China's Economic Growth outside the Farm Sector: Plausible Trends towards 2030

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1. Introduction

In the past three decades, China has enjoyed almost unparalleled economic growth with an average annual rate of over 9.5 percent between 1978 and 2007. This growth, which is in sharp contrast to the growth rate of roughly three percent in the rest of the world, has lifted China from a poor developing country to one of the top four economies of the world (World Bank, 2007). The vast size of Chinese economy and population, in combination with its increasing integration with the global economy, suggests that China's future growth over the coming decades will have important implications for the world economy. This prospect has captured the imagination of media commentators and researchers and led to a large body of literature trying to explain China's past economic growth and to assess its future growth potentials.

In the popular literature, opinions on China's future growth potentials are sharply divided, although less so on explaining China's past success. The division ranges from outright pessimism about China's future to fearing the threat of a strong China. For example, Brown (1995) wonders who will feed China. Chang (2001) proclaims the coming collapse of China. Terrill (2003, pp. 329, 313) highlights the "illusory nature of the market in most of the Chinese economy" and that "a crash looms because the Leninist core of the regime is unchanged from Mao's construction of it in Yan'an six decades ago". At the other end, Murray (1998) proposes China as the next superpower. A number of authors view an all-powerful China as a threat (cf., Gertz, 2000; Timperlake and Triplett II, 2002; Broomfield, 2003). Despite special insights these publications offer, a systematic study of future economic growth in China that makes full use of the hard facts already available today is largely missing in this popular literature.

In the academic literature, there is a huge body of studies tries to explain China's past economic success. Much of the transition literature attributes the success to institutional changes in Chinese style (e.g., Qian, 2000, 2003; Woo, 1994, 1999). Lin et al. (2003) accredit China's reform success to the shift from a heavy industry-oriented, "comparative advantage defying" development strategy to a "comparative advantage following" strategy. Others explain China's past economic growth based on factor-input contributions within the aggregate production framework (e.g., Wang and Yao, 2003; Wu, 2004; Young, 2003). Inquiries to the question of what we know today about China's growth prospects tomorrow are mainly conducted within the framework of growth accounting (e.g., Chow and Li, 2000; Chow, 2002; OECD, 2005; Holz, 2008; Herd and Dougherty, 2007). Growth accounting decomposes GDP growth into growth of variables other than GDP. In other words, growth of GDP is "explained" by the weighted growth rates of other variables. If there is a stable relationship in the past between GDP growth and the growth of the variables into which GDP is decomposed and if this stable relationship is likely to

continue into the future, then information about the future value of these "explanatory" variables allows derivation of future GDP growth (Holz, 2008).

The key message conveyed by this growth-accounting based inquiry into China's future growth potential is that past economic growth may continue into the future if current and future problems continue to be resolved as they arise and events of catastrophic dimensions (such as war across Taiwan Straits) do not occur. There are two intuitive reasons to support this "regularity" in relationship. First, if we follow the income approach to the calculation of GDP and decompose GDP growth into the growth of labor productivity, the growth of employment relative to the growth of the working population and the growth of working age population to the total population, we can use our knowledge of today about the future number of laborers and their education levels, as well as the plausible projection of labor productivity growth to derivate future GDP growth. In more details, we know with near certainty the size of China's working age population through 2020 and can project with high reliability for 2030. With regard to educational levels, a bottom line scenario can be developed based on recent development in high school and university enrollment, most of which are unlikely to be reversed. Consequently, future GDP growth can be recomposed using these reliable knowledge about the future quantity and quality of labor available today, plus an in-depth scenario analysis of plausible labor productivity growth.

Second, as Holz (2008) highlights, China's economic growth in the reform era matches standard growth patterns identified by theories of economic development and trade, which include structural change, technological catching up, and factor price equalization (cf. also, Sun et al., 2008). Furthermore, employing these three analytical frameworks, Holz (2008) shows that China's growth experience during the reform period matches those of Japan, Korea, and Taiwan at an earlier stage of their development. Although these four economies are different and so are the domestic and international circumstances under which they experienced a specific stage of development, these differences need not be systematic and alter theoretical relationship between GDP growth and structural change, technological catching up, or factor price equalization.

The objective of this report is to develop a set of plausible scenarios on total and non-agricultural GDP growth at both the national and regional level for China. We first adopt the growth accounting framework for setting up the benchmarks. Then, we make two sets of adjustments. The first set of adjustments is based on our understanding on the current and future development policies and their likely impact on the national and regional economies. The second set is based on our in-depth study on incorporating technology diffusion, factor mobility and structural change into growth regression cross Chinese provinces (Sun et al., 2008), the evolving spatial patterns of capital flow (Zhang, 2008), and an out-of-box explanation for China's high saving rate (Wei and Zhang, 2008).

Why is it worth putting such great research efforts to develop GDP growth scenarios? It is due to the following two set of reasons. First, on the one hand, in order for both CHINAGRO Model and CATSEI Project to focus on the crop-level details in the agricultural sector, growth in the non-agricultural sectors is set to be exogenous. On the other hand, household incomes, even for the majority of rural households, become increasingly dominated by incomes from the non-agricultural sector, which drive households' demands for food. This feature of dual income source of Chinese farmers deserves great care and research attention. Second, while economic development has been

the primary goal of China's future policies, China also concerns its national food security. Food expenditure has accounted for a large proportion of household expenditure, especially among low income groups. Existing literature suggests that different assumptions on the income growth could lead to scenario shifts from a large food deficit (OECF, 1995) to moderate (World Bank, 1997; IFRPI, 2001) and even only small deficit one (LEI-CCAP, 2003) in the coming decades. Therefore, it is essential to establish sensible and plausible scenarios on the domestic economic growth for a better understanding of China's food economy in the future.

While we try our best to formulate plausible and research-backed scenarios, it is worth noting that scenarios cannot predict the future with certainty and the results presented in this report should also be interpreted with the normal reservation that current and future problems continue to be resolved as they arise and events of catastrophic dimensions (such as political crisis or energy crisis or war) do not occur. As the uncertainty increases with the coverage of future years, three alternative scenarios of GDP growth are formulated, which enable the CHINAGRO model to conduct sensitive analyses and leave room for the readers to be able to make their own justifications among alternative scenarios.

The rest of the report is organized as follows. Section 2 reviews the literature on growth and examines the source of GDP growth in China during the reform era. In general, we focus on publications which cover the most recent period and reflect China's revision on the production side of GDP in 2005. Section 3 discusses the potentially major driving forces behind future growth, including economic transition, structural changes, technological catching up, and factor price equalization. It also examines potential constraints to the growth, including demographic change, domestic demand and increasing energy consumption. Section 4 reports the three scenarios by major regions and sectors. Finally, Section 5 concludes.

2. Sources of past Growth

There are different ways to decompose GDP growth. Production function framework is often used to measure the supply side sources of growth. Typically, this begins with a conventional production function and decomposes growth into inputs (labor and fixed capital) and total factor productivity (TFP). Table 1 presents two sets of most recent and relatively representative results in assessing the supply side sources of GDP growth in China.

Fixed Capital

Most studies find that fixed capital is responsible for the preponderance of the GDP growth in recent years with estimates typically ranging from 40-60 percent depending on the years included, the underlying assumptions, and the methodology (Tables 1). In recent years, its relative importance has increased from 28 in 1980-1989 to 58 percent in 1999-2005 (Herd and Dougherty, 2007). This is confirmed by Kuijs (2006) who reports an increase from 32 percent during 1978-93 to 56 percent during 1993-2005. A further confirmation is presented in Perkins and Rawski (2008) with an increase from 33 percent in 1990-1995 to 57 percent in 2000-2005.

The rising importance of fixed capital to GDP growth reflects the increased share of fixed investment in GDP from roughly 30 percent in 1978-93 to 37 percent between 1993 and 2005. Herd and Dougherty (2008) show an exchange of position between capital deepening and TFP growth in their contribution to GDP growth, from 2.96 (K/L ratio) versus 4.39 (TFP) in 1980-89 to 5.09 (K/L ratio) versus 2.45 (TFP) in 1999-2005. Kuijis (2006) presents a similar picture and estimates that 5.3 of the 8.4 percent increase in labor productivity is the result of an increasing capital to labor ratio (as opposed to 3.0 due to TFP growth) for the period of 1993-2005. The increasing investment comes from both domestic savings and foreign direct investment (FDI). Kuijs (2006) reports that gross national savings increased from 37 to 44 percent of GDP between 1996 and 2005.

Table 1. Factors behind Growth in China

	1980-1989	1990-1999	1999-2005	1978-1993	1993-2005
Growth (period average compound growth rates)					
GDP	10.62	9.94	8.75	9.7	9.5
Employment	2.9	1.17	1.01	2.5	1.1
Labor productivity	7.51	8.66	7.67	7	8.4
From increasing K/L ratio	2.96	4.81	5.09	3.1	5.3
Total factor productivity	4.39	3.68	2.45	3.8	3.0
Contribution to GDP growth (%)					
Employment	27.3	11.8	11.5	25.8	11.6
Labor productivity	70.7	87.1	87.7	72.2	88.4
From increasing K/L ratio	27.9	48.4	58.2	32.0	55.8
Total factor productivity	41.3	37.0	28.0	39.2	31.6
Memorandum items					
Growth in Capital stock	8.24	9.71	10.04		
Investment/GDP ratio (period average)				29.4	36.6
Authors	Herd and Dougherty (2008)			Kuijs (2006)	

Table 2. Ratio of inward FDI over gross fixed capital formation, comparing China with the major source economies of China's inward FDI (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
China	3.5	3.9	7.3	12.2	17.3	15.4	14.9	14.9	13.6	11.3	10.3	10.5	11.5	12.4
HK	16.3	4.4	13.8	21.5	19.8	14.4	21.4	19.5	29.4	58.6	139	55.7	25.8	38.4
Korea	0.8	1.0	0.5	0.4	0.5	0.6	1.0	1.4	4.8	7.1	5.4	2.6	1.8	2.1
Taiwan	3.7	3.2	1.8	1.6	2.3	2.4	3.0	3.4	0.4	4.4	6.8	7.8	2.9	0.9
US	5.7	2.8	2.3	5.4	4.4	5.3	7.0	7.8	10.3	15.4	15.8	8.1	3.3	1.5
Japan	0.2	0.1	0.2	0.0	0.1	0.0	0.0	0.3	0.3	1.1	0.7	0.6	1.0	0.6

Source: FDI database, *UNCTAD*.

In addition to growing domestic investment, China has also become the largest recipient of FDI among the developing countries. As shown in Table 2, the ratio of FDI over

China's gross domestic fixed capital formation is higher than that in all of other major source economies of China's inward FDI (except for Hong Kong between 1990 and 2003 and for the US in 1990, 1999 and 2000), increasing from 3.5 percent in 1990 to 12.4 percent in 2003 with the record-high ratio of 17.3 percent in 1994.

Table 3. Labor Allocation by Sector and Region (in percentage) [a]

Region [b]	Year	Agriculture	Urban industry	Urban services	Rural nonfarm
East	1980	67.3	16.3	9.4	7.1
	1985	56.0	14.9	8.9	20.2
	1990	52.5	14.7	9.6	23.2
	1995	44.4	15.3	12.8	27.5
	2001	42.2	11.2	15.6	31.0
Northeast	1980	43.4	32.9	19.3	4.4
	1985	39.8	32.0	20.1	8.1
	1990	39.7	31.2	21.1	8.0
	1995	36.6	29.3	24.5	9.7
	2001	44.8	16.7	24.6	13.9
Central	1980	76.4	11.4	7.5	4.7
	1985	68.0	12.2	8.2	11.6
	1990	65.8	11.4	9.2	13.6
	1995	58.1	11.0	10.8	20.1
	2001	57.3	6.8	11.5	24.4
West	1980	78.4	10.3	8.6	2.7
	1985	72.5	10.3	9.3	7.9
	1990	71.5	9.7	9.2	9.6
	1995	64.8	9.4	10.9	14.9
	2001	61.0	6.3	11.7	21.0
CHINA	1980	71.2	14.5	9.4	4.9
	1985	62.8	14.2	9.7	13.3
	1990	60.8	13.6	10.3	15.3
	1995	53.6	13.5	12.6	20.3
	2001	52.2	8.9	13.9	25.0

Note: [a] The labor data at the national level by sector and the sum of the data at the provincial level by sector are slightly different. Since 1997, this discrepancy has shown a large increase. The national labor force data are regarded as more accurate because they are generated from population census and sample surveys. In contrast, the provincial labor force data are reported from lower level governments. When labor becomes more mobile, the difference between the two measures gets larger (Zhang and Tan, 2007, appendix S.1). Nevertheless, for analyzing regional variation in labor reallocation, we have to base our calculations on the provincial level data, despite their limitations. Consequently, this table should be viewed as indicative of relative magnitude and trends rather than definitive.

[b] East includes the municipalities of Beijing, Shanghai, and Tianjin, and the provinces of Fujian, Guangdong, Hainan, Hebei, Jiangsu, Shandong, and Zhejiang. Northeast includes Heilongjiang, Jilin, and Liaoning Provinces. Central includes Anhui, Henan, Hubei, Hunan, Jiangxi, and Shanxi Provinces. West includes the autonomous regions of Nei Mongol, Ningxia, Tibet, and Xinjiang, the municipality of Chongqing, and the provinces of Gansu, Guangxi, Guizhou, Ningxia, Qinghai, Shaanxi, Sichuan, and Yunnan. The details of calibration on four sectors are given in Annex 2 of World Bank (2005).

Source: Provincial database compiled by Zhang and Tan (2007).

Table 4. Labor Productivity by Sector and Region

Region	Year	Labor productivity (yuan/person, 1978 constant prices)					Ratio to LP of agriculture		
		Agriculture	Urban industry	Urban services	Rural nonfarm	Region average	UI/AG	US/AG	RI/AG
East	1980	389.1	4156.4	2558.3	885.7	1249.5	10.7	6.6	2.3
	1985	627.3	6238.7	4728.6	747.9	1859.7	9.9	7.5	1.2
	1990	713.3	7818.6	6476.0	1667.6	2578.2	11.0	9.1	2.3
	1995	1040.8	12694.5	9504.0	6129.6	5429.0	12.2	9.1	5.9
	2001	1310.5	22554.6	10530.0	11779.0	9035.5	17.2	8.0	9.0
Northeast	1980	701.6	3367.9	1438.7	1052.0	1714.2	4.8	2.1	1.5
	1985	836.1	4126.7	2232.8	1378.6	2214.1	4.9	2.7	1.6
	1990	1038.9	4756.8	3610.4	3157.4	2912.0	4.6	3.5	3.0
	1995	1266.9	6557.8	4584.0	9330.1	4409.2	5.2	3.6	7.4
	2001	1532.0	15652.0	6076.3	15932.4	7293.9	10.2	4.0	10.4
Central	1980	356.2	2807.7	1974.4	957.9	792.4	7.9	5.5	2.7
	1985	543.3	3550.0	2953.6	826.9	1169.5	6.5	5.4	1.5
	1990	577.1	4307.4	4129.6	1370.7	1470.5	7.5	7.2	2.4
	1995	718.4	5767.1	5375.7	4397.2	2566.9	8.0	7.5	6.1
	2001	929.3	15563.6	6895.0	6071.3	4255.7	16.7	7.4	6.5
West	1980	312.1	2821.8	1776.6	761.9	683.5	9.0	5.7	2.4
	1985	391.1	3914.0	2646.2	595.0	950.6	10.0	6.8	1.5
	1990	422.9	5244.1	3776.1	940.6	1200.6	12.4	8.9	2.2
	1995	531.0	7610.1	4507.8	2348.2	1841.7	14.3	8.5	4.4
	2001	717.8	17011.4	5654.3	3387.5	3087.4	23.7	7.9	4.7
CHINA	1980	368.9	3386.5	2026.8	902.0	974.0	9.2	5.5	2.4
	1985	532.8	4601.3	3221.4	777.9	1403.9	8.6	6.0	1.5
	1990	584.9	5712.9	4615.2	1509.7	1840.6	9.8	7.9	2.6
	1995	761.0	8636.0	6312.7	4867.3	3356.2	11.3	8.3	6.4
	2001	988.0	18613.3	7797.9	7944.2	5616.8	18.8	7.9	8.0
Growth rate (%), 1980-2001									
East		5.95	8.39	6.97	13.11	9.88%	2.30	0.96	6.76
Northeast		3.79	7.59	7.10	13.82	7.14%	3.66	3.19	9.66
Central		4.67	8.50	6.14	9.19	8.33%	3.65	1.40	4.32
West		4.05	8.93	5.67	7.36	7.44%	4.70	1.56	3.19
CHINA		4.80	8.45	6.63	10.92	8.70%	3.48	1.74	5.83

Note: The definitions of regions are presented in the note of Table 1. Labour productivity is measured as the ratio of total value-added to the number of employees in the sector and region. As noted in Table 1, this table should be viewed as indicative of relative magnitude and trends rather than definitive.
Source: Compiled from Tables 1, 2, and 3(i)-(iv) in Annex 5 of World Bank (2005).

Labor

In general, the contribution of labor to GDP growth has been low with estimates in the range of 10-15 for the period after 1990 (cf., Table 1; Bosworth and Collins, 2008; Perkins and Rawski, 2008). This is partially the result of a relatively slow increase of labor inputs since 1978, which was about 2-3 percent per annum between 1978 and 1993 and has

slowed even further to 1-2 percent per annum since 1993 even when accounting for the overall increase in education (Bosworth and Collins, 2008).

Total Factor Productivity

TFP is generally found to be the second most important factor driving GDP growth, which account for 30 to 40 percent of GDP growth during the reform era according to various estimations. Herd and Dougherty (2007) report an inverted "U" shape for the contribution of TFP to GDP growth as it increases from merely 5.5 percent in 1950-1979 to a peak of 41.3 percent in 1980-1989 before decreasing to 28 percent in 2000-2005. Perkins and Rawski (2008) present a more detailed account of this inverted "U" shape using half decadal decompositions. They show that the contribution share of TFP to GDP growth increases from 32.8 percent in 1978-1985 to a peak of 57.3 percent in 1990-1995 and then returning to 32.3 percent in 2000-2005. Their growth accounting indicates that since 1978, TFP growth has been typically about 3 percent on average with the exception of the period 1990-1995, where it increases to 6.7 percent. They argue that this peak appears to be an anomaly and may reflect the effects of the third phase of reform beginning in 1992.

Young (2003) argues that total factor productivity has been substantially overestimated due to systematic underreporting of inflation, labors transfers from agriculture to non-agriculture, rising participation rates and improvement in educational attainment. Young (2003) finds an adjusted average annual TFP growth rate of just 1.4 percent between 1978 and 1998.

TFP may not play such an important role in overall economic growth as suggested in Table 1 once some of its traditional components such as structural change are taken out from it. Nevertheless, it is still generally viewed as being the leading driver of agricultural growth since the advent of reform (Huang and Rozelle, 1994; Fan and Pardey, 1995; Dekle and Vanderbroucke, 2006, tied with physical capital as most important; and Bosworth and Collings, 2008).

Structural Change

In the reform era Chinese economy has undergone massive transformation as workers have left agriculture in inland regions for manufacturing jobs in coastal China. With the progress of the reform, institutional barriers to labor mobility have been gradually removed. Increasing labor movement has been observed across different regions and sectors and mainly from rural to urban areas. The latest sampling data of the 2000 census indicates that there were 131 million migrants during 1995-2000, of which 33.92 million were inter-provincial and 97.24 million intra-provincial.[1] It is estimated that 78% of inter-provincial migrants and 52% of intra-provincial migrants were from rural to urban areas. This means that the total number of rural-to-urban migrants is about 76 million during 1995-2000 (World Bank, 2005). Furthermore, much of the inter-provincial migration was interregional. According to the calculation of Lin *et al.* (2004) based on the same census data, inland-to-coast migration accounted for 60.1% of all inter-provincial migration of the

[1] In the 2000 population census of China, migration is defined as the movement of residence within the last 5 years. If a change in *hukou* registration occurs along with the change in residence, the movement is recorded as *hukou* migration in the census. If a person has left the place of *hukou* registration for more than 6 months, the movement is recorded as non-*hukou* migration. The census does not consider the movement of residence for shorter than 6 months as migration, which is called "floating population" in Chinese media.

working-age population and thus dominated the whole migration scene. In contrast, the corresponding shares for coast-to-inland, within-coast, and within-inland migration were 6.1%, 18.6% and 15.2%, respectively.[2]

Labor mobility across sectors has been even more substantial due to the rise of rural township and village enterprises (TVEs) and the growth of urban services sector. Table 3 presents the patterns of labor allocation across four major sectors at the national level and for four large regions. Figures at the national level suggest that the most remarkable labor movement is from agriculture to rural non-farming activities. The rapid expansion of the rural non-farming sector created additional jobs for 20.1% (25% – 4.9%) of China's total labor force (in employment) during 1980-2001, and about 95% [(71.2% – 52.2%)/20.1%] of these new jobs, which was at a scale of 120 million, were taken by those moving away from agriculture. The dominant part of this huge scale labor reallocation took place within the same township or county ("left farmland but didn't leave the local community") and therefore cannot be accounted for by inter-provincial migration. In the urban areas, the urban services sector created additional jobs for 4.5% of China's total labor force (in employment) during the same period, which were took by those urban workers who left the urban industry and by migrants from the countryside.[3]

This structural transformation in employment has had an important effect on economic growth. Fan, Zhang and Robinson (2003) estimate that it accounted for 17.47 percent of GDP growth between 1978 and 1998. Sun *et al.* (2008) find that provincial variation in employment structure has significant explanatory power on variation of TFP across Chinese provinces. The extent to which labor reallocation across sectors and regions can contribute to the enhancement of aggregate productivity depends on the gaps of labor productivity between sectors and between regions. Table 4 presents labor productivity by sector and region for the period of 1980-2001. Despite the large scale reallocation of labour from the agricultural to non-agricultural sectors and migration from rural to urban areas, the productivity disparity between the urban industry and the agricultural sector is large and increasing. At the national level, the ratio had risen from 9.2 in 1980 to 18.8 by 2001 due to the relatively slow growth rate of labor productivity in the agricultural sector (4.8% vs. 8.45% per annum). This rising disparity is most severe in the western region, with the ratio standing at 23.7 by 2001. It is also worth noting that the labor productivity in the urban industry in the poorest western region had improved faster than that of agriculture in the booming eastern region. Another sharp contrast is that the rural non-farming sector had the fastest growth in labor productivity while the traditional agricultural sector has the lowest labor productivity and slowest growth. Such severe disparity in inter-sectoral and inter-regional productivity of labor not only explains a large

[2] For the sake of comparability, Lin *et al.* (2004) adopts the definition of non-*hukou* migration in the 1990 census, that is, the person concerned has left the place of *hukou* registration for more than 1 year. After reconciling the differences in definitions of two censuses and discount the 2000 migration figures, they come to a figure of 27.53 million inter-provincial migrants during 1995-2000.

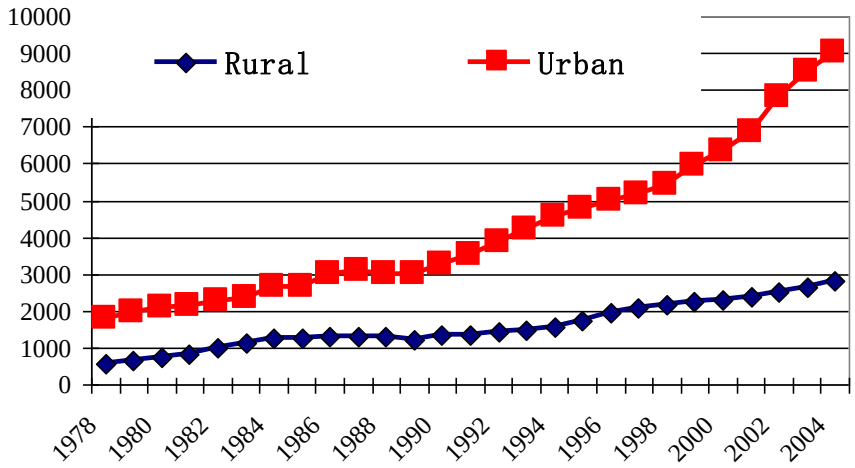
[3] It is worth noting that the aggressive economic restructuring started in the mid-1990s led to the layoffs of 43.28 million workers in the urban industrial and services sectors during 1995-2001. Many millions of them with no expectation of reemployment were either involuntarily retired early or did not register with local governments for unemployment benefits. The estimations based on 2000 population census put China's urban unemployment rate at 10-12.7% in 2000 (Giles *et al.* 2005), indicating that the urban unemployed was equivalent to 2.3-2.9% of China's total employment.

part of growth in aggregate productivity but also indicates future opportunities for achieving productivity gains by reallocating labor across sectors and regions.[4]

Table 4 also reminds us that under fast economic expansion seemingly small differences in regional or sectoral performance can eventually create significant disparity. Over a period of 25 years the difference between, for instance, 9 and 12% annual growth would lead to 100% difference in the cumulative factor of increase (8.6 versus 17). Migration from the slower to the faster growing segments of the economy could not mitigate these gaps, especially not in the earlier, restrictive years of the reform period, and neither could growth in agricultural incomes. Therefore, the rapid non-agricultural expansion was a source of increasing inequality across regions.

Table 4 also indicates that the fast expansion outside agriculture leads to widening income disparities also within the same region (and province), especially between urban and rural areas. Figure 1 visualizes this comparison with the annual data of national average per capita rural and urban incomes in the period 1978-2004, which are expressed in constant 2000 Yuan. The absolute income gap increased in all years since 1985 but the relative income gap, albeit less easy to see in the figure, shows an alternating picture, with its lowest value in the mid-eighties at about 2.5, then rising until 1995, declining slightly between 1995 and 2000 and rising again in recent years, reaching a value of around 3.3 in 2004.

Figure 1. Development of rural and urban per capita income (in constant 2000 Yuan)



Source: calculated from NBSC, Statistical Yearbook of China, various issues

The consequences of continued growth outside agriculture would be threefold: (1) there will be strong competition for land and water in urban and semi-urban areas, and in some regions possibly also for labor, (2) food self-sufficiency becomes less critical as the

[4] Nevertheless, Dekle and Vandenbroucke (2006) suggest that the importance of the migration has decreased since the mid-1990s due to the stagnation in employment creation by the TVEs. Their estimations indicate that the contribution of migration to average annual labor productivity growth fell from 2.0 of the 5.2 percent in 1978-1995 to 0.2 of the 6.6 percent in 1996-2003. More recently, labor productivity growth has been driven by the reallocation of labor from the public to the private sector.

country can afford significant agricultural imports, (3) the rising incomes will shift demand to better quality foods. These three developments combined would define the major policy challenge of containing the widening income gap between the agricultural sector and the rest of the economy, and more generally between urban and rural areas, in China's near future. They also provide plausible policy guidelines for our growth scenario design.

Demand-Side

Some scholars have argued China's growth is mainly driven by external demand. Household consumption as a share of GDP has decreased over time and government consumption peaked in the late 1990s. Perkins and Rawski (2008) note that "without the extraordinarily rapid growth of exports in recent years, China very likely would have experienced a shortage of aggregate demand, and, unless the government had taken steps to prime the pump as in 1997-1999, the growth rate of GDP would have fallen markedly because of inadequate aggregate demand." (p. 1223).

As can be seen in Table 5, both imports and exports have grown rapidly since the beginning of reforms. In large part, this is because Chinese exports rely on imported parts and material along with rising imports of primary products (Winters and Yusuf, 2007). Between 2002 and 2006, the rate of trade increased even further especially for exports as it grew by over 31% annually as compared to GDP growth of a little less than 10 percent. While this impressive development does reflect the increasing importance of foreign markets as opposed to domestic demand, the overall contribution of exports to GDP is difficult to estimate, not only because over 50% of imports are used as part of the manufacturing process and also because opinions on the local value-added part of Chinese exports are divided.

Table 5. Increasing Importance of Exports and Imports

	Exports			Imports		
	Ratio to GDP		Annual rate of growth	Ratio to GDP		Annual rate of growth
	Initial	Final		Initial	Final	
1980-1990	6	16	13.1	6.6	13.8	10.3
1990-2005	16	41.3	14.9	13.8	35.8	15.5
2000-2005	23.1	41.3	25.0	20.8	35.8	24.0
2002-2006	25.6	47.5	31.3	23.2	38.8	28.0

Source: World Economic Outlook at http://www.econstats.com/weo/index_glweo.htm, UN, Monthly Bulletin of Statistics, December, various years. www.WTO.org.

3. Mechanisms Underpinning the Future Growth

In the sense of growth accounting, China's GDP growth has primarily been driven by fixed capital accumulation and TFP growth with the role of the latter decreasing in the recent years. In terms of mechanisms which provide incentives and channels for capital accumulation and productivity improvement, it is widely acknowledged that China's legendary growth in the past three decades has been a result of economic transition,

structural change, technological catching-up, and factor price equalization. To what extent these mechanisms can continue to facilitate future growth, Holz (2008) presents an excellent overview on each of them. The following first four subsections will be partially based on his overview.

Economic Transition

In the literature of economic transition, the growth contribution of the reform process is explained by transition facts and strategies. For example, the list in Woo (1994) includes the creation of non-state firms in every sector of the economy; a high savings rate; good initial conditions such as a limited extent of central planning, widespread underemployment in the countryside that could be taken up by TVEs, and a poor social security net; historical conditions; and the Chinese Diaspora. Qian (2000, 2003) attributes much of China's reform success to the unorthodox economic policy measures adopted by China's leadership and argues that the key to China's economic growth was the unleashing of incentives and competition while making reform interest-compatible for those in power.

While the transition literature is powerful and insightful in explaining the past growth, it would be difficult to "extrapolate" its explanations to ten or twenty years in the future because one could argue that the key elements of transition have been in place since the early 1990s (e.g., price and domestic trade liberalization, the dominance of private and non-state enterprises, etc.) and that therefore the gains from transition may have been largely exhausted. In contrast, growth patterns identified by economic theories of development and trade seem able to offer firmer ground for assessing the future growth prospect of China. Following this perspective, the contribution of economic transition can be interpreted as has removed major constraints that prevented well-known development patterns from unfolding. If China's growth patterns in recent decades match those exhibited by other economies at the stages of their economic development similar to that of China, it would be more likely that China's future growth patterns also match those of the other economies at the similar development stages. This perspective implies that after three decades of transition, standard growth patterns would become more relevant to the assessment of China's future growth. Consequently, it helps to conduct a cross-country comparison with countries/regions which experienced relatively "most similar" growth patterns in the past (Ragin, 1987), such as Japan, Korea, and Taiwan.

Structural Change

As we discussed in the previous section, if the marginal/average product of labor is lower in agriculture, the movement of agricultural workers to sectors where the marginal/average product is higher will raise the total output. Because this additional output is produced without additional input of capital and labor, the reallocation of labor raises aggregate productivity. A comparison of the labor productivity of the industrial and service sectors relative to agriculture between China and several other Asian countries helps to put China's economic transformation in a broader international perspective (Table 6). The differences are striking. The labor productivity ratio of industry to agriculture is much higher in China than in other Asian countries except Indonesia. What more remarkable is that while the ratios for other countries have generally remained stable or fallen, the ratio for China has risen substantially over the past 20 years. The same rise is also observed for the labor productivity ratio between services and agriculture although at a less extent.

These extremely high ratios for China as well as their increasing trends are symptomatic of major distortions in China's factor markets. While the existing distortion in factor market puts a demand for further transition efforts as discussed above in near future, there appears to be considerable potential for further economic growth simply by reallocating labor and capital among sectors.

Table 6. Ratio of Labor Productivity Relative to Agriculture, Selected Asian Countries

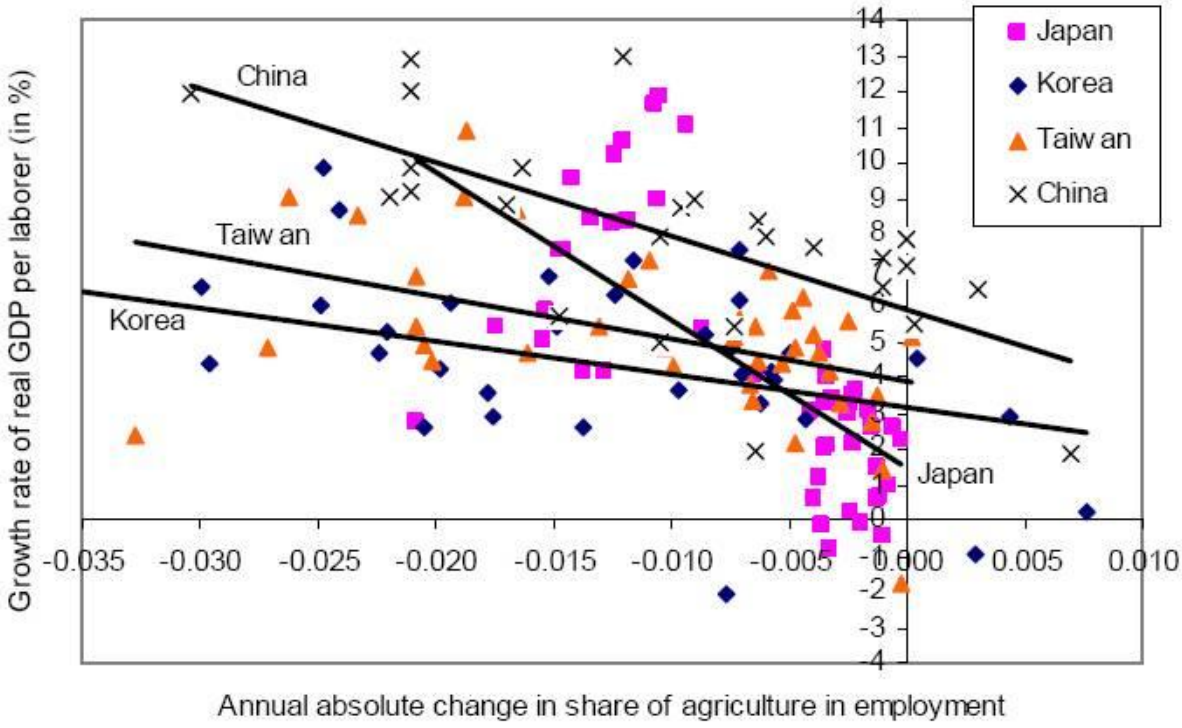
Country/year	Industry/agriculture	Services/agriculture
China		
1978	7.0	4.9
1988	4.6	3.8
1995	5.4	3.2
2001	7.5	4.0
Philippines		
1989	4.4	2.1
1995	4.5	2.1
2002	4.2	1.8
Korea, Rep.		
1987	2.5	2.6
1995	2.4	1.9
2002	3.1	1.7
Japan		
1990	3.2	3.0
1995	3.1	3.4
2001	3.3	3.4
Indonesia		
1993	7.2	3.6
1998	7.0	2.8
2002	6.5	3.0
Malaysia		
1987	2.7	1.5
1995	2.1	1.8
2001	2.5	1.9
Taiwan, China		
1981	2.4	3.9
1988	2.6	3.9
1995	2.9	4.7
2002	3.0	4.5
United States		
1987	1.5	1.6
1995	1.8	1.7
2001	1.4	1.3

Source: Zhang and Tam's (2007) calculation based on World Development Indicators.

Figure 2 confirms a stylized growth pattern driven by structural change in the context of East Asia. Each data point in the Figure reflects a particular country in a particular year. It clearly shows that in years with a high absolute reduction in the share of agricultural laborers in the total employment, the growth rate of real GDP per laborer is high. This pattern holds for all four economies. Furthermore, the trend-lines in Figure 2 indicate that for a same amount of annual reduction in the share of agricultural laborers, China reaps

the highest gain in real GDP growth.[5] This is consistent with the fact that China has the highest labor productivity ratio of industry to agriculture among these four economies (Tables 5 and 6). During 1978-2005, the share of laborers in agriculture decreased from just above 70% to 45%. This implies an annual reduction in the share of laborers in agriculture by, on average, an absolute value of 0.01 (or 1 percentage point) every year. At this rate China would have another 35 years to go before its agricultural labor share reaches the 10% level at which the agricultural labor share of Japan, Korea, and Taiwan stabilize. This observation suggests that China may face another 35 years of structural change as a source of economic growth.

Figure 1. Structural Change and Labor Productivity Growth



Note: Japan 1956-2005, Korea 1971-2005, Taiwan 1967-2005, and China 1979-2005 (except 1990). Annual absolute change in share of agriculture in employment is based on end-year employment values, while the growth rate of real GDP per laborer is based on average (or, in the case of China, midyear) employment values. Two data points are omitted in order to keep the chart compact: Korea 1972 (0.0224, 0.9448) and 1998 (0.0125, -4.6146).

Source: Holz (2008).

Technological Catching up

There is a large body of literature on income convergence points to the advantage of backwardness, which suggests that poor economy may be able to grow faster because of their greater potential for catching up (Dowrick, 1992, Drysdale and Huang, 1997). Catching up means that production techniques and technologies that have already been invented and implemented can be copied rather than need to be re-invented. There are many channels facilitating technology transfer and spillovers. The most traditional one is

[5] Please note that for Japan there is only one observation goes beyond the value of -0.02 (or -2%).

the import of foreign equipment. More recent one includes joining the global allocation of production and distribution value chain of multinational companies, which typically associated with export-processing and FDI. The cases of Japan, Korea and Taiwan are often cited as the illustration of successful catch-up. Japan's GDP per capita was only 17 percent of that of the US in 1950. The ratio rose quickly to 30 percent in 1960 and 56 percent in 1970. By the early 1990s, GDP per capita in Japan and US was already in the same range if using PPP estimates. Korea and Taiwan (also including Hong Kong and Singapore) caught up in a similar way after the 1960s. Labor productivity in Korea and Taiwan grew at an average 4% to 5% between 1970 and 2005 (Drysdale and Huang, 1997; Holz, 2008).

In comparison, China is still at a very low development level. China's labor productivity between 1978 and 2005 was only 1.2 to 3.4 % of that of the US if using the official exchange rate, and was less than 12% if using PPP exchange rate. This suggests that China appears to be at a stage of economic development (labor productivity) where her major neighbors started out more than 30 years ago. This backwardness in combination with China's active integration with the world production and trade system suggests that China may be able to reap her greater potential of catching up for more than 30 years in the coming future.

Factor Price Equalization

The factor price equalization theorem (or Heckscher-Ohlin-Samuelson theorem) states that the relative prices for two identical factors of production in the same (international) market will eventually equal each other due to competition. The price for each single factor need not become equal, but relative factors will. For example, after two countries integrate economically and become effectively one market, the country with labor that is cheap relative to capital should see demand for its labor rise. As underemployed laborers become fully employed (or labor shifts out of low-productivity agriculture), labor productivity rises. Put it more intuitively, when two countries enter a free trade agreement, wages for identical jobs in both countries tend to approach each other. For instance, after NAFTA was signed unskilled labor wages gradually fell in the US and gradually rose in Mexico. The same force has applied to the various countries of the European Union.

Holz (2008) shows that in Korea and Taiwan in 2005, the relative factor price equalization in terms of relative wage rates divided by relative investment prices was at about 40% of the US level. The corresponding figure for China is about 7%, which is well below the early levels of Japan (in the 1950s), Korea (in the early 1970s) and Taiwan (in the 1960s). This observation may suggest that if China were just at the beginning of a long-run trajectory as the case of Japan, Korea and Taiwan forty or thirty years ago, China's potential for economic growth from relatively low labor costs will continue to exist for another thirty or more years.

Government Policies

Macroeconomic stabilization has been the number one policy objective of Chinese national leaders since Deng Xiaoping. Macroeconomic stability is regarded as one of the pre-conditions to generate long-term growth as it will provide favorable environment for both domestic and foreign investment. A stabilized macroeconomic environment has helped and will continue to help the government better foster development of the

infrastructure and institutions necessary to sustainable growth. The stability system has been well tested in 2003 when China was seriously attached by the SARS and in 2008 when China was shocked by a devastating 8 degree earthquake.
The strategic emphasis on "Booming China through Science and Education" (*Ke Jiao Xing Guo*) is likely to be further emphasized in the future. The government investment in R&D programs are planned to rise at a pace more than the average growth of government fiscal revenue (State Council, 2007). The growth of public investment in professional educations (mainly, colleges and universities) has been increased substantially since the late 1990s (NSBC, various issues). As a consequence, new recruitments of colleges and universities quintupled within 7 years between 1998 and 2005. Since 2001, the absolute new enrollment number in Chinese BA and BSc programs at regular institutions of higher education exceeds the number of freshmen in the US. In 2005, China's new enrollment figure was twice that of the US (Holz, 2008). It would be reasonable to expect that such significant investment in human resources development will contribute to technological progress and further to the TFP increase more visibly in the future.

In additional to the policy focus on R&D and education, the national leaders decreed a new development orientation called *Yi Ren Wei Ben* (or people-oriented development) in 2003. The new orientation emphasizes the overall human development (not only professional education). For example, rural primary education is planned to become one of top priorities in public investment, which has been largely ignored in the past two decades (State Council, 2003). In order to implement this new development strategy, an ambitious program has been proposed to reduce or eventually eliminate primary school education fees in the western China and other less developed regions. Other programs that aimed to improve the primary, secondary and professional educations are under considerations. The improvement in the human capital for all people, particular the new generations, might be the most important engine of China economic growth in the next twenty to thirty years.

In order to pursue more balanced development across regions and between the rural and urban areas, the Central government has initiated several regional development programs, including the Great Western Development Plan (GWDP) and new National Poverty Alleviation Program, to redirect the resources toward less developed regions (State Council, 2003). According to the nation's development plans, in the first 10 years of this century, the major investment under GWDP is in infrastructure, ecosystem and environmental conservation, and human resource development (Du, 2003). The implementation of these programs would help the less developed regions to catch up the national growth path and thus reducing income disparity. In line with the central government's initiatives, many local governments in the less developed regions have also adopted policies to improve macroeconomic stability and foster development of the infrastructure and institutions necessary to generate local economic growth. A number of provinces in western China have shown improved economic prospects that should continue into the future, through the attraction of large inflows of both domestic and foreign investments (Zhang, 2007). The growth convergence presented in Sun et al. (2008) is also a partial reflection of the effects of these new policies. If this trend of policy efforts continues, the future regional growth pattern is likely to gradually converge over time.

Constraining Factors

While economic transition, structural change, technological catching up, factor price equalization, and human resources development oriented development policies are going

to strengthen China's growth potential in the coming two or three decades, there are three key challenges may put severe constraints to the future growth, which are the demographic transition, domestic demand and rising energy consumption. In evaluating China's growth potential, it is also important to examine the likely constraint impact of these factors.

Demographic Transition. China will undergo a dramatic demographic transition over the coming years as the proportion of old age (65+) population in the total will be doubled from current level of about 0.08 to 0.16 in 2030 (Toth et al., 2003) and the medium age will increase from current level of about 30 to 37.4 by 2020 (Shi, 2006). Currently, China is experiencing a demographic "dividend" due to the high proportion of working-age population, the low dependency ratio and the increased saving. Cai and Wang (2006) estimate that during the reform era, the demographic transition has contributed 15-25 percent of economic growth and 5-21 percent of increased savings. This dividend, however, is coming to an end as Cai and Wang (2006) and Shi (2006) foresee a turning point in the dependency ratio in 2013 or 2020 respectively. Afterwards, the dividend will become a debt with potentially large negative implications for growth. Cai and Wang's (2006) estimate, using a growth regression approach, suggests a marginal effect of the dependency ratio on growth of -0.115.

This demographic change will put its mark on both fixed formation capital via savings and the supply of labor. Saving in China primarily depends on households (50%), although enterprises (33%) and the government (15%) also play an important role (Perkins and Rawski, 2008). In the immediate future, the change in the dependency ratio will have only a limited impact. Kuijs (2006) forecasts no change in the savings rate as a percent of GDP up to 2015. By 2025, he estimates that the share of savings in GDP will decrease by 2 percentage point relative to 2005 before decreasing by 7 percentage point (relative to 2005) in 2045.

Shi (2006) foresees a shrinking and aging work force as a potential impediment to future growth. The manufacturing boom in the past three decades has been largely fueled by a shift in labor from the low-productivity agricultural sector. This may be coming to an end as a shortage in rural migrant workers first emerged in coastal south China in 2003 (Cai and Wang, 2006). Once turning point of surplus labor as envisioned in the Lewis Model is passed, future shortages of labor may bid up wage rate and hurt the competitiveness of Chinese manufacture sector in the global market.

Although the demographic transition may have explained about 5-21 percent of increased savings, a large proportion is still unexplained. Wei and Zhang (2008) propose a new potential contributor, namely, a high and steadily rising sex ratio imbalance, or an excess of men relative to women. A nature-intended sex ratio at birth is 105 boys per 100 girls (to correct for the slightly higher mortality rate for boys during the age 0-5). The sex ratio in China climbed from about 106 (boys per 100 girls) in 1981 to about 120 in 2006. A higher local sex ratio raises the degree of competition by men for potential mates, which may motivate parents with a son to save more than otherwise. Wei and Zhang (2008) show that more investment in housing construction bids up marriage cost. According to their estimate, about two-thirds and one-fifth of the increase in rural and urban savings from 1985 to 2006 can be attributed to the rise in sex ratio. Given the sex ratio at birth has been on the rise until now, the saving rate is likely to increase or maintain at a high level if the hypothesis holds true. Therefore, the net impact of demographic transition on savings and economic growth may be muted.

Perkins and Rawski (2008) also hold a more optimism view, arguing the demographic transition will have a limited impact due to increasing migration to urban areas and, especially, the general rise of educational attainment.

The demographic transition may have more significant impacts on the agricultural sector than on aggregate growth. In general, structural change discussed above has resulted in an aging agricultural labor force. It is important to evaluate the impact of aging on agricultural productivity. It is expected that the trend of aging agricultural population will induce innovations in land tenure arrangement and in development of labor-saving technologies.

Energy. China's spectacular growth has led to an increasing demand for energy and China has become the number 2 consumer of total primary energy in the world, behind the United States. Despite the foreseeing increasing growth in the future, and therefore increased energy consumption, energy is not expected to hinder its economic growth in a significant way, except for environmental concerns. The rising demand for energy in China has been primarily fueled by coal, which has accounted for more than two-third of total energy use in China (Streifel. 2007). Although China consumes one-third of the global coal supply, it primarily uses domestically produced coal. It is also worth noting that given China's relatively low labor cost, labor intensive energy sources like coal enjoy a comparative advantage in China. Similarly, the production of small-scale hydropower stations, wind turbines, and solar panels may enjoy a relative price advantage as well (Holz, 2008).

While China is expected to account for 20% of the growth in world oil demand, its rate of consumption will only increase by 3% per annum over the next twenty years (Streifel, 2007). Streifel (2007) argues that the increased oil use in China has been partially offset by declining oil use in other countries. He notes that so long as prices increase gradually, there will be no significant impact on GDP growth. In the case of a US$ 35 increase per barrel for two years over the long-term price trajectory, China's GDP will lose 1.6 percent growth for each of the two years. Nevertheless, in the long run, any pressure China exerts on world energy resources would also provide incentives for the exploration of new energy resources and for more efficient use of current sources of energy.

A sudden rise in energy costs may hurt the agricultural sector more severely via increasing fertilizer prices and irrigation costs. Between 1978 and 2005, the amount of fertilizer used per hectare of arable land has quintupled. Increased fertilizers prices may have a strong negative impact on agricultural yields particularly as the rural Chinese agricultural work force further ages and shrinks due to the demographic transition.

Exports and Domestic Demand. As previously noted, China's exports have played an important role in boosting demand for Chinese goods and services. The impressive rise of export is in sharp contrast to the consistently fallen share of household consumption in GDP, which was about 40% of GDP in recent years (Perkins and Rawski, 2008). It seems that there is still room for future export growth in part due to the little overlap with the exports of India, another rapidly rising export economy (Dimaranan et al., 2006; Perkins and Rawski, 2008). Nevertheless, it would be difficult for exports to continue to grow as rapidly as in the past decade due to the increasingly large size of exports and the political

consequence of the rapidly expanding exports in both the European Union and the United States.

In the recent past (1997-1999), when financial crises affected aggregate demand, the Chinese government increased government consumption. Recently, the governments have allocated more investment in the interior regions and the rural sector so as to stimulate domestic demand. More research is needed to evaluate the potential effects of government programs, such as the Western Development Program, and to identify strategies to fuel domestic demand.

4. Growth Scenarios

In the strategy for long-term economic development as laid down in its Tenth and Eleventh Five Year Plans (2001-2005 and 2006-2010), China set ambitious goals to move the nation to a "welfare society" (*Xaiokun Shehui*) in the next 20 years: (a) doubling of GDP every 10 years, with a smooth transformation of the economy from rural to urban and from agriculture to industry and service based, (b) ensuring sustainable management of the environment, and (c) maintaining a socially balanced growth path (NDRC, 2006). Doubling of GDP in 10 years means obtaining an annual average growth rate of 7.2%, and, therefore, an even higher rate in industry and services since agriculture cannot grow at such a pace over a prolonged period.

In the period 1997-2005 the industry and service sectors have realized high rates of growth of more than 9% and 8% respectively on average, rather uniformly distributed over the regions (NBSC, various issues). Based on the discussions in the previous sections, it is plausible that China would be able to achieve its goals set for the next 20-30 years. High growth is likely to continue in the coming decades even though inevitably moving to a lower rate as the size of the economy becomes larger. The growth will become more balance among regions and the regional growth rates will gradually converge over time due to the combined force of technological spillovers, increasing factor mobility, and active policy interventions (Sun et al. 2008; Zhang, 2008). Depending on the extent of China's ability to manage its economy, three growth scenarios are formulated: baseline scenario, low and high growth scenario. Table 7 reports the baseline scenario which represents a central level of growth projection. In the baseline scenario, high growth will continue in all regions, but gradually at more common rates, ending with 4-6% in the period 2020-30, implying that by 2020 China's non-agricultural output will have grown to 3.7 times its 2003 level, whereas it will reach about 6 times its 2003 level by 2030. The table also mentions the growth path for fisheries and forestry (exogenous sectors in the model) that are kept at constant rates of 2.5 and 2%, respectively.

Promoting balanced development among regions is a separate chapter in the country's Five-Year Plans. This policy is reflected in the distribution of investments and public consumption. Table 8 shows for the period 1997-2003 highest growth in investments in the poorest regions, Southwest, Plateau and Northwest. The baseline assumes gradually more moderate increases (as in the output projections above), leading in all regions to investment growth rates of 6.8% and 3.8% for the periods 2010-2020 and 2020-2030, respectively. The growth rate in 2020-2030 might seem rather low compared to the earlier period, but this reflects that it would be difficult to keep on spending productively more than 40% of GDP on fixed investment as is done in the baseline until 2020.

Table 7. Non-farm production: regional growth rates in baseline

Region	Sector	1997 output (billion Yuan)	Annual growth rate (in %) at constant prices				
			1997-2003	2003-2010	2010-2020	2020-2030	**2003-2030**
North	Industry	3248.9	9.8	11.1	5.8	4.6	**6.7**
	Services	1339.9	8.3	9.0	7.6	5.6	**7.2**
Northeast	Industry	1248.7	8.6	8.8	5.1	3.8	**5.6**
	Services	490.7	6.1	7.9	6.2	5.0	**6.2**
East	Industry	3830.0	9.8	10.7	6.2	5.0	**6.9**
	Services	1224.2	9.5	9.5	7.7	5.7	**7.4**
Central	Industry	1255.6	10.5	10.0	5.7	4.0	**6.2**
	Services	506.5	8.7	7.7	7.0	5.2	**6.5**
South	Industry	2385.5	10.5	11.4	6.9	5.7	**7.6**
	Services	949.3	9.5	8.3	8.0	6.6	**7.6**
Southwest	Industry	876.8	7.8	10.3	5.1	3.8	**5.9**
	Services	414.7	8.2	7.9	6.6	5.4	**6.5**
Plateau	Industry	25.1	9.0	9.5	5.7	4.9	**6.4**
	Services	19.5	9.0	9.6	7.1	5.8	**7.3**
Northwest	Industry	530.4	9.5	12.3	5.6	4.3	**6.8**
	Services	300.0	6.7	8.3	7.0	5.8	**6.9**
China	**Fisheries**	**233.2**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
	Forestry	**80.4**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	Industry	**13400.9**	**9.7**	**10.7**	**6.0**	**4.8**	**6.7**
	Services	**5244.7**	**8.6**	**8.6**	**7.6**	**5.8**	**7.2**

Note: The growth rates between 1997 and 2003 are real growth rates of total output produced by CHINAGRO simulation, which replicates the statistical data on value-added (thus GDP) for the years 1997 and 2003 and for each of the eight regions. As discussed in Huang et al. (2003), since 1995, the summation of provincial (or regional) statistical figures in total GDP, or industrial GDP or services GDP, has been larger than the figure of national GDP or its sectoral components, respectively. It is widely acknowledged that the national statistics is more plausible. Consequently, provincial GDP and its components in both production accounting and use accounting are rescaled so that the sum of them equals to the corresponding figures in the national statistics. The projection of sectoral GDP shares follows the procedure specified in Huang et al. (2003). By assuming that the input-output coefficients across the three sectors of agriculture, industry and services are stable in the coming two decades, the growth rate of the total output in the sector will be the same as that of value-added.

When comparing non-agricultural output and non-agricultural demand in the period 2003-2030 one may observe that the average growth rate of fixed investments is a little lower than the average growth rate of output, whereas the opposite applies to the average growth rate of public consumption to represent a steady improvement in the provision of public services. Together, these trends point to a gradually more pronounced role of human and institutional capital formation, as compared to fixed capital formation, in maintaining the growth momentum of the economy.

Despite the expected high imports of capital goods associated to the persistently high levels of fixed investment, the trade surplus of the country, also a scenario variable, is assumed to grow at 10% in real terms annually in the period 2003-2030 up to about 470 billion dollar (1997 prices) in 2030, reflecting China's intention to maintain its growth in offshore investments. Combined, the high investment rate and the high trade surplus imply that the domestic saving rate, which is well over 40% in 2003-2007, is to be kept around that level in the baseline.

Table 8. Exogenous non-agricultural demand: regional growth rates in baseline

Region	Type of demand	1997 level (billion Yuan)	Annual growth rate (in %) at constant prices				
			1997-2003	2003-2010	2010-2020	2020-2030	**2003-2030**
North	Public cons.	254.1	9.0	12.0	7.0	6.0	**7.9**
	Investment	649.2	11.9	10.9	6.8	3.8	**6.7**
Northeast	Public cons.	97.0	7.7	10.9	7.0	6.0	**7.6**
	Investment	200.5	12.5	11.5	6.8	3.8	**6.9**
East	Public cons.	150.6	11.7	14.2	7.0	6.0	**8.5**
	Investment	650.6	12.7	11.7	6.8	3.8	**6.9**
Central	Public cons.	93.8	7.5	10.7	7.0	6.0	**7.6**
	Investment	228.5	12.0	11.0	6.8	3.8	**6.7**
South	Public cons.	174.3	10.5	13.2	7.0	6.0	**8.2**
	Investment	427.7	13.4	12.4	6.8	3.8	**7.1**
Southwest	Public cons.	83.3	9.5	12.4	7.0	6.0	**8.0**
	Investment	211.3	14.3	13.4	6.8	3.8	**7.3**
Plateau	Public cons.	4.7	17.1	18.8	7.0	6.0	**9.6**
	Investment	12.6	18.3	17.3	6.8	3.8	**8.3**
Northwest	Public cons.	69.2	4.0	7.8	7.0	6.0	**6.8**
	Investment	151.3	16.5	15.5	6.8	3.8	**7.8**
China	**Public cons.**	**927.0**	**9.2**	**12.4**	**7.0**	**6.0**	**8.0**
	Investment	**2531.7**	**13.0**	**12.0**	**6.8**	**3.8**	**7.0**

Note: The same as in Table 7.

The low growth scenario assumes that while China will continue to press ahead with its economic reform, the reform may encounter certain difficult in some sectors (i.e., SOE and financial reforms). To some extend China might run into financial stress that will limit its productivity enhanced investment and its goal to achieve the regional balanced development. This would lead to a more visible reduction in the economy growth compared to the baseline in the backward regions than those in the better-developed regions. It is also assumed that China will face less favorable external environment than those assumed under the baseline scenario (Table 9).

In the high growth scenario, China will have much better domestic and external development environments. A remarkably successful reform will substantially improve China's domestic development environment, which will facilitate the private investment and also advance China's ability to increase its public investment in education, R&D and

infrastructure and better pursue its regional balanced development strategy. Meantime, China will have more favorable external environment as those we assume under the baseline (Table 10).

Table 9. Non-farm production: regional growth rates under low growth

Region	Sector	1997 output (billion Yuan)	Annual growth rate (in %) at constant prices				
			1997-2003	2003-2010	2010-2020	2020-2030	**2003-2030**
North	Industry	3248.9	9.8	11.1	5.3	3.7	**6.2**
	Services	1339.9	8.3	9.0	6.9	4.7	**6.6**
Northeast	Industry	1248.7	8.6	8.8	4.3	2.6	**4.8**
	Services	490.7	6.1	7.9	5.3	3.9	**5.4**
East	Industry	3830.0	9.8	10.7	5.5	4.0	**6.3**
	Services	1224.2	9.5	9.5	6.9	4.7	**6.7**
Central	Industry	1255.6	10.5	10.0	5.0	3.2	**5.6**
	Services	506.5	8.7	7.7	6.2	4.4	**5.9**
South	Industry	2385.5	10.5	11.4	6.3	4.8	**7.0**
	Services	949.3	9.5	8.3	7.9	5.8	**7.2**
Southwest	Industry	876.8	7.8	10.3	4.5	2.9	**5.4**
	Services	414.7	8.2	7.9	5.9	4.6	**5.9**
Plateau	Industry	25.1	9.0	9.5	5.1	4.1	**5.8**
	Services	19.5	9.0	9.6	6.5	5.1	**6.8**
Northwest	Industry	530.4	9.5	12.3	5.1	3.5	**6.3**
	Services	300.0	6.7	8.3	6.3	5.0	**6.3**
China	**Fisheries**	**233.2**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
	Forestry	**80.4**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	Industry	**13400.9**	**9.7**	**10.7**	**5.4**	**3.9**	**6.2**
	Services	**5244.7**	**8.6**	**8.6**	**6.8**	**4.9**	**6.6**

Note: The same as in Table 7.

Table 10. Non-farm production: regional growth rates in the high growth scenario

Region	Sector	1997 output (billion Yuan)	Annual growth rate (in %) at constant prices				
			1997-2003	2003-2010	2010-2020	2020-2030	**2003-2030**
North	Industry	3248.9	9.8	11.1	6.5	5.6	**7.3**
	Services	1339.9	8.3	9.0	8.4	6.6	**7.9**
Northeast	Industry	1248.7	8.6	8.8	6.0	5.2	**6.4**
	Services	490.7	6.1	7.9	7.2	6.4	**7.1**
East	Industry	3830.0	9.8	10.7	6.9	6.0	**7.5**
	Services	1224.2	9.5	9.5	8.5	6.7	**8.1**
Central	Industry	1255.6	10.5	10.0	6.3	5.0	**6.8**
	Services	506.5	8.7	7.7	7.8	6.2	**7.2**
South	Industry	2385.5	10.5	11.4	7.5	6.6	**8.2**
	Services	949.3	9.5	8.3	9.4	7.6	**8.4**
Southwest	Industry	876.8	7.8	10.3	6.0	5.2	**6.8**
	Services	414.7	8.2	7.9	7.6	6.8	**7.4**
Plateau	Industry	25.1	9.0	9.5	6.5	6.3	**7.2**
	Services	19.5	9.0	9.6	8.1	7.2	**8.2**
Northwest	Industry	530.4	9.5	12.3	6.5	5.7	**7.7**
	Services	300.0	6.7	8.3	8.0	7.2	**7.8**
China	**Fisheries**	**233.2**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
	Forestry	**80.4**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	Industry	**13400.9**	**9.7**	**10.7**	**6.7**	**5.9**	**7.4**
	Services	**5244.7**	**8.6**	**8.6**	**8.4**	**6.8**	**7.9**

Note: The same as in Table 7.

5. Concluding Remarks

While a number of countries have experienced rapid economic growth after the World War II, China's continued high level of growth in the past three decades has been most impressive. This growth has transformed the country into one of the leading economies of the world. Viewing it from the perspective of growth accounting, the growth has been primarily driven by capital accumulation, and, to a lesser degree, total factor productivity growth. An examination of the mechanisms which provide incentives and channels for capital accumulations and productivity improvements indicates that China's economic development in the reform period fits well with the broad development patterns of structural change, technological catching up, and factor price equalization, particularly in comparison with her East Asian neighbors earlier in their economic development. Consequently, China has thirty or more years to reap growth gain from these three accounts. A review of China's current development policies and strategies suggests that there are several favorable conditions for China's future economic growth. A short-list of these favorable conditions includes the social and economic stability, the government commitments to the adaption to global best-practice institutions in business and economy, national development strategies to boost its economy primarily through science,

technology and education, massive development of rural and urban infrastructure, rapid growth of trade and continuing inflow of FDI and foreign technology, all these in combination with high domestic saving rates and abundant labor force will provide fundamental bases for China to continue to maintain high growth rates throughout the next twenty or thirty years.

On the other hand, China's future growth will face new challenges. While the demographic transition may have a significant impact by mid-century, its impact on savings (and therefore capital) over the next ten to twenty years might be muted due to the opposite force of increasing gender imbalance. Likewise, higher levels of educational attainment should mitigate a large part of the impact of demographic transition on labor supply. China's reliance on (domestic) coal should limit the constraining effects of her increasing demand for energy. Research suggests that as long as oil prices gradually increase in the long-run, the impact of oil price increase on China's growth will be limited. These new challenges may exert more pressure on the future of agriculture than on that of other sectors as agricultural labor force is depleted through migration and becomes older due to the demographic transition. Since past reforms have focused on the agricultural sector, future reforms may have only limited impacts both on the sector and the overall economy (Perkins and Rawski, 2008). The best way to maintain the competitiveness of this sector perhaps is to increase productivity through agricultural R&D. In sum, while China's economy faces challenges, and while many predict that it will slow down to 6-7 percent over the coming decades, China's economy will continue growth at a rate which will be the envy of most countries.

Our baseline scenario shows that average annual growth of China's industrial and services sectors will keep as high as 6.7 and 7.2 percent, respectively, between 2003 and 2030. With these growth rates, by 2030 China's non-agricultural output will have grown to 6 times its 2003 level. It means that at least five more economies of China's current size will be created in China in the first 3 decades of the 21st century and China's per capita income will approach the current average income of the high-income countries (in 2000). The high growth scenario, although less likely to occur, will bring 1.5 more economies of China's current size in additional to the five more "China" projected under baseline. Even under low growth scenario, China's non-agricultural output can still grow by more than 520 percent between 2003 and 2030.

While these growth scenarios are highly plausible, they are not necessarily guaranteed. Uncertainty may be associated with the long standing problems of non-performing loans in the state sector, severely under-funded pension scheme, the lack of rural health care system, bankrupt grassroots level governments, and environmental degradation. Innovative policy efforts are needed for addressing these problems and we hope that the track record of rising to economic challenges and dealing with problems as they become urgent in the past three decades will be kept in the coming two or three decades. In addition, at an average annual growth rate of more than 7 percent, GDP will double every ten years. This growth will grant rooms for addressing financial deficits because the significance of a given absolute size of a financial problem will be halved as a share of GDP in every ten years. This would provide the most intuitive reason for China's leadership to stay focused on economic growth. Considering the environmental degradation and resource exhaustion caused by economic growth, we hope that at some point, China's leadership and public opinion may no longer wish to trade off China's environment for GDP growth. Nevertheless, this shift will be a gradual process.

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