

## WORLD BANK CHINA RESEARCH PAPER NO. 7

## REBALANCING CHINA'S ECONOMY—MODELING A POLICY PACKAGE

Jianwu He \*/ and Louis Kuijs \*\*/

September 2007

**Abstract**

This paper discusses how China can rebalance its pattern of growth by implementing a package of policies. We first characterize the distinct features of China's pattern of growth and the specific policies that we think are behind it. We identify the key contributions of these distinct features to China's growth, as well as some downsides—issues that are currently of concern to China's government: high saving and investment, high resource and energy intensity, environmental impact, inequality, the small role of private consumption, and a large and growing external imbalance. We then discuss a package of policy reforms that we think can address most of the downsides. We look at how China may grow in the coming decades, modeling a few scenarios with a computable general equilibrium model. The first scenario is “on past trends”, extrapolating past trends and policies into the future. The second one is a “rebalanced” scenario, where we implement the package of policy reforms. The rebalanced scenario looks significantly better on the dimensions currently of concern to the government, while achieving broadly comparable overall growth. Our modeling work suggests that, with the right package of policy reforms, it is possible for China to continue to grow rapidly while relying less on industry and investment, and more on services and efficiency gains, including via reallocation of labor and capital.

Keywords: China, rebalancing, pattern of growth, model, saving, investment, consumption, energy, inequality, external imbalance

\* Development Research Centre, China.

\*\* World Bank Office, Beijing, China; corresponding author; [akuijs@worldbank.org](mailto:akuijs@worldbank.org).

We thank Bert Hofman for encouragement, support, and comments along the way. We also thank Li Shantong, Hans Timmer, Dominique van de Mensbrugge, and participants at seminars at the World Bank Office in Beijing and Washington DC for comments.

The paper is a background study for the World Bank's forthcoming Country Economic Memorandum for China. The views represent those of the authors, and should in no way be attributed to the World Bank, its Executive Directors, or the countries they represent.

## I Introduction and outline

China's government wants to change the pattern of growth, while keeping overall growth high. China's overall economic performance has been exceptional in recent decades. At the same time, the government has become increasingly concerned with some of the downsides of China's industry-led, capital intensive pattern of growth. Rebalancing China's economy is currently a major theme of economic policy in China. The government wants growth to become more sustainable economically, by making it less dependent on investment; less intensive in energy and raw materials; more friendly to the environment; and more equally shared, particularly between urban and rural parts and coastal and internal parts of the country. It also wants to reduce the external imbalance that is China's increasingly large current account balance.

How can the pattern of growth be rebalanced in those dimensions without hurting overall economic growth? This paper discusses long run economic scenarios and the impact of growth on living standards, energy and resource use, the environment, and the income distribution under 3 scenarios. The scenarios are modeled with the Computable General Equilibrium (CGE) model for China of China's Development Research Center.<sup>1</sup> The first one is "on past trends", including past policies. The second one is our central "on rebalanced policies" scenario, which include reforms in the areas of fiscal, financial, pricing, labor market, and migration policy. This reform package changes the character and composition of growth, although it does on balance not materially affect overall growth. Thus, while the rebalanced scenario has significantly less capital accumulation, it has higher increases in efficiency (TFP growth), in part because of more reallocation of labor away from low productivity agriculture. The rebalancing scenario looks significantly more benign on dimensions that the Chinese government has identified as important, like capital intensity, energy and raw materials use, the environment, and the income distribution. A third scenario includes more ambitious reform in the areas of the environment and inequality, on top of the policies pursued in the central rebalancing scenario. In this scenario, growth is somewhat lower than in the other scenarios.

The paper is organized as follows. In section II we first characterize the distinct features of China's pattern of growth, and look at its strengths and weaknesses, focusing on the areas that are currently of concern to China's government: high saving and investment, resource and energy intensity, the environment, inequality, and the external imbalance. We then look in section III how China may grow in the future, discussing the 3 scenarios that were modeled with a general equilibrium model: on "past trends", the "central rebalancing" scenario, and the "ambitious rebalancing" one. In section IV we take a closer look at the possible pace of growth in the decades ahead.

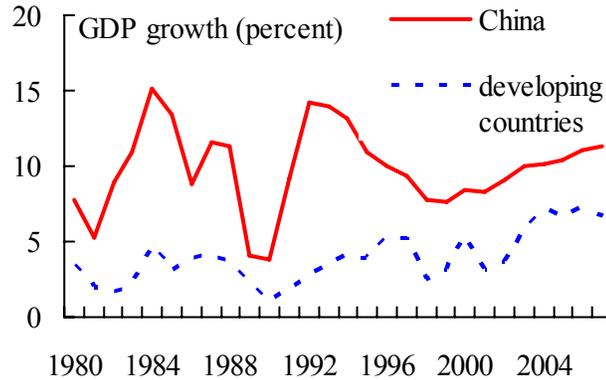
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<sup>1</sup> This modeling and the work more generally is part of a wider project at the World Bank in the context of the upcoming Country Economic Memorandum. The economic scenarios have been used as input into modeling exercises in the areas of resource use, energy demand, and environmental impact.

## II Growth in recent decades

China's growth has been exceptional since 1978. Developing countries can grow rapidly with good policies and institutions. China was very poor in 1978. Economic reforms and opening up to the outside world unleashed particularly impressive economic growth. China grew on average almost 10 percent per year since 1978, compared to 4 percent for all developing countries (Figure 1). Per capita GDP is still modest at \$2000 in 2006. However, with almost 1/5<sup>th</sup> of the world's population, China became the world's fourth largest economy in 2005, measured in current exchange rates. On current trends, it may overtake the US to become the largest one in a few decades.

Figure 1. Economic growth has been rapid.



Source: World Bank WDI and authors' estimates.

### How to characterize the distinct features of China's growth? <sup>2</sup>

The first key feature of China's growth pattern is that it is increasingly capital intensive, with high and increasing saving and investment. Growth accounting analyses suggest that capital accumulation has played a large and increasing role in China's growth. Gross fixed capital formation—in factories, buildings, and infrastructure—has always been relatively high in China. It increased further from 35 percent of GDP in 2000 to an estimated 45 percent of GDP in 2006. This was combined with a rise in (gross domestic) saving from 37 percent of GDP in 2000 to an estimated 51 percent in 2006.<sup>3</sup> The contribution of capital accumulation to labor productivity growth increased from 3.3 out of 7 percent per year in 1978-1993 to 5.3 out of 8.4 percent in 1993-2005 (Box 1). It is not the case, as has often been argued, that total factor productivity (TFP) has been low in China compared to other countries. TFP growth has been higher than in most other countries. However, most of the difference in GDP growth between China and other countries has been because of high and increasing capital accumulation (Box 1). Moreover, there are signs that, on past trends, TFP growth may be on a declining trend.

The second key feature is that the bulk of China's investment is financed domestically, much of it by enterprises. Foreign direct investment (FDI) played important role in China's development, in particular in transferring foreign technology. However, at 3-4

<sup>2</sup> This section draws on Kuijs (2005) and Kuijs and Wang (2006).

<sup>3</sup> These recent estimates are not fully comparable with the earlier estimates in Table 3 which were used as inputs in the simulation work.

### Box 1. Growth accounting for China

Several studies have used growth accounting to analyze the sources behind China's rapid growth of the past 25 years. Assuming a certain production technology, these studies assess what factor accumulation and total factor productivity (TFP) have contributed to growth. Heytens and Zebregs (2003) summarize earlier studies, which include Chow (1993), Hu and Khan (1997), and Wang and Yao (2002)). Although estimates differ because of variations in assumptions, the studies largely agree on several findings. TFP growth has contributed significantly to GDP growth, having increased since the introduction of reforms at the end of the 1970s. Estimates of TFP growth during the reform period range "between 2 and 4 percent per year" (Heytens and Zebregs). Annex Table 1 shows an updated list of results, including those of Kuijs and Wang (2006) and Bosworth and Collins (2007). Annex Table 2 presents results for other countries. These tables indicate that TFP growth in China compares favorably with that in other countries.

These studies find that the contribution of capital accumulation is high and rising. Notwithstanding respectable productivity growth, the contribution of physical capital accumulation has been large and growing, reflecting the high and increasing investment to GDP ratio. Kuijs and Wang (2006) did a growth accounting exercise for 1978-2004 using consensus assumptions on the key parameters.<sup>1/</sup> They found that, under these assumptions, the contribution of capital accumulation to GDP growth was significantly larger in 1993-2005 than in 1978-1993, reflecting the rapid investment growth in the last decade, while TFP growth declined with respect to the first period. A useful way of looking at these trends is to decompose labor productivity growth into TFP growth and the contribution of capital accumulation (higher K/L). As Table 1 shows, these results remain broadly unchanged using the revised national accounts data up to 2005, in large part because 2/3rds of the GDP revision took the form of higher price increases.<sup>2/</sup> The contribution of capital accumulation to labor productivity growth increased to 5.3 percentage point in 1993-2005 (Table 1). This is very high compared to other countries (Annex Table 2). High capital accumulation explains more than 2/3rds of the difference in labor productivity growth between China and other countries/regions (Annex Table 2, bottom). With overall employment growth slowing, the contribution of labor growth has been modest, especially over the last decade.

On most assumptions, TFP growth is estimated to have declined over time. On the "consensus" assumptions behind Table 1, TFP growth is estimated to have declined over time. In contrast, Bosworth and Collins found that TFP growth was higher in 1993-2004 than in 1978-1993.<sup>3/</sup> They suggest the difference may be because of a different assumption for the elasticity of output with respect to capital. However, our sensitivity analysis suggests that the capital share is not crucial here, although it is important for the estimated level of TFP growth (Annex Table 3). Instead, the starting assumption on the capital output ratio appears crucial. Only a relatively low starting assumption generates TFP growth in the period since 1993 that is higher than in the period 1978-1993.

1/ Assuming Cobb-Douglas technology, and a capital-output ratio of 2.4 in 1978 (as in Wang and Yao, 2002; Chow, 1993; Hu and Khan, 1997), depreciation of 5 percent per year (as in Wang and Yao, 2002), and an elasticity of output with respect to labor of 0.5, as in Wang and Yao (2002), and broadly the average of the range. The update presented in Table 1 further separates out an estimate of the contribution of human capital accumulation, using Barro and Lee data and an assumption of the rate of return to education of 10 percent.

2/ In end-2005, China's National Bureau of Statistics revised the production-side GDP, with better coverage of the service sector. 2004 GDP was revised up by almost 17 percent. In the update, the contribution of capital accumulation in 1993-2005 is 61 percent, rather than 62 percent, while TFP growth—including the estimated contribution of higher human capital—is 3 percent, instead of 2.7 percent.

3/ The Bosworth and Collins results do not differ with respect to the large and increasing contribution to growth of capital accumulation.

### Box 1 (continued). Growth accounting for China

Table 1. Sources and aspects of growth (1978-2005) \*  
(average annual increase, in percent)

	1978-93	1993-2005
GDP growth	9.7	9.6
Employment growth	2.5	1.1
Labor productivity growth	7.0	8.4
From TFP growth	3.3	2.8
<i>of which:</i> from reallocation of labor b/t sectors	1.3	1.1
From increasing H/L	0.5	0.2
From increasing K/L ratio	3.2	5.3
Memorandum items (in percent)		
Investment/GDP ratio (period average)	29.9	36.8

Source: NBS, and staff estimates.

\* Methodology as in Kuijs and Wang (2006), but adjusted to identify the contribution of human capital, and on the revised GDP data.

TFP growth is likely to come down over time if growth were to continue on past trends and policies. First, as discussed, on most sets of assumptions, estimated overall TFP growth was lower in 1993-2005 than in 1978-1993, despite the impact from the price reform of the early 1990s and WTO accession. Second, much of China's TFP growth in the recent decade actually seems to have come from embedded technological progress rather than reallocation of factors. We estimate that reallocation of labor from low-productivity agriculture to higher productivity sectors contributed 1.1 percent to annual productivity growth in 1993-2005, compared to 1.3 percent in 1978-1993—close to other studies' estimates, including Bosworth and Collins and IMF (2006)—and that most of labor productivity growth is coming from within sectors (Annex Table 4). Bosworth and Collins, who estimate sectoral TFP growth, find that annual TFP growth remained flat in agriculture at 1.8 percent in the post 1993 period, declined to 0.9 percent in services, but doubled to 6.2 percent in industry.<sup>4/</sup> This appears in line with findings on other countries that a significant part of TFP growth is actually embedded technological progress. In all, as China catches up, without changes in patterns and policies—that is, without new sources of growth—TFP growth is likely to decline to levels more typically found in other regions (see Annex Table 2).

4/ Estimated TFP growth in the services sector is biased downwards by the high share of infrastructure investment in total investment in China. This is recorded in the tertiary sector.

percent of GDP, FDI has not been a key source of financing. Indeed, as in most countries, domestic savings has been the key source of financing. Thus, even as the investment to GDP ratio increased by 10 percentage points from 2000 to 2006, saving outpaced investment. As a result, China's external current account rose from 1.7 percent of GDP in 2000 to an estimated almost 9 percent of GDP in 2006.

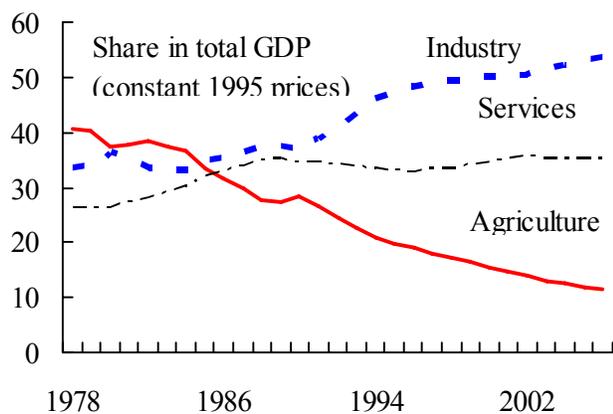
Much of China's high saving is done by enterprises, while China's government also saves considerably. Conventional wisdom has long been that enterprise investment was largely financed by households saving, and many discussions of China's high saving still focus mainly on household saving. Households in China save more than those in OECD countries, in part because they have to carry the bulk of the burden of health and

education and are worried about their pension. However, with household income around 60 percent of GDP, and with households now saving 25-30 percent of their income, down from more than 30 percent a decade ago, household saving has not been the driving force behind the impressive increase in China's domestic saving over the last decade. Indeed, much of China's high saving and investment, and the difference between China and other countries, is due to particularly high enterprise saving (see Kuijs (2005) for details). Since the end-1990s, rising enterprise saving has driven the impressive increase in economy-wide saving.

The third key feature is that much of GDP growth has been in industry. The bulk of GDP growth since the early 1990s has come from explosive growth of industrial production. Industrial value added increased on average 12.6 percent per year during 1990 and 2006, and the share of industry in GDP rose from 42 percent in 1990 to almost 49 percent in 2006 in current prices, among the highest for any country since the 1960s. In fact, the increase would have been larger but for declining relative prices of industry. In constant prices of 1995, the share of industry in GDP rose from 37 percent in 1990 to 53.5 percent in 2006 (Figure 2). In 2003-06, industry contributed 60 percent of total GDP growth, compared to 6 percent by agriculture and 34 percent by the services sector.

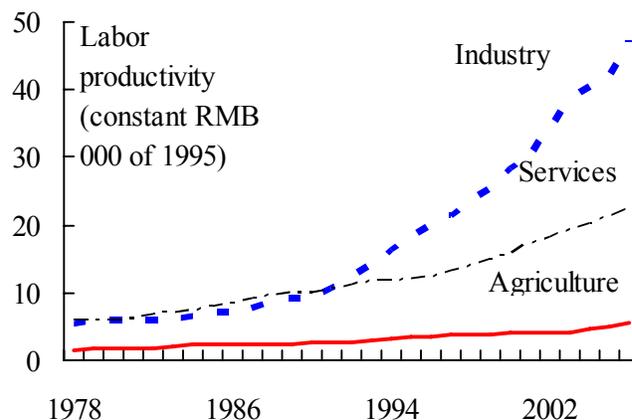
Industrial growth has largely been in the form of higher labor productivity (Figure 3). On the whole, 6/7<sup>th</sup> of the growth in industry during 1993-2005 was due to higher labor productivity rather than more employment. To a large extent this is due to the large-scale investment effort and increased capital-labor ratio. Of course, the low growth of industrial employment in this period masks important net movements of labor out of SOEs into private sector firms. Nevertheless, within firm productivity growth has also been very high. After having been virtually constant since the mid-1990s, employment in industry has picked up significantly since 2003. This may signal an end of the worst of large scale labor shedding in SOEs and the beginning of a change in trend, although it is too early to tell.

Figure 2. Industry has driven growth



Source: NBS, author's estimates.

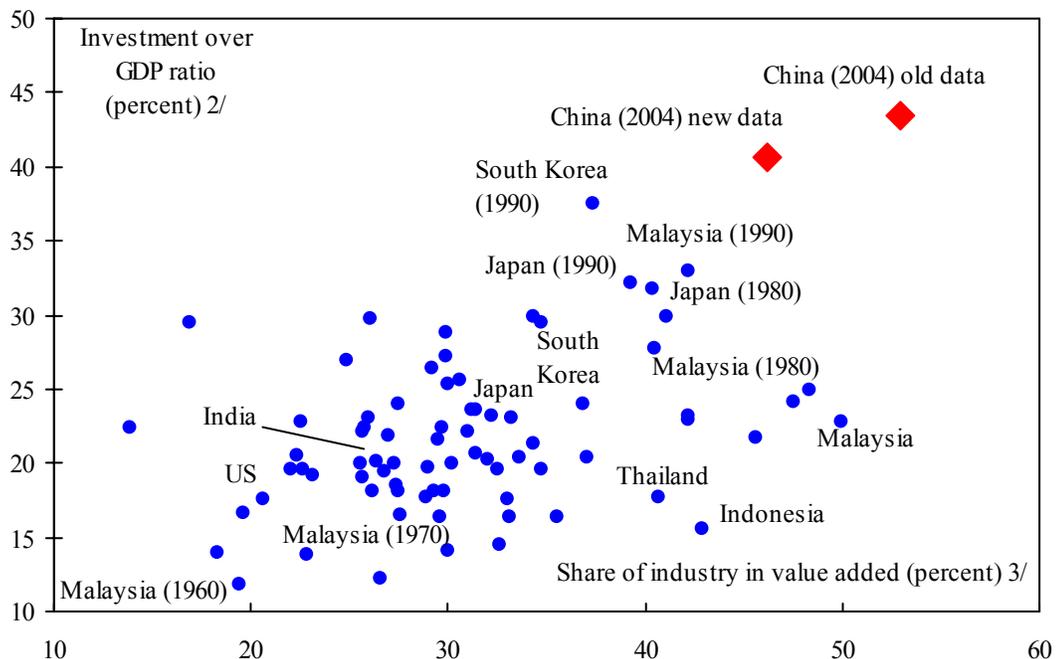
Figure 3. Labor productivity in industry has soared



Source: NBS, authors' calculation.

The importance of investment and industry are related (Figure 4). Industry is more capital intensive than other sectors. Relatedly, in industry a relatively large share of total income tends to go to capital in the form of interest and profits, instead of wages to labor. By the same token, industry requires a lot of investment, both to offset depreciation and expand capacity. Thus, much of industrial investment can be financed by internally generated cash flows. Another part of the correlation between industry and investment runs via government investment in successfully industrializing countries such as China. In these countries, heavy investment in infrastructure supports industrialization. The infrastructure pays off in terms of more growth and, indirectly, more government revenues. That is why the high government investment in infrastructure can continue and become part of the pattern of growth.

Figure 4. Industry and investment go together.



Source: World Development Indicators, NBS (for China), and authors' estimates.

The capital-intensive, industry-led growth pattern is largely a result of policies. The traditional pattern of growth is linked to China's traditional growth strategy. The government has subsidized and favored industry and investment over the services sector and domestic consumption in several ways. For example:

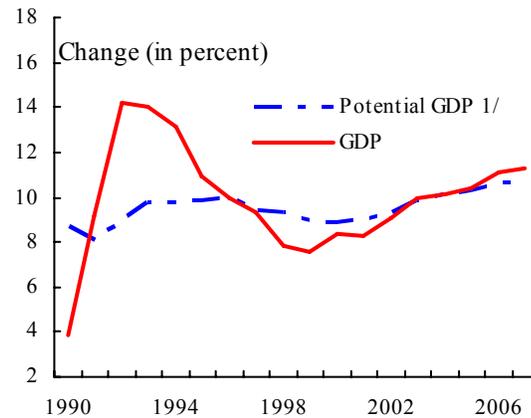
- Policies have encouraged saving and investment. Government spending has been geared to investment in physical infrastructure instead of current spending on areas like health and education. In addition, investment has been encouraged by exempting SOEs from paying dividend to the state, directing capital transfers and loans to SOEs and SOE-type entities, including for infrastructure investment, and tax exemptions for FDI. The use of government revenues for investment as

opposed to current spending has unintentionally also increased household saving. The retreat of the government in the areas of health and education during the reform period, which seems to have led to higher precautionary saving among households.

- Investment in industry has been encouraged in other ways as well. In the financial system, interest rates have been held low for those who have had access. Access has been easier for large, industrial firms. This has promoted capital intensive development in industry. The People's Bank of China (2004) estimates that small and medium-sized enterprises—which are significantly more prevalent in services than in industry—account for more than half of GDP but receive less than 10 percent of total bank loans.
- Industrialization has also been promoted, including by keeping the prices of inputs low. Besides capital, these inputs include energy, electricity, utilities (including water), and the pricing of environmental impact. On energy, while several energy subsidies have been removed, cheap electricity for industry, due to subsidies on coal for power generation, continues to encourage the establishment of electricity-intensive industry, fuel prices remain below world market prices, and a fuel tax is yet to be implemented. Besides environmental standards, the absence of rigorous enforcement of standards generally also promotes industry.
- Exchange rate policy may also have played a role in recent years. In particular, the reluctance to let the exchange rate appreciate in line with the reduction in unit labor costs in manufacturing—as productivity growth outpaced wage growth—has further stimulated the production of tradables.
- Prioritization of industry has also meant that the service sector did not get a lot of attention. A 2003 World Bank report concluded that “Service sector development suffers from restrictions and regulation and a lingering bias against private ownership” (World Bank (2003), and the OECD (2005) saw similar room for improvement on removing entry barriers and other barriers to the development of services industries. Recognizing these issues, China's State Council, in a document released in March 2007, called for an opening up of several service sectors—including telecommunications, railways, and civil aviation—to private and foreign investors and for an improved legal framework in the sector in order to stimulate the service sector.
- The containment of migration into urban areas has also shaped the capital intensive nature of growth. Migration has been slowed down by the Hukou system (Whalley and Zhang (2004)), discriminating regulations against migrant workers, non-portable labor and social benefits, and land tenure policies. As a result, much of the migration has taken place in the form of a growing “floating” population.

This capital intensive, industry-led growth pattern has served China well in many respects. The high saving and investment, combined with respectable rates of technological progress, mean that China's production capacity grew rapidly. In recent years, potential GDP growth, or the capacity to produce, has been increasing in line with actual GDP growth to over 10 percent per year (Figure 5). This means that the economy can grow rapidly without running into the kinds of problems that emerging markets often run into, such as high inflation, large current account deficits, and bottlenecks in the real economy. Thus, the above-mentioned policies have been key elements of a pro-growth and pro-industrialization policy package that also includes good macroeconomic management, trade liberalization, a favorable setting for FDI, good infrastructure, and pro-growth local governments.

Figure 5. Actual and potential GDP have grown steadily in recent years



Source: National Bureau of Statistics, World Bank.  
 1/ Estimated using a growth accounting framework with Cobb Douglas production function.

However, the capital-intensive industry-led growth pattern has also led to some developments that are increasingly seen as problematic by the government. These include the following downsides:

The first downside is that it may not be possible to finance the current capital-intensive mode of growth in the long run. This may not seem much of a worry at a time when the current account surplus is over 10 percent of GDP. However, the current pattern relies not just on high saving and investment rates. It relies on ever higher saving and investment rates. As discussed in Box 1, over time, more of growth has come from capital accumulation, and less from employment and TFP growth. If China would continue with rapid growth in the current mode of growth, the rates of saving and investment would need to increase to 50-60 percent of GDP in the decades ahead (see Table 2 below), which would be difficult to finance given pressures for saving to fall, including from demographics. Moreover, investment as such does not contribute to people's welfare.

Second, the industry-led growth has been particularly intensive in energy, primary commodities, and resources, and damaging to the environment. Because industry (including construction) is intensive in energy, commodities, and other resources, China's overall reliance on these inputs is high. China uses 4 ½ times as much energy per US dollar of output as the US (at market exchange rates), and 7 ½ as much as in Japan.<sup>4</sup>

<sup>4</sup> When economic activity is compared across countries using PPP exchange rates as calculated by the World Bank, China's energy intensity is closer to that in developed countries. However, estimates of PPP

China's energy consumption increased 70 percent between 2000 and 2005, contributing about ½ to the incremental increase in world energy demand in 2004 and 2005, and China has become the 2nd largest energy consumer after the United States. China now consumes more than 30 percent of the world total consumption of coal, steel, tin, and cement (Streifel, 2007). Emission and pollution are another problem. After a long period of declining NOx and SO<sub>2</sub> emission, these rose again since 2003, with the acceleration of heavy industry growth. China has become the largest source of SO<sub>2</sub> emission in the world and may soon become the largest emitter of CO<sub>2</sub>.

The third downside is that this pattern of growth has created fewer urban jobs than a more labor intensive pattern, and has in the process increased urban-rural inequality. Industry creates fewer urban jobs than services, and in 1993-2005, around 85 percent of the growth in industry has come from increased labor productivity instead of new employment, with industrial employment growing 1.6 percent per year in 1993-2005, compared to value added growth of 11.2 percent. As a result, absorption of agricultural surplus labor was largely left to the service sector, and has been moderate since the mid 1990s, especially taking into account the rapid overall growth. Indeed, urban employment growth has not been as high as it was in other South East Asian countries at similar stage of development, even though overall GDP growth in China now is higher than it was in those countries then. Urban employment growth slowed from 5.4 percent per year during 1978-93 to under 3 percent during 1993-2005. This limited the movement of people out of agriculture and the rural areas since the mid-1990s, where productivity and income are much lower (productivity in agriculture is about 1/6th of that in the rest of the economy, compared to a global average ratio of 1/3). While the share of total employment working in agriculture fell rapidly in 1978-95, the share did not fall much from the mid-1990s until around 2003. The reduction seems to have picked up speed since then, and the share fell to below 43 percent in 2006.<sup>5</sup> Nonetheless, this is high compared with other countries at a similar stage of development (Figure 6). The divergence of productivity has accentuated rural-urban income inequality, and is an important reason behind the increase in rural-urban income gap from 2.2 in 1990 to 3.3 in 2006, as well as the increase in overall income inequality as measured by the Gini coefficient.

The fourth issue is that a significant part of the growth in China stems from increasing production of manufacturing goods, with a tendency for increasing current account surpluses. While demand and supply in China's economy are growing broadly in line with each other, a significant share of the demand is coming from abroad, instead of Chinese households and businesses. Under the investment-heavy, business-friendly

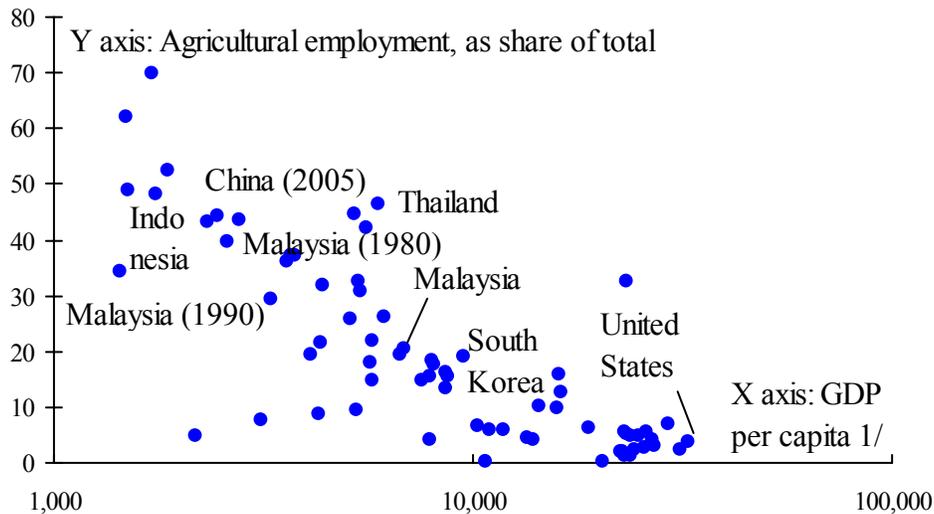
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vary considerably and some alternative exercises suggest a significantly smaller gap between the PPP exchange rate and the market rate.

<sup>5</sup> Appendix I discusses concerns that the actual agricultural employment share in recent years is substantially lower than the official data, and the implications for the results and conclusions of this paper. It finds that the results and conclusions would be qualified but not be materially affected by the estimates of researchers including Cai Fang (2007). There are estimates of the agricultural labor share that are substantially lower. If these are true, the results and conclusions for this paper would be materially affected. However, if these are true, the general understanding of China's economic history and of developments in and outside agriculture would be materially affected.

pattern of growth, and with surplus labor in agriculture keeping wage growth below productivity gains, production in China has tended to outstrip domestic demand.

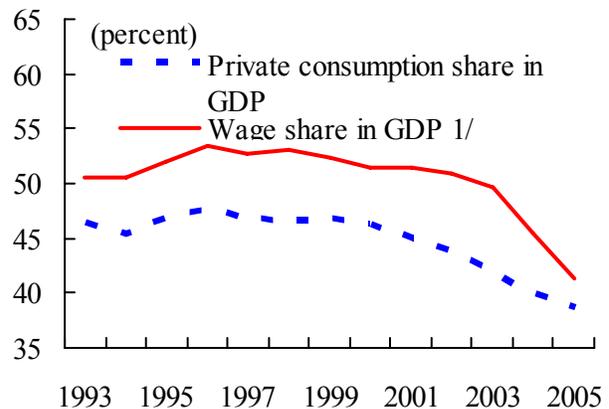
Figure 6. China still has a large share of employment in agriculture



Source: WDI, NBS, authors' calculation. 1/ 2001, unless otherwise indicated.

From the external perspective, accelerating manufacturing production means continued strong export expansion, whereas import growth has been more subdued, in part because of increasing import substitution. As a result, the current account surplus is rising steadily. Having reached 9.5 percent of GDP in 2006, the current account surplus has become the key source of China's impressive balance of payment surpluses. As the People's Bank of China buys the associated foreign exchange, it needs to sterilize the purchases by issuing central bank paper, which creates tensions and risks in its balance sheet. Moreover, a large difference between production and domestic demand in a large country like China can contribute to global imbalances and trigger trade tension. In terms of the distribution of income, the flipside of the increase in enterprise income and buoyant tax revenues is that wage income, and household income in general, has declined as a share of GDP. The wage share declined from 53 percent in 1998 to 41.4 percent in 2005 (Figure 7) (see World Bank, 2007 pp 6-7 for more detail).

Figure 7. The wage share has declined



Source: National Bureau of Statistics.  
1/ From Statistical Yearbook.

The declining role of wages and household income in the economy are the key driver behind the declining share of consumption in GDP since the late 1990s. Aziz and Cui (2007) find that a decline in households' investment income, largely because of declining interest rates, has amplified the reduction of the share of household income in GDP.

### III How could China grow in the future?—3 scenarios

In this section, we discuss 3 scenarios for China. We will discuss the pattern of growth and the impact of policies. The first scenario is “on past trends”, with policies and settings broadly unchanged from what they were in the recent decade. The second one is the central “rebalancing” scenario, with policy adjustments and reforms. The third one is with more ambitious rebalancing. The scenarios are modeled with the DRC-CGE model of the DRC to study the impact of different types of growth on the structure of production, demand, employment, and income distribution.

China's government has recently already made important first steps towards rebalancing. More measures are in the pipeline. Thus the “on past trends” is clearly not the default scenario. If anything, the “rebalancing” scenario is the default scenario.

While the first two scenarios differ in the nature of growth, they do not show materially different overall GDP growth. Given that there is still a lot of room for productivity catch up and reallocation of labor, in a benign setting China should be able to grow rapidly for another few decades in both scenarios, with the key differences between the 2 scenarios relating to the drivers and structure of growth. After discussing in this section “how may China grow?”, in section IV we focus more on the pace of future growth.

The first scenario, *on past trends*, includes only limited rebalancing away from the past trends of growth (Table 2). Growth remains largely investment-led and driven by industry. Thus, it has high saving and high investment, with corporate saving playing an important role while household saving also remains high. Patterns of employment growth and total factor productivity (TFP) are expected to continue as they have been in the recent decades. That is, employment would grow somewhat slower than the working age population, higher efficiency would play a modest role, and TFP growth would edge down over time.<sup>6</sup> This scenario is calibrated as follows. Employment is projected using demographic projections.<sup>7</sup> Using the Cobb Douglas production function, we calculate how much investment is necessary to reach a target rate of growth of GDP, assuming some moderation of TFP growth over time. In line with government objectives, the target rate of GDP growth is over 8 percent in 2005-15, under 7 percent in 2015-25, and 5½

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<sup>6</sup> As discussed in box 1, under certain assumptions on the production function, TFP growth has not fallen over time. Nonetheless, we would argue that on current policies and trends, TFP is still likely to fall in the medium term.

<sup>7</sup> Currently, China's participation rate—the labor force as a share of the population 15-64—is high. Official unemployment is low. As a result, the employment rate (employment over population 15-64) was 81.3 in 2003, high compared to other countries. Looking ahead, there will be forces bringing down the employment rate. These include more and longer education and improvements in the social safety net. The “on current trend” scenario assumes that the employment rate goes down by 0.4 percentage point per year. The employment rate would then be 73 in 2025.

percent in 2025-35. In section IV we will come back to the projected rate of growth, including by comparing it to other forecasts and to the experience in other countries.

Table 2: China, growth patterns on past trends  
(in percent)

	1993-2005	On past trends			
		2005-15	2015-2025	2025-35	2035-45
GDP growth 1/	9.6	8.3	6.7	5.6	4.6
Total employment growth	1.1	0.1	-0.5	-0.9	-1.1
Labor productivity growth	8.4	8.1	7.2	6.6	5.7
From TFP growth	2.8	2.5	2.2	1.9	1.6
From higher K/L	5.3	5.3	4.7	4.4	3.8
From higher human capital	0.2	0.3	0.3	0.3	0.3
Investment/GDP ratio (period av.)	37	44	49	55	60
Share industry in GDP (eop)	49	50	50	51	...
Share employment in agriculture (eop)	45	38	36	33	...
Urbanization rate (eop)	43	50	52	55	...
Urban-rural income disparity (eop) 2/	3.8	4.0	4.4	4.6	...

Source: NBS (2007), and authors' estimates.

1/ Potential GDP growth. In 2005-07, actual GDP growth is assumed to differ from potential GDP growth. From 2008 onwards, actual growth is assumed to equal potential.

2/ 2002 prices.

Factors and resources will continue to be channeled particularly to industry, instead of services. This is so because the relative attractiveness of industry v-a-v services remains broadly unchanged. The DRC-CGE model suggest that with a policy setting “on past trends”, the share of industry in GDP (“secondary industry”) would edge down only 2 percentage point between 2005 and 2035 (Table 2), despite rapid development that would in normal circumstances lead to a lower share of industry. The share of services (“tertiary industry”) would increase, by almost 9 percentage point, but in 2035 the secondary sector would still be almost as large as the tertiary sector.

How does this look on the dimensions of concern to the government?

Investment and saving would increase further. In this “on past trends” scenario, the policies that affect saving and investment patterns remain unchanged. Consistent with that, we find broadly “extrapolated” sectoral patterns of saving and investment (Table 3). In particular, with unchanged policies affecting industry and services, dividends, the labor market, and the financial sector, enterprise investment increases further over time in an increasingly industry and enterprise-led economy, with the increase matched by higher

enterprise saving.<sup>8</sup> Specifically, the calibration mentioned above would require an investment-to-GDP ratio of almost 50 percent on average in 2015-25 and even after that. With policies on health, education, and the social safety net unchanged, household saving also continues to rise. In all, in line with recent patterns, the current account surplus remains high despite high and increasing investment.

Table 3: Saving and investment patterns in 2 scenarios (2005-2045)  
(percent of GDP, period average)

	2005	On past trends		With rebalanced policies			
		2005-15	2015-2025	2005-15	2015-2025	2025-35	2035-45
GDP growth		8.3	6.7	8.3	6.7	5.6	4.6
Investment/GDP ratio (period av.)		44.3	48.8	34.6	31.5	29.2	26.1
GDP per capita, as share 2000 US GDP pc (eop)				9.1	16.9	29.2	46.8
Households							
Saving	16.2	17.2	18.2	15.7	14.7	13.8	12.8
Investment	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Saving-investment	10.4	11.4	12.4	9.9	8.9	8.0	7.0
Enterprises							
Saving	20.4	24.4	28.8	16.1	13.9	12.6	10.5
Net capital transfers received	4.5			3.9	2.7	1.6	0.5
Investment	31.3	35.3	39.7	25.6	22.4	20.1	17.0
Saving-investment	-10.9	-10.9	-10.9	-9.5	-8.5	-7.5	-6.5
Government							
Saving	5.7	5.6	5.5	5.2	4.4	3.5	2.7
Direct investment	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Capital transfers	-4.5			-3.9	-2.7	-1.6	-0.5
Saving-investment	2.4	2.3	2.3	1.9	1.1	0.2	-0.6
China							
Gross domestic saving	42.3	47.2	52.6	37.0	33.0	29.9	26.0
NFI + net transfers	1.6	2.2	3.5	2.2	3.5	3.3	2.5
Investment	40.4	44.3	48.8	34.6	31.5	29.2	26.1
Gross domestic saving-Investment	1.9	2.9	3.8	2.3	1.5	0.7	-0.1
Gross national saving (above the line)	43.9	49.4	56.1	39.2	36.5	33.1	28.5
Discrepancy	3.6	0.9	0.0	0.9	0.0	0.0	0.0
Gross national saving (below the line)	47.5	50.3	56.1	40.1	36.5	33.1	28.5
Current account (bop data).	7.2	6.0	7.3	5.4	5.0	4.0	2.4

Source: NBS (2005), and staff estimates.

In this industry-led scenario, the energy and resource intensity would continue to be high, and pollution and emission would continue to rise rapidly.

Limited urban job creation would further accentuate urban-rural income disparity and overall inequality. This scenario would continue to see only moderate urban employment growth and a moderate labor flow out of agriculture, leaving a relatively large share of people employed in agriculture (Table 2). In 2035, 33 percent of total employment would

<sup>8</sup> In the sectorally disaggregated saving-investment projections, we assume that household investment and government investment are constant as a share of GDP. Much of enterprise investment is saved by the enterprise sector, in line with recent patterns.

still be employed in agriculture, a high share for a country with a per capita income of around \$10,000 at that time, in prices of 2000. Consequently, urbanization would continue, but at a modest rate, to around 55 percent in 2035. The labor productivity gap between agriculture and the rest of the economy would rise further, and the rural-urban income disparity would remain high, with urban per capita incomes 5 times higher than rural ones (in constant prices) in 2035, compared to 3.8 in 2006. Income inequality as measured by the Gini coefficient would rise further from 0.46 in 2005 to 0.48 in 2035.

Clearly, continuing with the past pattern will become increasingly difficult, economically, environmentally, and socially.

Rebalancing the economy and creating a harmonious society have now firmly become economic policy objectives. The government's 2007 work programs presented at the National People's Congress in March indicated that, while rapid economic growth remains important, the government aims to improve the quality of economic growth, rebalance the growth pattern, and strive towards a harmonious society. The government would like to move to growth that is less intensive in resources and capital, cleaner, more knowledge-driven, and more equally distributed. On the macroeconomic side, the government would like to change the composition of demand, relying more on consumption and less on exports and investment, and to reduce the external surplus.<sup>9</sup>

In terms of the overall economic strategy, rebalancing means a shift in the pattern of growth. This shift means, on the production side, more growth of the services sector instead of industry and, on the demand side, a larger role for consumption instead of investment and exports. Such a shift in the economic structure would address many concerns. It would make growth less intensive in energy, raw materials, and resources, and less detrimental to the environment. It would also make growth less capital intensive, allowing China to grow with lower saving. Improving efficiency would play a larger role, as well as increasing human capital. Moreover, it would mean more labor intensive growth, with more urban employment creation, and therefore more TFP growth coming from reallocation of labor out of agriculture. By reducing excess labor in agriculture, urban job creation is also the key to reducing poverty and urban-rural inequality. Finally, it would ameliorate the pressures for overproduction of goods and current account surpluses.

Broadly, 5 types of policies would help rebalancing. In many of these areas, policy plans and/or proposals are in the pipeline, although that does not mean that they will be introduced soon.

First, several macroeconomic measures—largely fiscal—to stimulate domestic consumption, reduce domestic saving, and stimulate the services sector:

- Shift government spending from investment to health, education, and social safety. The government plans to raise the ratio of fiscal spending on education to GDP to

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<sup>9</sup> These objectives are quantified by “anticipative” benchmarks in “Special Column 2” of the 11<sup>th</sup> 5 year plan.

4 percent. Specific policies include the central government's commitment on funding to gradually ensure free 9 years compulsory education in rural areas. In health, the government decided in October to reform medical insurance to ensure access to *primary* health care for everyone, including rural people, before embarking on the more complex overhaul of the health system.

- Speed up financial market opening and reform, to improve the efficiency of the allocation of capital—thus keeping growth up with less investment—and increase the role of consumption.
- Establish a dividend policy for State Owned Enterprises (SOEs) and improve corporate governance, to remove an over-investment bias. An SOE policy is scheduled to be introduced in 2008.

Second, several price and tax measures would help rebalancing by readjusting the relative attractiveness of manufacturing production (tradables) over producing services (non tradables):

- Increasingly allow the exchange rate to move in response to underlying pressures, which at moment would imply an appreciation;
- Adjust the price of inputs into manufacturing—land, energy, water, utilities, natural resources, and the environment—bringing them in line with relative scarcities and social preferences. The government has indicated that “industrial policies, fiscal and taxation policies and pricing policies shall be amended to encourage environmental protection.” At the technical level, plans to introduce a fuel tax are much-advanced.
- Remove distortions in the tax system subsidizing and stimulating manufacturing, including from the VAT system and preferential tax treatment of FDI, notably on corporate taxes. The government has recently agreed to unify corporate tax rates for domestic and foreign companies. Further measures could include introducing a VAT for services.<sup>10</sup> Removal of other preferential treatment of FDI may also be appropriate.<sup>11</sup>
- Remove remaining restrictions on the development of a thriving services industry. Addressing, as planned, monopolies and oligopolies in several service sectors would be important, as is removing other barriers including by vigorously implementing WTO agreements.

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<sup>10</sup> This measure may seemingly contradict the government's efforts to promote services as a source of growth. However, because most economic decisions are influenced by local rather than central government, it is important to provide local governments with a fiscal incentive to promote this sector—namely the local share in VAT revenues.

<sup>11</sup> Lardy (2006) discusses the considerations surrounding possible tax cuts.

Third, further relax restrictions on the movement of labor and land transactions to facilitate rural-urban migration and mitigate rural poverty. Further, the fiscal system could be improved to provide host cities with more incentives to deliver social services to incoming migrants.

Fourth, introduce institutional reforms that give local decision makers stronger incentives and better tools to pursue rebalancing.<sup>12</sup> Central here is the performance evaluation of local officials. The recent measure to include land revenues in the local government budget, rather than as part of the extra-budgetary funds managed by the land bureau, could improve the governance of these funds and reduce the incentive to pursue a land-intensive development pattern.

These policy reforms have been modeled with the DRC-CGE model for China. Appendix II describes the model and the specific on how the reforms are simulated. The modeling is easier for some reforms than for others. Some reforms could not be modeled, or could not be fully modeled in the GE model. For instance, while the shift in government spending from investment to health, education and the social safety net is modeled, it was difficult to capture the effect on precautionary saving. In response, we have assumed an effect. Also, while energy is included in the model, land and water are not. This means that we could not capture the impact of higher land and water prices on rebalancing. As a result, the “rebalanced” scenario does not fully capture all the rebalancing policies discussed above. In other areas, it was difficult to separate the impact of specific parts of the rebalancing policy package. For instance, on the labor market, it was difficult to fully separate the factors behind more supply of agricultural labor to urban areas and higher demand for labor in a more labor intensive pattern of growth. This means that it was not possible to simulate separately the effect of these 2 sets of policies/reforms. Nonetheless, overall the GE modeling shows that the rebalancing scenario is (a) reasonably convincingly associated with the identified policy package and (b) internally consistent. This increases our comfort with the results, despite some of the difficulties and complexities.

In addition to these reforms, many important sector-specific policies are under discussion and/or preparation.

### ***The central rebalancing scenario***

The second scenario, ***with rebalanced policies*** as discussed above, has more growth coming from services, and less from industry (Table 4). The contribution of the secondary sector to GDP declines by 13 percentage points through to 2035, while that of the service sector increases by 20 percentage point. On the expenditure side, more growth comes from consumption, and less from investment and exports. In this scenario, continued rapid growth will require significantly less capital accumulation. However, the rebalanced policies allow for higher efficiency gains (TFP growth). A substantial part of

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<sup>12</sup> As an indication that rebalancing is not yet top on the agenda of all local governments, local governments are still regularly attracting investors with preferential treatment in several areas, including land (see for instance regular “supplements” in the China Daily).

the improvement comes from more reallocation of labor, largely from rural to urban. For instance, in the first 20 years, this scenario has about 0.5 percentage point more TFP growth from reallocation of labor than the “on past trends” scenario. TFP growth gets additional support from more financial sector reform, better corporate governance, removing distortions and barriers hindering the development of the service sector, more R&D, and more development of human capital. A more employment-friendly setting also allows for somewhat higher overall employment growth. We assume that in this scenario employment grows in line with growth in the working-age population. This means that, even though saving and investment are significantly lower in this scenario, GDP growth is broadly the same as in the on past trends scenario.

Table 4: China, growth patterns in 2 scenarios  
(in percent)

	1993-2005	On past trends			With rebalanced policies		
		2005-15	2015-25	2025-35	2005-15	2015-25	2025-35
GDP growth 1/	9.6	8.6	6.9	5.6	8.6	6.8	5.6
Total employment growth	1.1	0.1	-0.5	-0.9	0.5	-0.1	-0.5
Labor productivity growth	8.4	8.5	7.4	6.6	8.0	6.9	6.2
From TFP growth	2.8	2.6	2.2	1.9	3.1	2.8	2.3
From higher K/L	5.3	5.6	4.9	4.4	4.4	3.7	3.4
From higher human K/L	0.2	0.3	0.3	0.3	0.5	0.4	0.4
Investment/GDP ratio (period av.)	37	44	48	53	34	30	28
Share industry in GDP (eop)	49	49	48	47	44	40	36
Share emp.mnt in agriculture (eop)	45	40	36	33	31	21	12
Urbanization rate (eop)	43	48	52	55	57	66	72
Urb.-rur. income ratio (eop) 2/	3.8	4.5	4.7	5.1	3.4	3.2	3.0

Source: NBS (2007), and authors’ estimates.

1/ Potential GDP growth. In 2005-07, actual GDP growth is assumed to differ from potential GDP growth. From 2008 onwards, actual growth is assumed to equal potential.

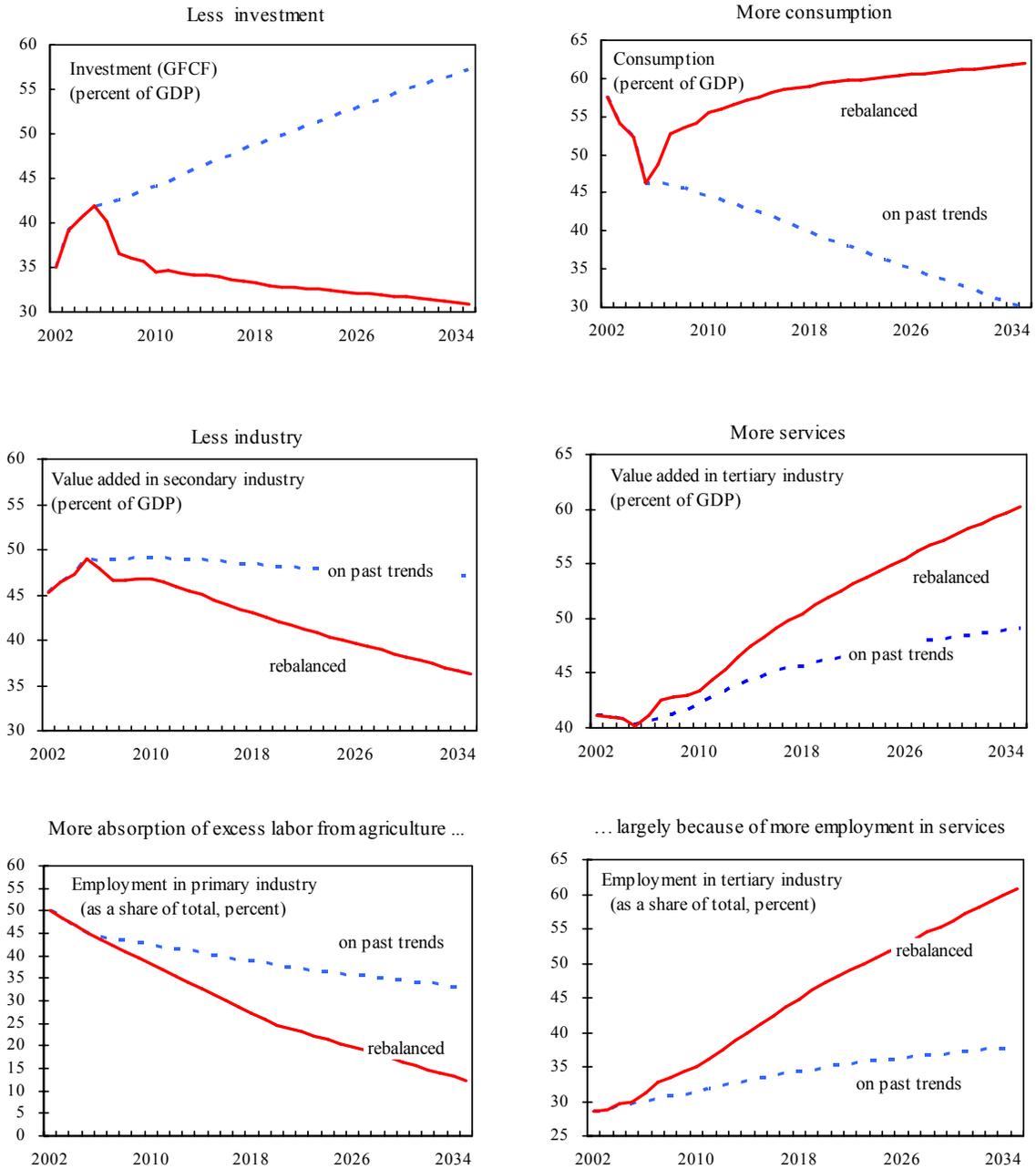
2/ 2002 prices.

As a result, it shows more balance in the dimensions noted above (Figure 8).

First, saving and investment would decline significantly over time because of policy reform. Saving and investment would be significantly lower than in the on past trends scenario, with the investment-to-GDP ratio averaging a more sustainable 34 percent in 2005-15 and 30 percent in 2015-25, compared to over 44 percent and 48 percent in the on past trends scenario (Table 3).<sup>13</sup> This lower overall investment-to-GDP ratio would be more consistent with prospective long-term trends in demographics and saving. Saving

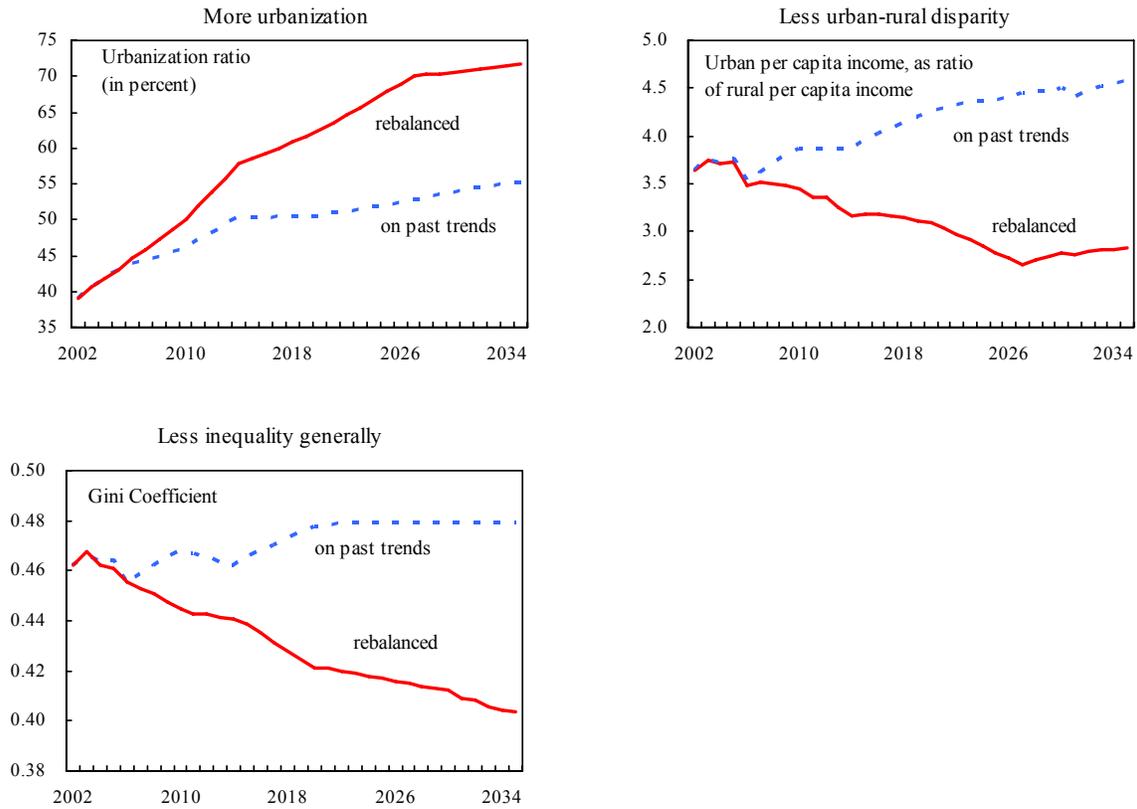
<sup>13</sup> Specifics about the long term saving and investment projections and the estimated impact of policy reforms are discussed in Kuijs (2006).

Figure 8: The impact of rebalancing



Source: NBS, DRC-CGE model, and authors' estimates.

Figure 8 (continued): The impact of rebalancing



Source: NBS, DRC-CGE model, and authors' estimates.

and investment are lower because of the policy reforms in the areas of the industry/services trade-off, dividends, labor market, and the financial sector. Thus, there would be less enterprise saving in a less capital intensive, less industry-based economy.<sup>14</sup> Moreover, reforms of government finance would result in lower government saving, with more current expenditure and less capital spending. Finally, reforms in health, education, and the social safety net would reduce the need for precautionary saving and thus allow household saving to decline as a share of GDP. Most of the adjustment in investment is driven by changes in the sectoral composition of income as opposed to changes in sectoral saving rates. In all, the current account surplus would gradually decline over time, as a share of GDP (Table 3).

Second, in this scenario China uses less primary commodities and energy, and produces less pollution. This is because it has less industry and, within industry, less heavy and

<sup>14</sup> In the sectorally disaggregated saving-investment projections, we assume that household investment and government investment are constant as a share of GDP. Much of enterprise investment is saved by the enterprise sector, in line with recent patterns.

dirty industry, in large part because of better pricing of energy, commodities, and environmental degradation. The difference in structure within these broader sectors is also telling, with in the rebalanced scenario significantly less heavy industry and construction, but more education, science, and technology (Table 5).

Table 5. Sectoral distribution of GDP, selected sectors, 2002 and 2035 (percent of GDP).

	2002	2035	
		on past trends	rebalanced
Agriculture	13.6	3.8	3.5
Coal mining	1.9	1.1	0.7
Chemicals	4.8	4.1	3.7
Metal smelting	3.1	3.2	2.3
Electronics	2.2	2.7	2.2
Construction	5.4	7.8	4.0
Finance	3.8	2.6	3.4
Education, Science, and Technology	5.5	11.3	14.2

Source: DRC-CGE model, authors' estimates.

Third, in this scenario the economy creates more urban employment and, as a result, more rural-urban migration, higher rural productivity and incomes, and less urban-rural inequality (Table 4). Urbanization would rise to 72 percent in 2035, compared to about 55 percent on past trends. At the same time, more urbanization stimulates the service industry, including via the spending patterns of urban residents.<sup>15</sup> Combined, these factors mean more urban employment growth and more transfer of labor out of agriculture. The share of employment in agriculture in this scenario would fall to 12 percent in 2035.<sup>16</sup> As a result, labor productivity in agriculture will rise much faster, supporting higher incomes there. The decrease in the productivity gap between agriculture and the other sectors would underlie lower urban-rural income inequality. The ratio of urban over rural per capita income would decline to 3 in 2035, while the Gini coefficient would decrease to 0.40 in 2035.

Fourth, in this more labor intensive urban growth scenario, household and wage income are significantly higher, as a share of GDP and, as discussed above, the current account surplus is substantially lower, than in the on current trends scenario.

<sup>15</sup> Urban residents spend 8 percent more of their income on services than rural residents.

<sup>16</sup> This may seem fast. However, it is not out of line with experiences in other South East Asian countries. South Korea witnessed a faster pace, from 50 percent in 1973 to 10 percent in 2001. Malaysia decreased its agricultural employment share from 37 percent in 1980 to 18.4 in 2001.

The objective to adjust the structure of the economy is largely a *medium to long term* objective, and it relates to *medium to long term* challenges. In the current institutional and policy setting, lower investment alone would just mean lower growth. This would be inconsistent with China's development goals, which feature GDP growth prominently. That is why reducing the importance of investment needs to be a gradual process and needs to go hand in hand with higher efficiency, more reallocation of labor out of agriculture, better allocation of capital, and a redirection of factors and resources towards sectors that require less capital. A conservative estimate about the efficiency gains to be gotten from rebalanced policies is all the more appropriate since implementing policies and processes to achieve the higher efficiency and redirection take time. At the same time, a declining investment to GDP ratio in a rapidly growing economy still means rapid investment growth. Investment needs remain high, in industry, for housing, and for urbanization. Typically, as countries develop, at some point the investment to GDP ratio falls significantly. However, in normal circumstances, that means still significant investment growth.

### ***More aggressive rebalancing***

This additional scenario models additional rebalancing on the environment and inequality. Here, the rebalancing becomes more costly in terms of overall growth. On the other hand, the impact on the environment and improvement in equality is greater. First, the government's policy of closing factories and mines with "outdated technology" is modeled—imperfectly—by speeding up depreciation of the capital stock. Second, the corporate income tax is increased by 30 percent, and the proceeds are distributed to low income households in rural areas. The income transfer from the enterprise sector to households reduces total saving and investment. These policies lead to lower overall GDP growth, with growth on average 0.4 percentage point lower. At the same time, there is less industry and more services. The output of key energy-intensive sectors will decrease by about 15 percent in 2035, relative to the central rebalancing scenario. Urban rural income disparity will decrease to 2.4 in 2035, compared to 3 in the central rebalancing scenario.

## **IV. How rapidly can China grow in the decades ahead?**

While there is significant uncertainty about how China will grow, there should be less uncertainty about the pace of growth. Our central scenario is one with non-aggressive rebalancing. As shown in section III, a scenario more akin to past trends would look quite different in many respects. However, it would look broadly the same in terms of overall GDP growth. This is because less growth from capital accumulation is compensated by more growth from efficiency improvements, including from better allocation of labor and capital, and some more overall employment.

Growth would gradually come down. On the basis of our long-term projection framework, using our assumptions on employment growth, capital accumulation, and technological progress, in a scenario without major economic or other setbacks, GDP growth would

gradually come down from over 11 percent in 2006 to around 7½ percent in 2016, under 6 percent in 2030 and 5 percent in 2035.

These growth projections are relatively high compared to other projections. Other recent international studies, which included China as part of a large set of countries, show significantly lower long term real GDP growth through 2030. Goldman Sach's revised BRICs study implies 5.4 percent through 2030, and the World Bank's recent Global Economic Prospects 5.7 percent. Economic projections made by the Chinese government and Chinese academics tend to show higher growth than the international studies (Appendix III summarizes recent Chinese projections). However, even these studies tend to have GDP growth that is a little lower than our long-term forecast.<sup>17</sup> That is largely because these projections were done before the revision of the GDP data, which showed higher growth of GDP and labor productivity, and before the realization of China's recent economic performance, which includes rapid growth without overheating. GDP growth has been over 10 percent in 2004-06 and the consensus projections for 2007 is over 10 percent. Importantly, this rapid growth is matched by an equally rapid rise in the capacity to produce, as opposed to being the result of overheating. In recent years, GDP has grown in line with potential, with potential GDP growth having been boosted by a spurt of particularly high investment and productivity growth as a result of restructuring of the economy and WTO accession (Figure 5).

Our forecast reflects the recent data revision and the strong recent performance. It is right to be conservative in long term forecasting, and our scenarios do include a significant easing of growth compared to the recent pace. Nevertheless, it is not clear why growth in the medium term would have to be much lower than the recent and current growth. Labor productivity growth averaged 8.4 percent in 1993-2005. But it was 9.3 percent in 2003-06. Our existing "rebalancing" scenario sees labor productivity growth easing to 8.0 in 2005-15 and 6.9 percent in 2015-25, largely due to lower capital accumulation and a gradual reduction in TFP growth over time.<sup>18</sup>

Importantly, China's growth will continue to be supported by relatively high investment. Even in the rebalanced scenario China continues to invest more than most countries (Table 4). Economic theory suggests that, other things equal, higher investment leads to higher labor productivity growth. Figure 9 confirms this relationship. High investment plays an important role in explaining China's track record, and is likely to continue to do so in the decades ahead.

How do these projections compare to the experiences of other countries?

Looking at the experience of other similar countries provides another bench mark. Japan and South Korea are useful comparators. They are also large East Asian countries that

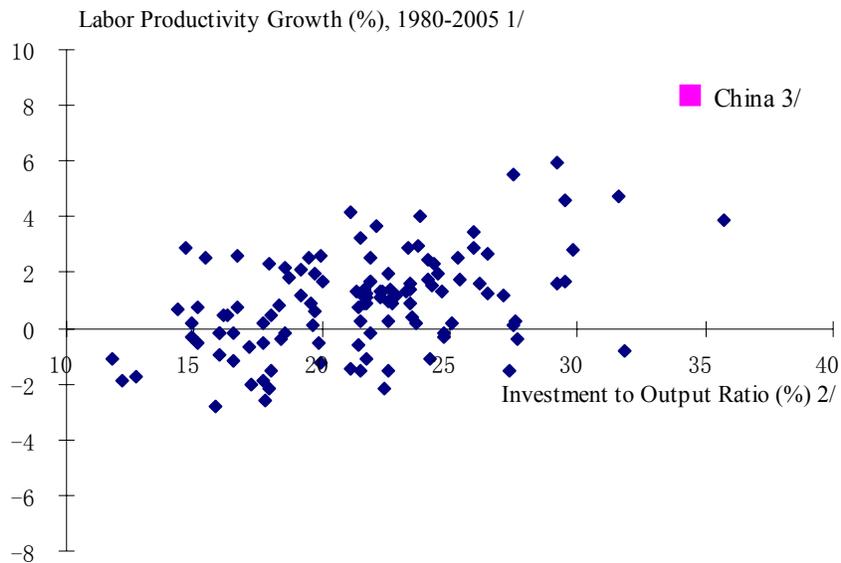
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<sup>17</sup> For instance, the 2005 study by Li and others of the DRC has average GDP growth of 8.1 percent in 2006-10 and 7.2 percent in 2010-20, compared to our average of 7.5 percent in 2010-20, with broadly similar contributions of labor, capital, and TFP as in our scenario. See appendix III for details.

<sup>18</sup> In the "on past trends" scenario, labor productivity growth is higher than in the rebalanced one, because of more capital accumulation. But TFP growth is lower.

pursued rapid, outward-oriented growth with a significant role for the government in the economy. And in these countries growth was also investment and industry-led, although the importance of industry and investment in those countries was never as high as it is in China now (Table 6).

Figure 9: High investment countries have more rapid labor productivity growth



Sources: World Development Indicators and staff estimates.

1/ In order to increase the number of observations, labor force is used instead of employment.

2/ Period average

Japan’s GDP grew 10.5 percent on average between 1960-70, even though in 1960 its level of GDP per capita, relative to the US, was at 16 percent significantly higher than China’s 4.5 percent in 2006.<sup>19</sup> While data are not available, employment growth must have been significant, implying that labor productivity growth must have been significantly lower than 10.5 percent. Nonetheless, Japan’s example in the 1950s and 1960s shows that prolonged rapid growth has precedents. With the investment to GDP ratio around 36-37 percent in Japan during the 1960s, capital accumulation contributed significantly to labor productivity growth. Real GDP grew “only” 4.5 percent per year during the 1970s, in part because of a much weaker world economy. But by 1970, Japan’s GDP per capita was already 39 percent of the US level (in current prices and exchanger rates).

<sup>19</sup> These comparisons are done using GDP per capita at current prices, in order to capture the possible amount of catch up. The often used indicator of comparing GDP per capita at 2000 prices would not indicate correctly the difference in living standards and room for catch up. Using GDP per capita at 2000 prices, Japan’s GDP per capita was already 65 percent of that in the US in 1965. That does not strike most observers as an appropriate indication of Japan’s catch up to the US at that time.

South Korea's GDP grew 9.4 percent on average between 1960-70, starting from a broadly similar relative GDP per capita position v-a-v the US as China is now. However, with rapidly growing labor force and employment, labor productivity growth was significantly lower at 5.7 percent on average in this decade. Key in understanding why labor productivity growth was not higher is that the investment to GDP ratio was still modest in Korea in the 1960s, increasing from around 11 percent in 1960 to 20 percent in 1970. As the investment to GDP ratio continued to increase, to around 30 percent in the 1970s and 1980s, Korea had higher labor productivity growth in the 1980s, an average 5.8 percent, even though it was by then more developed. Thus, capital accumulation was important in maintaining GDP growth of 8 percent during the 1970s and 1980s.

In benchmarking China's potential future growth to these and countries' experiences, a combination of factors supports our view that China may be able to continue to have labor productivity growth that is high, even compared to the experience of Japan and Korea. First, as mentioned, China is likely to have investment that is higher than most other countries even in the rebalanced scenario. Second, with a per capita GDP of 4.5 percent of the US level, China's starting position is still very low, implying a lot of scope for catch up. Moreover, compared to Japan and Korea at comparable level of development, China is now more open to foreign direct investment and technology, while globalization makes import of technology and ideas easier. This is probably another reason why growth of labor productivity and TFP in China now are higher than in these countries then.

Table 6. Sectoral developments in other countries (1960-2001)

	1960	1970 1/	1980	1990	2000
<b>Japan</b>					
Share in employment					
Agriculture	..	..	10.4	7.2	5.1
Industry	..	..	35.3	34.1	31.2
Services	..	..	54	58.2	63.1
Share in value added					
Agriculture	..	5.2	3.6	2.5	1.4
Industry	..	44.4	40.4	39.2	32.2
Services	..	50.3	56.0	58.3	66.5
GDP per capita, ratio US (2000 \$)	...	96	106	118	108
GDP per capita, ratio US (curr \$)	16	39	75	107	108
I/Y ratio (10 years backward)		35.6	34.1	29.9	29.0
GDP growth (10 years backward)		10.5	4.5	4.0	1.4
Labor productivity growth (10 years bw)				2.7	1.1
RER appreciation (10 yrs backward)		2.9	5.0	2.3	1.0
<b>South Korea</b>					
Share in employment					
Agriculture	..	..	34.0	17.9	10.9
Industry	..	..	27.8	35.4	28
Services	..	..	38.2	46.7	61
Share in value added					
Agriculture	..	..	..	..	4.3
Industry	..	23.7	32.5	37.3	36.2
Services	..	..	..	..	59.5
GDP per capita, ratio US (2000 \$)	...	11	14	23	31
GDP per capita, ratio US (curr \$)	5	5	13	25	28
I/Y ratio	...	20.3	29.0	31.0	35.0
GDP growth (10 years backward)		9.4	7.3	8.7	6.2
Labor productivity growth (10 years bw)		5.7	3.6	5.8	4.5
RER appreciation (10 yrs backward)		-2.6	5.6	1.5	-2.1
<b>Malaysia</b>					
Share in employment					
Agriculture	..	..	37.2	26	18.4
Industry	..	..	24.1	27.5	32.2
Services	..	..	38.7	46.5	49.5
Share in value added					
Agriculture	34.3	29.4	22.6	15.2	8.6
Industry	19.4	27.4	41.0	42.2	50.8
Services	46.3	43.2	36.3	42.6	40.5
GDP per capita, ratio US (2000 \$)	...	6	8	9	11
GDP per capita, ratio US (curr \$)	9	8	15	11	11
I/Y ratio	...	17.9	23.7	28.3	35.5
GDP growth (10 years backward)	...	...	...	5.6	7.2
Labor productivity growth (10 years bw)	...	...	...	2.9	3.8
RER appreciation (10 yrs backward)				-2.8	-1.3

Source: WDI. 1/ Some Japan data is for 1971. For S. Korea, 1960s averages from 1963.

## Appendix I. Concerns about the labor market data

There are concerns that the labor market data has not captured all the movement of labor out of agriculture into industry and services associated with migration.

According to the labor market data as from the NBS Statistical Yearbook (Table 5-2), which is considered the most comprehensive official data and the most commonly quoted, there were 340 million people employed in agriculture in 2005, or 44.8 percent of total employment.<sup>20</sup> The concern is that even though these data are supposed to exclude rural people that actually work in sectors other than agriculture, the actual number of people employed in agriculture is lower. The data do not reflect this in large part because of the difficulty of correctly classifying people who work partly in agriculture and partly in other sectors, including as migrants. Cai Fang (2007) estimates that in reality around 285 million people worked in agriculture in 2004, or 38 percent of total employment, and other experts' estimates, including from the Ministry of Labor and Social Affairs, are comparable. Brandt, Hsieh, and Zhu (forthcoming) have suggested that the agricultural employment share is as low as 32 percent. Researchers also note that migrants tend to be young, implying that a disproportionately large share of those still present in agriculture are older, presumably less employable people.

A debate is ongoing on what the implication of these findings are for the discussion in China about a possible exhaustion of the surplus labor in agriculture and a possible labor shortage. An overview of this discussion, together with some arguments why China may not face a labor shortage any time soon, in a Special Focus of World Bank (2007b).

For the conclusions of this paper, we limit the discussion to the implications for our analysis and results of actual agricultural employment in recent years being lower than the official data.

The estimate of Brandt, Hsieh and Zhu that the number of people still working in agriculture was only 31.6 percent of total employment would mean that productivity growth in agriculture has been much higher than previously thought, and productivity growth in the rest of the economy much slower. We calculated how using the estimates of Brandt and others would change the numbers. Using their estimates for employment in the 3 main sectors, the ratio of labor productivity between agriculture and the rest of the economy would not have increased over time, and would be 3.4 in 2005, as opposed to 6 using the official data.

If true, this would call for a substantial re-interpretation of China's economic history, because so far the understanding has been that, due to large scale restructuring and capital deepening in industry, labor productivity grew much faster than in agriculture in the last 15 years. This observation is not a sufficient reason to call into question the new

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<sup>20</sup> Holz (2006) notes that the SYB data on employment in agriculture is 20 percent lower than that in the Population Census. Comparing the sets of data, he suggests that this may be because of different treatment of people who work partly in agriculture and partly in other sectors.

estimates of the agricultural labor share. However, it does mean that one has to be sure that the estimates are consistent with the overall understanding of growth in China.

The estimations of Cai Fang (2007) that 38 percent of employment was in agriculture in 2004 suggest a more moderate adjustment. This would imply that the ratio of labor productivity between agriculture and the rest of the economy has risen over time to 4.2 in 2005.

Further on implications for the analysis of this paper, a lower agricultural employment share recently would mean that the contribution of reallocation of labor has in the past been higher than previously thought. Looking ahead, it would imply less scope remaining for reallocation of labor to contribute to TFP growth. If the estimates of Brandt and others are right, this adjustment would be significant. In that case, it would not be realistic anymore to argue—as we do—that overall GDP growth in the rebalancing scenario can be broadly the same as in the on current trends scenario. If the estimates of Cai Fang are broadly correct, the adjustment is substantially lower. In that case, our results and conclusions would not be materially affected.

## **Appendix II. Description of the DRC General Equilibrium model**

This appendix first gives a general description of the computable general equilibrium (CGE) model of the Development Research Center (DRC) of China's State Council, the various components, and the data used. It then discusses the implications of the 3 scenarios.

### **MODEL DESCRIPTION**

#### **General Description**

The model used for the simulations is DRC-CGE 2004, the CGE model (2004 edition) developed by the DRC. The model includes 34 production sectors; 14 representative households distinguished by area and income level; and 4 primary production factors: capital, agricultural labor, productive workers, and professionals. The 34 production sectors include 1 agricultural sector, 24 industrial sectors, and 9 services sectors.

#### **Production and Factor Market**

All sectors are assumed to operate under constant returns to scale and cost optimization. Production technology is represented by a nesting of constant elasticity of substitution (CES) functions. At the first level, output results from two composite goods: a composite of primary factors plus energy inputs (i.e., value-added plus the energy bundle) and aggregate non-energy intermediate input. At the second level, the split of non-energy intermediate aggregate into intermediate demand is assumed to follow the Leontief specification; that is, there is no substitution among non-energy intermediate input. The value-added plus energy component is decomposed into an aggregate labor and energy-capital bundle. Aggregate labor is further split into 3 types of labor: agricultural, unskilled non-agricultural (blue collar), and skilled non-agricultural (white collar). And energy-capital bundles are decomposed into energy bundle and capital. Finally, the energy bundle is made up of 3 types of base fuel components.

The model distinguishes two types of capital – new and old. This capital vintage structure allows the elasticity of substitution in the production function to vary for different capital vintages. This model also reflects the adjustment rigidity in the capital market. The model assumes that new capital goods are homogeneous while old capital goods are provided by the second-hand market. In a dynamic simulation, when one sector is in shrinkage, the capital deployed in this sector can be taken out partially. The supply curve of such old capital takes the form of a constant elasticity function of the relative return of old capital. The higher return of old capital in relation to new capital, the more supply will be available. But the return rate of old capital cannot exceed that of new capital.

#### **Foreign Trade**

The rest of the world supplies imports and demands exports. China's import prices are exogenous in foreign currency, in line with an infinite price elasticity. Exports are

demanded according to constant-elasticity demand curves, the price-elasticities of which are high but less than infinite.

### **Income Distribution and Demand**

Household income comes from labor and capital, as well as from profit distributed by enterprises and transfer payment from the government and overseas. Rural residents get labor income through agricultural labor and as productive workers while urban residents get labor income as productive workers and professional technicians. Capital income is distributed to residents and households. Household disposable income is used for consumption and saving. Households maximize their utility under the condition of meeting their budgets. The implied relations can be described with a Stone-Geary utility function, and the derived household demand function is the extended linear expenditure system (ELES).

Capital revenues are distributed among households and enterprises. Enterprise earnings equal a share of gross capital revenue minus corporate income taxes. A part of enterprise earnings is allocated to households as distributed profits based on fixed shares, which are the assumed shares of capital ownership by households. Retained earnings, i.e. corporate savings for new investment and capital depreciation replacement, equals a residual of after-tax enterprise income minus the distributed profits and fee.

The government collects tax from enterprises, households, and the foreign sector; makes transfers to households; and buys public products. Government income includes value-added tax, business tax, other indirect production tax, resident income tax and corporate income tax, and import tariffs. Subsidy and export return-tax are dealt as negative income of government. The key income source for the off-budget part of the public sector is fees collected from enterprises; this income is used in consumption and saving. Total public consumption and investment demand is determined by fixed expenditure shares.

### **Macro Closure**

Macro closure determines the manner in which the following three accounts are brought into balance: (i) the government budget; (ii) aggregate savings and investment; and (iii) the balance of payments. Real government spending is exogenous in the model. All tax rates and transfers are fixed, while real government savings is endogenous. Total investment expenditure must equal total resources allocated to the investment sector: retained corporate earnings, total household savings, government savings, and foreign capital flows. Investment is the sum of the separate endogenous saving components. This specification corresponds to the “neoclassical” macroeconomic closure in CGE literature. Meanwhile, the exchange rate is chosen as the model numéraire.

### **Recursive and Dynamic Structure**

The current version of the China's CGE model has a simple recursive dynamic structure as agents are assumed to be myopic and to base their decision on static expectations

about prices and quantities. The dynamic characteristics of the model are reflected in the following areas: (1) growth of production factors; (2) TFP growth and partiality of technological progress; and (3) the vintage structure of capital. In such a model structure, the basic factor driving structural change are the income demand elasticity of residents for different commodities (the Engel effect), the structural change of intermediate input demand resulted from technology change, and factor composition change resulting from different factor accumulation speeds.

In this model, the growth rate of population, labor and productivity is exogenous. The growth rate of capital is determined endogenously by the savings/investment relationship. At the aggregate level, the current capital stock equals the capital stock in the previous period minus depreciation plus total investment. But at the level of sectors their capital accumulation functions may vary because the demand in capital (including new capital and old capital) for some sectors is less than the depreciated old capital of the sector. The model assumes that producers use an optimal method to decide the vintage structure of production. When demand for a certain sector exceeds its production capability of existing capital, the producer of the sector will need new capital input. Otherwise part of its existing capital will be shifted to other sectors.

### **Data**

The model is calibrated to the 2002 Chinese Social Accounting Matrix (SAM) developed from the 2002 national Input-Output table. The SAM provides a consistent framework to organize the relevant statistics for China's economy to satisfy the requirements of a benchmark data set for CGE modeling. Some key parameters of the model – essentially substitution elasticities and income elasticities – were derived from a literature search. All other parameters – mainly shift and share parameters – are calibrated in the base year using the key parameters and the base data.

## **II SCENARIO IMPLEMENTATION**

### **On past trends scenario:**

1. Population growth and composition is exogenous.
  2. The ratio of intermediate input to gross output is exogenous, following historical trends.
  3. All tax rates are fixed at the base year level.
  4. Governmental consumption growth is exogenous.
  5. GDP growth is exogenous, at targeted level. TFP growth is exogenous, set to decline gradually following the trend from 1979-2005
  6. Total labor supply and agricultural labor supply are exogenous, depending on the demographic projections.
  7. Investment is endogenous, at a level necessary to obtain the targeted GDP growth.
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### **Central Rebalanced Policies scenario:**

1. Adjust the role of the government and shift government spending from investment to spending on health, education, and social safety; and strengthen pension system.

Specific: (i) Shift governmental spending from investment to health, education, and social safety.

(ii) Reduce the marginal propensity to save, stimulating consumption.

2. Speed up financial market opening and reform, in order to improve the efficiency of the allocation of capital and, simultaneously, increase the role of consumption.

Specific: Speed TFP growth for all sectors by 0.25 percentage point from 2007 to 2011 (five years).

3. Establish a dividend policy for State Owned Enterprises (SOEs), and improve corporate governance more generally, to remove an over-investment bias.

Specific: Increase the payment received by government from corporation and governmental spending on health and education. Speed up TFP growth for all sectors by 0.2 points according to the improvement in corporate governance.

4. Strengthen the nominal exchange rate;

Specific: RMB will appreciate by 10 percent from 2007 to 2011.

5. Increase the price of inputs in manufacturing—including land, energy, water, utilities, capital, natural resources, and the environment—getting them in line with relative scarcities and social preferences.

Specific: (i) Impose an energy tax of 50 percent, phased in over 5 years.

(ii) Remove a subsidy on the use of capital in manufacturing of 3 percent of value added.

6. Remove remaining restrictions on the development of the services industry.

Specific: Increase TFP growth for service sectors and adjust the ratio of intermediate input to reflect the improvement of the efficiency of service

7. Further relax restrictions on the movement of labor (labor market and Hukou system) and land transaction that facilitate rural-urban migration and mitigate rural poverty. Introduce institutional reforms that give local decision makers stronger incentives and better tools to pursue rebalancing. Further, the fiscal system could be improved to provide host cities with more incentives to deliver social services to incoming migrants.

Specific: Speed up the migration of labor from agriculture; increase fiscal spending on health and education.

8. Stimulate the transfer of land from agricultural to non-agricultural use.

Specific: The land transfer is 0.5 percent per year faster than in the On past trends scenario.

9. Introduce policies to help upgrade the production structure and promote the “knowledge economy”, including well-targeted government support for R&D and improving access to financing (“venture capital”) for innovators.

Specific: Increase TFP growth in line with more investment on R&D and innovation.

**Ambitious rebalancing scenario (additional rebalancing):**

1. Closing down “small, inefficient” mines, steel and aluminium factories, and comparable measures.

Specific: During 2007-2015, the depreciation rate of the capital stock is increased from 5 percent to 10 percent.

2. Increase government spending on the poor, financed by an increase in the corporate tax rates.

Specific: Raise the corporate income tax by 30 percent and distribute the proceeds to low-income rural households

### **Appendix III. Chinese long term forecasts**

#### **An Analysis of China Economic Growth Prospect for 2005-2020, March 2005**

By Li Shantong, Hou Yongzhi, Liu Yunzhong and He Jianwu

The report conducts simulations for China's long term growth prospect in 2005-2020 under three scenarios—a central “basic” scenario, a more positive “coordinated” scenario, and a less positive “risk” scenario—through a dynamic recursion China CGE model (DRCCGE2004). The Chinese economy is forecast to maintain rapid growth in 2006-10, at an average annual growth rate of about 8 percent. In 2010-20, the economic growth is projected to slow down, to an average rate of around 7 percent. In all scenarios, capital accumulation would be the most important driven force for rapid economic growth, while the contribution of labor would be very small. In the coordinated scenario, TFP growth would be higher than in the other two scenarios because of more technological improvements and efficiency gains, including in the use of resources. And in the risk scenario, the negative impact of slower labor flow absorption from agriculture to non-agricultural industries and less capital accumulation would lead to slower economic growth in the next 10-15 years, to around 6 percent on average.

#### **National Bureau of Statistics Forecast: Another 15 years' rapid growth in China, November 2005**

The NBS forecasts that China will maintain rapid economic growth in 2005-2020, with an average annual growth rate of over 8% before 2010, and a slower rate of over 7% in the next decade. Capital accumulation and TFP growth would be two most important contribution factors to such a rapid growth. Over the whole period, the contribution of capital accumulation would remain higher than 50 percent. TFP growth will make an increasing contribution to growth, which would be higher than 40 percent from 2010 on. In the meanwhile, the contribution of labor will continue to decline. The full text of this report (in Chinese) is available at: <http://finance.qianlong.com/26/2005/11/18/1100@2890290.htm>

#### **Analysis and Forecasts of China's Economic Development (2000-2050) (in Chinese), Dec. 1999, by Li Jingwen**

China's economic growth can be divided into three stages: the economy grows by an average annual rate of 8 percent in 2000-2010, at an average rate of 6 percent in 2010-2030, and further slow down to a rate of 4-5 percent in 2030-2050. Full text of this report is available at: 李京文：“21世纪中国经济发展预测与分析（2000-2050年）”，张卓元主编：《21世纪中国经济问题专家谈》，河南人民出版社1999年12月出版。

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**Annex Table 1: China's TFP growth estimates**

Source	Period	TFP growth (percent)
Jefferson and Rawski (1994)	1980-1992	2.4
Hu and Khan (1997)	1979-1994	3.9
Wang and Hu (1999)	1978-1995	2.9
Chow (2002)	1978-1998	2.7
Heytens and Zebregs (2003)	1990-1998	2.7
CSLS (2003) *	1980-2000	1.7
Wu (2004)	1982-1997	1.4
Kuijs and Wang (2006)	1993-2004	2.7
Hong Kong Monetary Authority (2006)	1978-2003	2.9
CEM update of Kuijs and Wang **	1993-2005	3.0
Hofman et al		3.0
Bosworth and Collins (2007) **	1993-2004	4.2

Source: HKMA (2006) table 1, Bosworth and Collins (2007)

\* This is the TFP growth of state owned enterprises.

\*\* On the revised GDP data.

**Annex Table 2: TFP growth rates of other countries**

Country	Period	Growth (%)	Country	Period	Growth (%)
Japan	1960-89	2	US	1960-89	0.4
Hong Kong	1966-91	2.3	Singapore	1966-90	1.7
S. Korea	1966-90	1.7	Taiwan	1966-90	2.1
UK	1960-89	1.3	Germany	1960-89	1.6
France	1960-89	1.5			

Source: HKMA (2006) table 2.

	Labor productivity	Capital accumul.	TFP growth (incl. from H/L)	Human cap. TFP growth accumul.
China (1978-1993)	7	3.2	3.8	3.3
China (1993-2005)	8.4	5.3	3	2.8
India (1993-04) 1/	4.6	1.8	2.7	2.3
East Asia, ex-China (1960-1980) 1/	4	2.2	1.7	1.2
East Asia, ex-China (1980-2003) 1/	3.7	2.2	1.4	0.9
Asia (1970-2005) 2/	3.7	2.0	1.7	0.9
Advanced economies ex-Asia (1970-2005) 2/	2.1	0.6	1.5	1.1
Latin America and Caribbean (1970-2005) 2/	0.4	0.3	0.0	-0.8
Other developing economies (1970-2005) 2/	0.8	0.5	0.3	-0.7

Contribution of capital accumulation to labor productivity growth

	in percent	in pp
China (1978-1993)	46	3.2
China (1993-2005)	63	5.3
India (1993-04) 1/	39	1.8
East Asia, ex-China (1960-1980) 1/	55	2.2
East Asia, ex-China (1980-2003) 1/	59	2.2
Asia (1970-2005) 2/	55	2.0
Advanced economies ex-Asia (1970-2005) 2/	29	0.6
Latin America and Caribbean (1970-2005) 2/	89	0.3
Other developing economies (1970-2005) 2/	62	0.5

Difference in contribution to labor productivity growth, other countries v-a-v China (1993-2005)

	Difference (percentage point)			Difference (% of total)	
	Lab prod	Cap acc	TFP	Cap acc	TFP
India (1993-04) 1/	3.8	3.5	0.3	92	8
East Asia, ex-China (1960-1980) 1/	4.4	3.1	1.3	70	30
East Asia, ex-China (1980-2003) 1/	4.7	3.1	1.6	66	34
Asia (1970-2005) 2/	4.7	3.3	1.3	70	28
Advanced economies ex-Asia (1970-2005) 2/	6.3	4.7	1.5	75	24
Latin America and Caribbean (1970-2005) 2/	8.0	5.0	3.0	62	37
Other developing economies (1970-2005) 2/	7.6	4.8	2.7	63	35

1/ Bosworth and Collins (2007)

2/ IMF (2006).

**Annex Table 3: TFP growth estimates other countries**

	K/Y 1978 = 1.6		K/Y 1978 = 2.4		K/Y 1978 = 3	
	78-93	93-05	78-93	93-05	78-93	93-05
<b>Capital share = 0.4</b>						
Share cap acc 1/	48	50	37	49	32	48
TFP growth	3.4	4	4.4	4.1	4.9	4.2
<b>Capital share = 0.5</b>						
Share cap acc	60	63	<b>46</b>	<b>61</b>	40	60
TFP growth	2.5	2.9	<b>3.8</b>	<b>3.1</b>	4.4	3.2
<b>Capital share = 0.6</b>						
Share cap acc	72	75	56	73	48	72
TFP growth	1.6	1.9	3.1	2.1	3.9	2.2

Sources: Staff estimates.

1/ Contribution of capital accumulation to GDP growth (in percent)

2/ This includes the contribution of increasing human capital

The results are not very sensitive to changing the assumption on depreciation. With more depreciation, 10 percent instead of 5 percent, and a capital share of 0.5 and a K/Y ratio in 1978 of 2.4, the contribution of capital accumulation would be broadly similar at 36 and 62 percent, respectively. TFP growth would be 4.3 and 2.8 percent.

Annex Table 4. China: sectors' contribution to overall labor productivity growth (1978-2005) (average annual increase, in percent)

	1978-93	1993-2005
Labor productivity 1/	6.8	8.3
From shifts in employment b/t sectors	1.3	1.1
From organic productivity increase in sectors	5.5	7.3
Agriculture	1.4	0.8
industry	2.6	4.7
Services	1.5	1.8

Source: NBS, Kuijs and Wang (2005), and author's estimates.