratios

	1978-93	1993-2004
GDP growth	9.7	9.0
growth in capital stock	8.6	12.0
growth in capital productivity	0.10	-2.65
growth in employment	2.5	1.1
growth in labor productivity	7.0	7.86
growth in capital-labor ratio	5.96	10.8

Source: NBS, and author estimates.

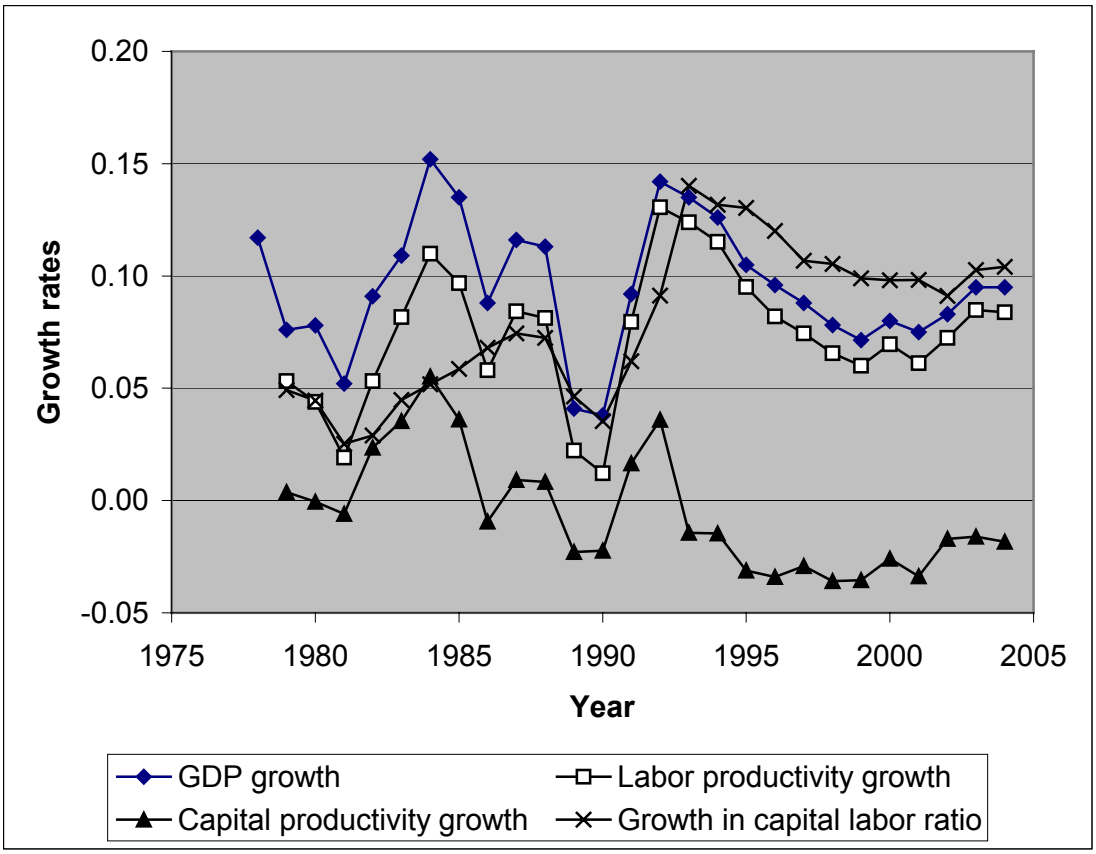

Figure 2 GDP Growth, growth in ratios (1978-2004)

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3. Capital Accumulation

China still has a low capital-labor ratio relative to Western economies.[10] Labor is abundant, but human capital measured as the average level of education is still low. Thus, investment in both physical and human capital is important for growth. While the rate of accumulation is very high, the new capital has not been allocated and used efficiently. In this section, we discuss the process of capital accumulation since 1990 and the policy supporting it. We discuss the way capital was utilized and its impact on total factor productivity in the next section.

Recovering from a recession in 1989-90 (Cheng 1993), investment accelerated in the early 1990s when China's leadership signaled its long-term commitment to market-based reforms. Gross capital formation reached a record of 43.5 percent of GDP in 1993. Investment was then slowed by the bursting of a real estate bubble and retrenchment policies aimed at controlling the surging inflation in 1995-96.

[10] An interesting discussion can be found in Artus and Melka (2004).

Consumption and exports played an increasingly important role, although the effects of the Asian financial crisis of 1997-99 temporarily slowed China's growth somewhat (Shane and Gale, 2004). Beginning in 2000, investment surged again through a combination of massive government infrastructure spending and investment in manufacturing by both foreign and domestic investors. Preparations to host the 2008 Olympic Games contributed further to the frenzy of construction projects. China's 2002 accession to the World Trade Organization spurred many companies, both domestic and multinational, to invest in China in anticipation of greater market opportunities. Gross capital formation rose from 36.4 percent in 2000 to 43 percent in 2003 — about 5 percentage points above China's average over 1978-2003 — as investments in factories, real estate, roads, and other infrastructure reached unprecedented levels (Shane and Gale, 2004). The investment strategy meant that GDP grew by over 9% a year from 1995.

There were two aspects of central government policy that supported this extraordinary investment growth (Hunt, 2006). First, key input prices, such as land, electricity and utilities, including water, were kept low through subsidies and controlled pricing. In many cases land was allocated for development at zero cost, and electricity for FDIs was sold at half price. Second, cheap finance was channeled into industry, particularly to large companies and SOEs, often effectively at zero cost of capital. The cheap finance was made possible by the high savings rate, which has grown over the past couple of years to close to 50% after averaging 40% or so of GDP for most of the 1990s (IMF, 2005).

The investment boom was also fueled by local governments, over which Beijing had limited control following a fiscal decentralization in 1994 (Lin and Liu 2000, and OECD 2002 p. 57). They constructed plant and infrastructure even if it made little economic sense. These investment-supporting policies, which have been in place since the mid-to-late 1990s, have led to a rapid build-up of production capacity.

Besides the high growth rate, China's investment strategy produced three side effects. First, the buildup of excess capacity led to deflation (Lin, 2004). At the macroeconomic level, investment in inventories has been negative since the second half of 1999, signaling an excessive storage of finished products and production

capacities (Zhang, 2006). In 2004, nine-tenths of manufactured goods were in oversupply, and yet investment in fixed assets a year before grew by 30% and contributed 47% of GDP (Economist, May 2004). In some sectors such as autos and steel, there was some evidence that rising competition and excess capacity are beginning to drive prices down (China Business Review, 2005). This could result in an accumulation of new non-performing loans in the banking system, setting back some of the progress that has been achieved in recent years (Prasad, 2005). [11]

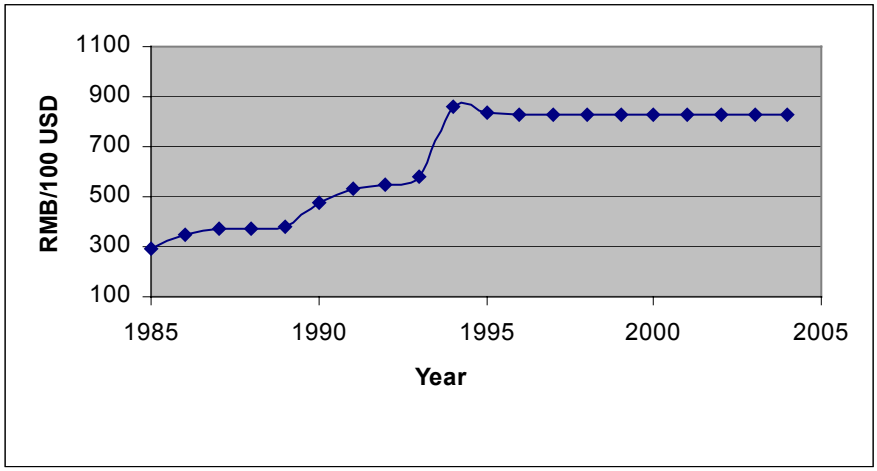

Figure 3 China's exchange rate to the dollar, 1985-2004 (authors' calculation)

Second, unwilling to deal with structural problems accumulated due to excessive investment in industries in the past, the government policy turned to export markets. This explains the growing efforts of Chinese businesses in recent years to go global. Globalization is increasingly viewed as an alternative to domestic structural complexity (Project Syndicate, 2005). China's export in part relies on what may be an unsustainably low fixed exchange rate. China depreciated its currency against US dollar to 8.62 in 1994 from 5.76 and has maintained its currency at a fixed rate of approximately 8.28 yuan per U.S. dollar since 1997, a rate that some economists suggest is undervalued by as much as 40 percent (Figure 3). As a result, exports increased 5-fold between 1993 and 2004 and so did imports (Figure 4).

[11] The Standard & Poor's rating agency currently estimates that China's banks have issued about $650 billion in bad loans, or about 40 percent of outstanding loans (Wolf, 2005).

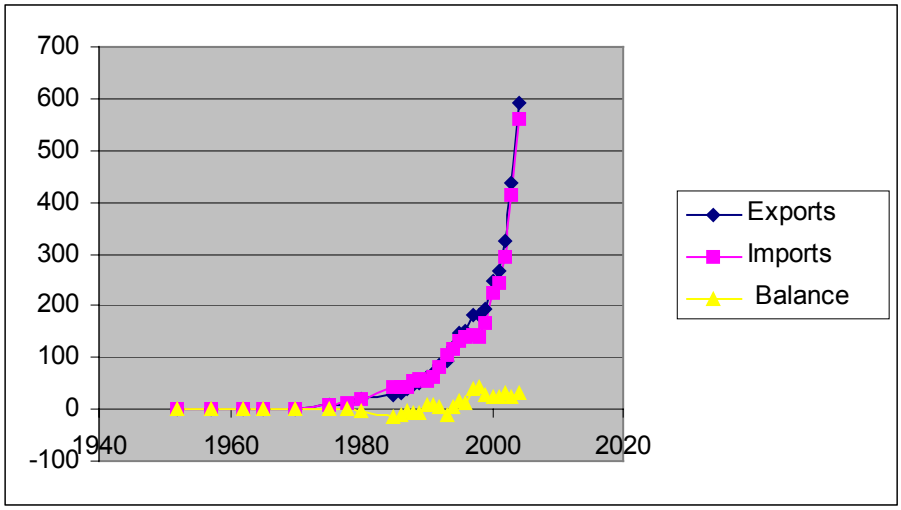

Figure 4 China's Export Performance (authors' calculation)

Third, building up a huge trade surplus with particularly the US (China Business Review, 2004), China's stock of foreign exchange reserves has risen sharply since 2001. By June 2005, China's foreign exchange reserve reached over 700 billion dollars (Prasad, 2005). Maintaining a (more or less) fixed exchange rate regime, China is facing an excessive growth of money supply and credit (China Business Review, 2005), which are fueling real estate bubble in the major cities (Chan, 2004). Monetary policy measures to deal with this are required.

By now, a vicious circle seems to have evolved. High investment rate has built up excess capacity, which has caused deflationary pressure on manufactured goods, cut profit margin, and created huge bad loans in the banking sector. On the other hand, the export market was chosen as an alternative for the absorption of that excess capacity and this resulted in the large buildup of foreign reserves and a rapid increase in money supply. The cheap money in turn fueled another round of excessive lending and investment, generating more excess capacity.

While the half-reformed production system with financial reform lagging far behind other reforms generated excess capacity on the supply side, some radical reform measures in public health, housing, and education created problems on the demand side. A very high domestic savings rate and the uncontrolled exploitation of its natural resources make it possible for China to invest on such a large scale. The

main reason for the high savings is that the transition from planned to market economy has involved a massive shift of financial risk from state-owned enterprises to households, thereby creating a large perceived need for precautionary saving by households to fund anticipated retirement, medical and educational expenses (Kroeber, 2005). Household savings rates in China, while high, do not alone explain the nations' high savings rate. High savings rates among enterprises,[12] in the form of retained earnings, and a high public savings rate, have also been driving Chinese savings (IMF, 2005).

Excessive investment in the manufacturing sector also led to a degradation of the environment and a misuse of the country's natural resources, including energy (Hunt, 2006). The government has not been able or willing to enforce strict environmental regulations, which means that China's environment is under tremendous pressure. About 70% of the country's rivers and lakes are seriously polluted. WHO reports that two-thirds of Chinese cities have air quality below standard, of which nine are in the world's top ten of the most polluted having the highest rates of carbon monoxide. Chinese government estimates that around 400,000 people die each year of diseases related to air pollution (Hunt 2006). This is another area where radical policy initiatives are called for.

Furthermore, the export oriented growth strategy requires easy access to international sea-lanes and concentration on low value-added, low technology, non-branded goods. The benefit of growth has thus not been shared evenly across regions, skill levels, and among industrial sectors, which created increasing gaps between the rich and the poor. The newly rich have achieved an economic standard, which is vastly different from those of the rural poor and urban dispossessed (Gilboy and Heginbotham, 2004). There is an increasing concern from policy makers that the growth pattern is not sustainable. Chinese policy makers are at present pushing the notion of "harmonious development", which suggests that measures to spread the benefits of growth more equitably are underway.

[12] As companies have improved their performance, corporate saving has risen and now accounts for almost half of national saving. Corporations have an incentive to retain their earnings in order to self-finance their investment (Dunaway and Prasad, 2006).

4. Allocation and Utilization of Capital

About two-thirds of China's gross capital formation (GCF) is in construction of infrastructure such as roads, dams, public buildings, and other facilities. Most of the remainder is spent on machinery and equipment (Shane and Gale, 2004). Much of these investments go to the manufacturing sector; while agriculture representing about 15 percent of GDP only get 2 percent of investments.

The state sector, although contributing only one third of China's GDP, still controls much of the country's capital resources (Wu, 2000). Between 1993 and 2000, more than 60 percent of all loans went to state-owned enterprises (Wolf, 2005). Most "private" investments are made by state-owned or collectively owned enterprises, funded by internally generated funds or loans from state-owned banks. Foreign investments have increased, but still they account for only about 5 percent of investment in fixed assets (Shane and Gale, 2004).

There are signs that the economy may have gone too far into manufacturing for export markets (Blanchard and Giavazzi, 2005), which means that investments on the margin have low returns. In the 1980s and 1990s it took $2-3 of new investment to produce $1 of additional growth, now it needs more than $4 (Zhang 2006). None of the high performing East Asia countries such as South Korea, Taiwan, and Japan, had such high incremental capital to output ratio at comparable stages in their development (Kwan, 2004). India, often compared unfavorably with China, is more efficient on that measure (Economist, March 2004).

A major source of inefficiency is the state enterprise sector (OECD 2005). The state business sector remains large and some parts waste resources. The poor economic performance of state firms can be traced in part to the accumulation of policy burdens arising from the long-standing use of enterprises to accomplish social policy goals. Poor SOE management and inefficient operations have lead to low profits and high debt, and this has prompted government interventions that spread the problem by extracting resources from stronger enterprises to prop up those that are failing. Large SOEs remaining under government control receive preferential treatment from the government and are often sheltered from competition, but their performance is often

mediocre and their flexibility is constrained by government intervention in their management and by various policy burdens (OECD, 2002).

The major imbalance in the state industrial sector lies is the spread between the minority of companies that earn respectable returns and the majority that barely breakeven. The median company in the state-controlled industrial sector was still earning a rate of return of only 1½ per cent in 2003, hardly registering any change since 1998. Indeed, almost two-thirds of all firms in this sector failed to earn a return of 5% on capital (OECD, 2005).

A second source of inefficiency is the government intervention with economic activities and along with it rampant corruption. There has emerged what Hunt (2006) has termed China's trilogy of local company, local government and local bank. Each had a vested interest in building whatever plant was in vogue, whether a steel mill, a power station, an air conditioner factory or a copper tube plant and so on. Very often these plants were financed with zero cost capital. Corrupted officials were often benefited financially in the process. The growth promoting policy initiated by the central government was virtually interpreted at the local level as growth at any and all costs. Achievement projects and image projects ran rampant as local governments competed for a nominal share of the increase of gross domestic product numbers, leading directly to administrative intervention in economic activities (China Daily, 2004).

A third source of the inefficiency is that Chinese markets are fragmented due to local protectionism. In contrast to formerly centrally planned economies in Eastern Europe, China’s industry is characterized by sub-optimal scale in production facilities, fragmentation and duplication. There are for example 200 separate producers of automobiles, most of which complete only a few thousand units per year. Economies of scope are also poorly exploited, as illustrated by the nearly 8 000 independent cement firms in China compared to 110 in the United States, 51 in Russia, 58 in Brazil, and 106 in India (OECD, 2002).

Given the political perils of challenging competitors and their local patrons, few Chinese firms develop alliances with or invest in companies in other provinces. One

recent survey of 800 companies that have conducted domestic mergers and acquisitions found that 86 percent of them invested in firms within their own city and 91 percent invested in firms within their own province. Strong local political ties tend to isolate a region from the rest of the economy, which helps explain why Chinese firms are often small and the country's industries fragmented. For example, a recent study performed for the State Council (China's cabinet) revealed that Chinese managers regard the country's two most politically powerful technology and industrial hubs, Beijing and Shanghai, as leading centers of local protectionism in China. Among the industries most affected by such protectionism were pharmaceuticals, electrical machinery, electronics goods, and transport equipment. SOEs, private firms suffered the most, foreign funded enterprises the least, which suggests that the burden of particularism falls most heavily on Chinese firms (Gilboy, 2005).

The scale of the inflow of FDI has been large, amounting to a 6% of GDP in the early 1990s, falling back to 3½ per cent of GDP since 2000 – though the absolute amount increased in that period (China Business Review, 2005). Slightly more than one-quarter of this inflow represents retained earnings and this part has been declining in aggregate. It is difficult to be precise about the geographic origin of FDI flows, but official figures show almost half as coming from Hong Kong, China or tax havens (OECD, 2005). A significant part of such flows presumably comes from third, unidentified, countries, including even Chinese capital that has been recycled through these areas in order to benefit from the advantageous tax treatment offered to foreign-based companies. Of the remaining identified inflows, two-thirds comes from other Asian countries (OECD, 2005).

Tax benefits provide a bias in favor of foreign investors, and this may explain why domestic investors are engaging in FDI round-tripping schemes. But Huang (2005) shows that any favoritism shown towards foreign investors at the expense of domestic investors pales in the face of favoritism shown towards state companies. The real issue is not domestic vs. foreign investment, he argues, but a reluctance to support the growth of the domestic private sector. Better to welcome FDI than allow the growth of an indigenous entrepreneurial class that might challenge the political status quo. In effect, FDI has acted as a reason for the delay in reform (Mihalca, 2005).

Most sources of China's FDI are small and medium-sized foreign companies, and one investors of this size often bring relatively little technology, organizational know-how (see a book review by Mihalca, 2005). Econometric estimates suggest that their overall productivity is actually slightly lower than that of privately controlled domestic companies (OECD, 2005). So the role of foreign-controlled companies in raising productivity should not be overstated.

A major current government policy concern is that China has not invested in the type of long-term technological capabilities that their Japanese, South Korean, and Taiwanese predecessors built during the 1970s and 1980s. Chinese firms tend to import technology by purchasing foreign manufacturing equipment, often in complete sets such as assembly lines. Throughout the 1980s and 1990s, hardware accounted for more than 80 percent of China's technology imports, whereas licensing, "know-how" services, and consulting accounted for about 9 percent, 5 percent, and 3 percent, respectively. Over the last decade, large and medium sized Chinese industrial firms have spent less than 10 percent of the total cost of imported equipment on indigenizing technology. Indigenizing spending of state firms in the sectors in which China is most often cited as a rising power (telecom equipment, electronics, and industrial machinery) is also low (at 8 percent, 6 percent, and 2 percent of the cost of imported equipment, respectively). This is much lower than the average for industrial firms in OECD countries, which amounts to about one-third of total technology import spending. [13]

5. Lessons from a Productivity Perspective

In reviewing China's recent growth performance, there are a few lessons that might be learned from a productivity perspective. In the late 1990s, Chinese planners used to be preoccupied with a task of maintaining a growth rate of 8% in light of East Asia financial crisis and a subsequent slowdown in output growth in China. What was not clear to the planners at the time was the role that would be played by the TFP growth in the standard growth accounting framework. One type of forecast relies very much

[13] The practice of Chinese firms also stands in contrast to spending patterns in Asian countries such as South Korea and Japan in the 1970s and 1980s, when they were trying to catch up with the West. Industrial firms in those countries spent between two and three times the purchase price of foreign equipment on absorbing and indigenizing the technology embodied in the hardware (Gilboy, 2004b).

on the high formation rate of capital, but if the capital formation rate is too high to the extent that growth rate in capital stock exceeds GDP growth one would end up with a growth pattern of the "extensive type".[14]

Table 3. Growth Accounting: contributions to GDP growth (1979-2015, %)

Period	Capital	Labor	TFP
1979-1997	37*	16*	47*
2000-2005	32*	12*	56*
	37	10	53
2006-2010	32*	10*	58*
	37	9	54
2010-2015	32*	8*	60*
	37	7	56

Note: TFP forecast after 1998, GDP growth was given at 7%. Estimates with * indicate that cost share of capital was used as weight, while estimates without used accumulation rate as weight.

Source: Research Center, Ministry of Science and Technology, cited in Song and Li (1999-2000).

Another type of forecast says that TFP is important but difficult to quantify (Song and Li, 1999-2000),[15] but in practice one often assumes that TFP will grow at an

[14] The rationale can be understood as follows. For example, with a capital elasticity of 0.6 and TFP growing at 3% per year, China should be able to sustain at least a growth rate of 7% if the expected high rate of capital formation of over 30% of GDP were to be maintained (Chow and Li, 2002). Even if capital stock grows at a breakeven rate of 8% together with the growth in output, and labor force at 2%, the growth in GDP will be almost exhausted by input growth with capital's contribution of 6.4% and labor's contribution of 0.8%. What is left is that TFP will only need to grow at 0.8%, which makes productivity a rather minor issue in this exercise.

[15] If one instead assumes smaller output elasticity for capital, say 0.5, TFP will become more important. If the labor force grows slightly above 1% as it has in the recent decade, one needs a TFP growth at 3.6% to achieve an 8% GDP growth. In this case, Chinese planners seemed to be overly optimistic (Table 3), forecasts of TFP's contribution to output growth at around the year 2000 were estimated as high as from 54% to 60% for the 10th and 11th five year plans (Song and Li, 1999-2000). Researchers at the State Planning Committee also made the assumption that TFP growth increases from 3% to 4.5-5% in forecasting economic growth from 2001 to 2015 (Research Group, 2000). Although forecast on TFP's contribution to output growth after the 10th five year plan was concluded was adjusted downward to as low as less than 30%, researchers at the Development Research Center of the State Council predict that growth of total factor productivity, brought about by urbanization, investment in human capital, economic system reform and technological innovation, would make increasingly bigger contribution to economic growth (People's Daily, 2005).

increasing rate (Table 3).[16] It was not clear whether investments have been used as a last resort to counterbalance business cycles when TFP performance does not deliver as expected. Perhaps it is fair to say, had there been a deeper understanding of the forces behind the TFP growth, policies could have been better designed with regard to several aspects of the economic reform. Some of these aspects concern rather standard results in the growth and productivity literature.

(1) Level effects vs. growth effects: Economists often point out that the most important component of China's growth is the immense productivity gain arising from the shift of labor from low-productivity agriculture to higher-productivity services and industry (e.g., Kroeber, 2005). While this type of policies has been successful in promoting growth and productivity for a sustained period, the limitations of such policies were not properly understood among policy analysts. Some policies that aimed at alleviating past distortions of the planning period would only have one time level effect. For example, when the TVEs development, which transferred more than 120 million people out of agriculture, had been exhausted in the early 1990s,[17] a policy substitute often heard from Chinese officials as well as policy analysts was urbanization. However, a recent reversal in the policy of promoting urbanization was signaled by the government's call for the construction of the new socialist countryside, indicating an intended slowdown in the urbanization process in the near future.[18]

(2) Technical progress vs. efficiency improvement

According to applied production analysis, the change in TFP can be decomposed into technical progress and efficiency change; the former is associated with changes in the

[16] It's still not very clear how the assumption of increasing TFP's contributions to growth found its way entering these forecasts, while recent economic studies rather predict either slowdown in TFP growth or reported unsatisfactory performance by Chinese firms in technology absorption and innovation.

[17] Kuijs and Wang (2005) find that growth of industrial production, led by a massive investment effort that boosted the capital/labor ratio, has been the single most important factor driving GDP and overall labor productivity growth since the early 1990s. The shift of labor from low-productivity agriculture has been limited, and hence, contributed only marginally to overall labor productivity growth.

[18] Hunt (2006) interpreted the new policy as follows. The corollary of slowing down urbanization is to bring industry to the countryside, though no longer industry that is energy intensive; that trend has finished. This means also that the migration of rural workers will come to an end. China's surplus rural workers, which are probably, anyway, mostly in the age bracket of over 40 years, will stay at home as jobs will come to them.

best-practice production frontier, and the latter with other productivity changes, such as learning by doing, improved managerial practice, and changes in the efficiency with which a known technology is applied. Some researchers believe that this distinction is fundamental for policy actions, especially in developing countries, where identifying TFP growth with technical progress can miss the fact that technical efficiency change seems to be the most relevant component of the total change in TFP, and therefore, the introduction of new technologies without having realized the full potential of the existing ones might not be meaningful (Felipe, 1999). In fact, several studies using Chinese data found that productivity growth in China has mainly been achieved through technical progress rather than efficiency improvement (e.g., Zheng, Liu, and Bigsten 2003, and Zheng and Hu, 2004). Therefore, China should pay more attention to efficiency improvement while taking advantage of advanced foreign technologies.

(3) Economic reform: It has often been taken for granted that economic reform aiming at establishing a market system with private ownership will automatically boost efficient production and promote technological progress including innovations. But the important thing in this context is to understand that the establishment of market, ownership reform, foreign direct investment, and trade will only improve the situation under which Chinese firms operate to a certain extent. Recent advances in endogenous growth modeling have recognized the fact that technology is neither a conventional good nor a public good; it is a non-rival, partially excludable good (Romer, 1990). Market is not the most efficient in encouraging innovative activities of technological development.

Policy miscalculations may also arise in health care, education, and housing. One school of thought on the interpretation of Chinese reform is that China has achieved the greatest success in precisely the areas where market reforms have gone the furthest (Sachs and Woo, 2000). However, this may not apply in certain areas. For example, the transition from planned to market economy has involved a massive shift of financial risk from state-owned enterprises to households, thereby creating a large perceived need for precautionary saving by households to fund anticipated retirement, medical and educational expenses.

(4) Education: A gray area with what is good for productivity in China concerns the role of education. A typical Chinese planner would think education is good for growth and productivity, taking account of what the standard textbook says. As we have mentioned in the introduction, a growing body of research suggests that, even after physical and human capital accumulation are accounted for, total factor productivity (TFP) accounts for the bulk of cross-country differences in the level and growth rate of GDP per capita (Easterly and Levine, 2001). Several studies pointed out that differences in physical and intangible capital couldn't account for the large international income differences that characterize the world economy today. One recent study by Holz (2005) even found a negative relationship between output and education using Chinese aggregate time series data. This perhaps is an area need to be further looked into as far as China is concerned.

(5) Low value-added production and extensive growth: A lesson to be learned is that productivity performance at firm level will have real implications for sustainable growth at macro level. Taking account of the more than 60% of industrial exports from foreign-invested enterprise, a substantial fraction of the remainder of the country's exports consists of industrial products that are either OEM (original equipment manufacturer) manufactures, or low value-added, low technology, non-branded goods for global giant firms (e.g. garments, footwear, furniture, toys). Chinese firms spend negligible amounts on research and development. While the world's giant firms are rapidly building their research and development bases in China, employing relatively cheap, highly skilled Chinese researchers, indigenous is not a single Chinese firm in the world's top 700 firms by research and development expenditure. China does not have a single one of the world's top 100 brands. Its leading firms are almost unknown outside the country. Among the 14 Chinese firms in the Fortune 500, none has become a truly globally competitive company that could compete without government protection. All of these firms are state-owned and subject to systematic state interference in their operation (Nolan, 2005).

(6) Growth and employment: One problem that has been noticed when working with the Chinese growth accounting exercise is the growth in the labor force. Between 1993 and 2005, number of people employed only increased 1.1%, much slower than the 2.5% growth for 1978 to 1993. Almost all the East Asian tigers experienced

extensive growth for more than two decades with capital growth exceeding that of output by a substantial margin, but their employment growth was much faster than China's, ranging from 2.6% to 5.4% (Young, 1995). In the industrialized countries, normally economy boom would be accompanied with increase in employment as well as total factor productivity. In China, capital was accumulated at a historical record speed, while less employment was created (Hu, 2003, and Zheng and Hu, 2004). China appears to heavily rely on imported foreign technologies to raise productivity while keeping the employment growth slow. The result is capital deepening and sluggish growth in total factor productivity.

(7) Productivity and exchange rate: China attempts to preserve an undervalued currency as an export promotion measure. Guillaumont Jeanneney and Hua (2003) show that the appreciation of the real exchange rate in China had an unfavorable effect on technical progress but a favorable effect on efficiency growth, and these two effects offset each other partially to give a lesser negative effect on productivity growth.

(8) Environmental constraint: One may expect that TFP will grow faster when an economy grows very rapidly. However, both GDP and TFP growth can be reduced if environmental costs are taken into account. The Chinese government has been working on the criteria and indexes of a green GDP, which deducts the cost of environmental damage and resources consumption from the traditional gross domestic product, and the new set of criteria is expected to be finished in three to five years (People's Daily, 2004). From the aspect of productivity analysis, the concept of green GDP can be straightforwardly extended to TFP, i.e., green TFP. A slower green GDP growth may imply a slower (green) TFP growth.

Policy challenges: There have been many discussions about what policy adjustments are needed. Blanchard and Giavazzi (2005) recommend a three-handed strategy. This entails a decrease in saving (particularly private saving), an increase in the supply of services (particularly health services), and an appreciation of the RMB. Dunaway and Prasad (2006) point out that this discussion runs the risk, however, of prompting a string of ad hoc policy actions that could provide temporary relief, but no lasting solution to fundamental imbalances in the Chinese economy. They argue instead that

the real issue in China is how to rebalance the economy away from heavy dependence on exports to lead growth towards domestic demand, including a substantial improvement in the efficiency of investment. They note that, as companies have improved their performance, corporate saving has risen and now accounts for almost half of national saving. Corporations have an incentive to retain their earnings in order to self-finance their investment. This is particularly true for private sector companies, which have limited access to bank financing and few domestic alternatives for raising money. State-owned enterprises that do make profits are generally not required to pay dividends to the government, and these companies naturally prefer to retain their earnings and plow them back into new investments. By some measures, Chinese households have in recent years saved almost a third of their disposable income. The precautionary motive for saving is very strong among Chinese households. Demographic factors add to this saving motive.

Kroeber (2006) argues that the ultimate cure is for people to get richer, and this will take time. It makes sense for China gradually to encourage greater consumption growth. There are, however, three main impediments that ensure this will be a lengthy process: 1) People don't have much money. 2) Incentives for precautionary saving are high. 3) Corporate saving is not intermediated.

The slow development of financial markets in China has meant limited availability of credit, so that households generally have to save in order to purchase big-ticket items. It also has meant that there are low returns on households' financial assets and limited opportunities for portfolio diversification, since there are few alternatives to depositing savings in state-owned banks. All of this suggests that financial market reform and development is a key priority, which the Chinese authorities recognize (Dunaway and Prasad, 2006).

Rodrik (2006) notes that China’s export is more technology intensive than one would assume given its factor endowments. He argues, however, that the country has via its industrial policy managed to shift its export structure in this direction. The government has been willing to support investments that are more sophisticated than what its comparative advantages would typically support and what the market left to itself would generate. And he argues that once one successful firm can be established

in a new type of production it tends to be followed by others. Once investors in a country "discover" a number of high-productivity exportable, this has a powerful demonstration effect. Such an investment strategy may have static inefficiency costs, but he argues that it is an essential force behind the rapid Chinese growth. This proposition has not been properly investigated yet, but this is something that needs to be looked into in greater detail.

Prasad and Rajan (2006) argue that China's current stage of development, along with its rising market orientation and increasing integration with the world economy, may make the incremental and piecemeal approaches to reforms increasingly untenable and, in some cases, could even generate risks of their own. The present favorable domestic and external circumstances provide an excellent window of opportunity for bolder reforms and for tackling some deep-rooted problems without causing much economic disruption.

6. Concluding Remarks

The unorthodox reform policies followed by China have been characterized by one wave of measures after another to balance demand and supply, and they have often resulted in short-term gains in productivity but not long run effects. Structural reforms, which could have mitigated the major drawbacks of the short-run measures, were delayed in the process. China's growth strategy since the mid-1990s has emphasized the expansion of output at the expense of efficient allocation and utilization of factors of production, which has led to a slowdown in total factor productivity growth.

The irony of China's recent capital-intensive growth pattern is its resemblance to the Soviet Union's, which China has every intention of avoiding during its nearly thirty years of economic reform and opening up to the outside world. One may argue that the Soviet Union only managed to achieve a GNP growth rate of 4-5 percent per year (Perkins, 1988), while China's growth has been 8-9 percent and its economy is much more open to the outside world. China to many international commentators looks more like the East Asian tigers rather than the Soviet Union.[19] However, one thing has

[19] Our survey shows that productivity growth has slowed down since the middle of the 1990s, but over the whole period of reform total factor productivity has been rising at an rate of 2-3%

often been forgotten is that the conventional model of unlimited labor supply (Lewis, 1954) and the Soviet Union strategy both emphasized saving and investment as the central issue in economic development (Sachs, 2004).[20]

To achieve a continued high rate of growth it seems likely that the country will have to rely more on TFP growth and less on capital deepening than in recent years. The current concern for the income distribution aspects of development also seem to be very important for economic stability to be maintained. According to the recently released 11th Five Year Plan, the government recognizes that future economic growth depends on its ability to innovate in science and technology, which, in turn, depends on government policies towards entrepreneurial activity, research and development, and on the establishment of market-based institutions.

Non market institutional arrangement is also required to complete China's move to a viable market economy that promotes sustained productivity growth. Igniting economic growth and sustaining it are somewhat different enterprises. The former generally requires a limited range of reforms that need not overly tax the institutional capacity of the economy. The latter challenge is in many ways harder, as it requires constructing over the longer term a sound institutional underpinning to endow the economy with resilience to shocks and maintain productive dynamism (Rodrik, 2003).

Conventional development strategy has emphasized the importance of increasing stock of capital and reducing economic distortions. But development represents a far more fundamental transformation of society, including a change in "preferences" and attitudes, an acceptance of change and an abandonment of many traditional ways of thinking (Collier and Gunning, 1999). Greater effort should be attempted in the

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a year. That may not sound much, but it is faster than in the East Asian tigers at the same stage of their development. During 1960-84 their total factor productivity growth averaged only 1% (Economist, May, 2004). The answer may lie in the concept of trend growth, defined in Prescott (2002), which is the result of growth in the stock of world knowledge that can be accessed at modest cost and that enhances production possibilities. Remember the fact that China is an open country during reform, while Soviet Union didn't have access to the Western Technologies at the time of Cold War.

[20] Krugman (1994) was correct in one aspect, that is, input-driven growth is inevitably limited.

direction of encouraging social and cultural development if China is to achieve the transformation from a pattern of extensive growth to an intensive one.

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Appendex A

Data Description

The main variables investigated in the study are aggregate output (GDP in constant price), aggregate labor (number of people employed), and capital stock (accumulated fixed capital investment in constant price). Although the purpose of our work was basically to update the data for a few years, each of the variables involves some degree of complications. The controversial issue on GDP growth is well known in the literature, we simply used the official figures in order to avoid complications. Dealing with statistics on the number of employment also encountered some difficulties, with the major problem of a huge jump in the 1990 figure, which registered a 17% increase in the labor force in comparison with 1989. Capital stock is the most problematic; we basically followed Hu (2003) and referred to the estimates and method used in Maddison (1998) to update the figures for recent years (2002-2004).

GDP

The most recent study on China's reform period economic growth figures is Holz (2006), who disputes Maddison's 1998 OECD study in favor of the official data. Data problems were also discussed in Holz (2004) with special attention to GDP data as the aggregate measure of productive activities in China. Maddison's adjusted GDP growth figures gives an average annual real GDP growth rate of 7.49 percent between 1978 and 1995, which contrasts the official statistics of 9.88 percent. The advantage of using the Maddison figures is that it has been incorporated into the Penn World Tables if one is to work with cross-country comparisons, which is not the situation in our case.

We thus followed many other researchers, taking notice of the arguments made in Holz (2006 and 2004), and used the official statistics for the aggregate measure of output. The statistical yearbook we use is from 2005. As noted in Table C.8. by Maddison (1998), the Chinese authorities do not publish estimates of GDP at constant prices. However, GDP in constant prices can be imputed using GDP in current price in Table 3-1 and GDP (growth) index in Table 3-3. One way to impute GDP in constant price is to calculate the GDP deflator first, our calculation appears to be consistent with the (GDP) implicit price deflators reported by the World Bank (1997, China 2020) in Table 3, page123.

Labor

Employment figures as labor measure appears to be the least problematic since it just measure number of people employed, but a major change in the registry in 1990 and subsequent layoff of state workers made the employment statistics inconsistent before and after 1990. This problem was not present in Table D.3., Maddison (1998), but he notes, "The 1997 Yearbook give a total for the years 1990 onwards which is bigger than the sum of the sectors, and differs from the total in previous yearbooks. There seems to be some sort of error in the new official total." (p.172, cited in Holz, 2006). Holz took the matter more seriously, he reported that the Statistical Yearbook 1997 and in all later editions, the NBS retrospective revised total employment of 1990 upward by 14.12 percent, and similarly for later years, without, however, attributing this increase in employment to individual industrial sectors (agriculture, industry, construction, etc). However, with the Yearbook 2005 we use, the increase in the employment from 1990 was also distributed to the different sectors (the first, the second, and the third industries).

Chow and Li (2002) registered a similar increase for employment in 1990 but with a smaller figure (63909, instead of 64749 in the 2005 Yearbook).

Young (2003) discussed the phenomenon in a more detailed manner. He noted, in 1997 the employment series reported in the CSY was revised on the basis of the results of the annual Survey of Population Change. While the figures for earlier years were retained, the numbers from 1990 on rose substantially. The linking of the old data on the labor force of society (prior to 1990) with the new labor force series (from

1990 on) in current official publications is regrettable, since it generates spurious labor force growth, which, unfortunately, has been used by some economists as a measure of employment growth.

While the labor force of society is no longer reported as the official aggregate employment series, these data continue to be collected and can be inferred from the detailed tabulations of the CSY. Young used these data to extend the "old" series to 1998, as reported in table 5 of his study. However, he was not able to avoid a further discontinuity, introduced in 1998, when the definition of workers in urban enterprises was revised to include only those actually working and receiving income (as opposed to those who retained employment contracts, without actually working in the unit). This resulted in a substantial reduction in the estimated working population, particularly in manufacturing.

In our study, we follow the practice in Kuijs (2006), who used an estimate of 2.5 per cent average growth in the labor force during 1978-93. In Hu (2003), the figure was 2.6 for 1978-95. An old series for employment was found of 1990-1995 in World Bank (1997, Table 30), so the growth rate in employment in 1990 was taken from this old data series for time plot and estimate of TFP by year.

Capital stock

We update Hu's (2003) capital stock figures from 1952-2001 to 2002-2004, using Maddisson's method. In principle, it is possible to recalculate the capital stock from 1996 to 2004 using the Maddison method of estimating gross non-residential fixed investment in constant 1987 price (Table C.12.), but we have yet to duplicate the exact estimates in Hu. The capital stock figures for 2002 to 2004 were updated as follows.

First, the official estimate of gross fixed investment or gross fixed capital formation (GFCF, Table 3-14, Statistical Yearbook, 2005) was multiplied by a coefficient of 0.9 to exclude categories of investment, such as military investment, which would not be included in western national accounts (Table C.12., Maddison 1998). This statistic excluded inventories. Young (2003) also excluded inventories from his measure of the

capital stock and focus on GFCF due to the consideration of the unsold inventories of state enterprises as an unproductive element of the capital stock, among other things.

Second, gross housing investment, which one finds in Table 6-6 of the CSY (2005), was subtracted from the above adjusted GFCF figures. Recently, Zhang, Wu, and Zhang (2004) argue that housing provides services to production process and should be included in the capital stock, we will get back to this issue later.

Third, the gross non-residential fixed investment is deflated using the index of fixed capital price index in Table 9-2 of the CSY (2005). Because the base year of the deflator was set in 1991, to make the base years for both CSY and Maddison deflators consistent, an implicit deflator was calculated using the "official estimate of gross fixed investment" in Table C.11 and 12 for 1991 (594000 / 421445=1.41 with based year in 1987).[21] We then multiplied the CSY capital price index by this factor of 1.41 to change the base year from 1991 to 1987.

Growth rates in capital stock for 1978-93 and 1993-2005 were also reported in Kuijs (2005), with capital increase at a speed of 11.8 percent during 1993-2005 well-above the 9.5 GDP growth rate on average during the same period.

A capital investment deflator seems to be provided in Holz (2005).

Chow and Li (2002) and Li (2003) provided capital stock estimates, which appear to be different from Maddison (1998). Gross capital formation was used there, which includes inventories. We mimicked Chow and Li (2002) in updating the capital stock, and obtained capital stock series with growth rate from 1999 to 2004 declining from 10 percent to 8 percent. Since inventories in recent years have also been declining, this will result in an underestimate of gross real fixed investment.

[21] This implicit deflator for capital seems originated from SSB-Hitotsubashi (1997), cited in Table C.12. by Maddison (1998).