Structural Change in China during 1978-2005: A Review[1]

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Abstract

This paper studies the industrialization of China and documents some stylized facts for the structural transformation of the Chinese economy during 1978-2005. We present a set of sectoral accounts for China and lay out a sectoral growth accounting exercise, linking sectoral total factor productivity (TFP) growth rates to the institutional reforms throughout the period. We find that high TFP growth rates in agriculture and industry are the primary factors driving growth in these sectors. On the other hand, the service sector experienced significant capital deepening (increases in the capital-labor ratio) between 1993 and 2005. At the aggregate level, we find that growth in TFP factor has been the most important component of growth in output per working-age person in the post-1978 era in China.

Keywords: China, growth, sectoral productivity, structural change

JEL classification: C82, O11, O14.

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1. Introduction

The emergence of China in the world economy has been one of the central topics of the research in international economics. This paper reviews a particular aspect of this phenomenon between 1978 and 2005: an association of long-run economic growth with a significant shift in the composition of economic activity. Beginning in 1978, China adopted a series of economic reforms leading to rapid economic growth and structural transformation. Our paper, studying data for sectoral variables regarding economic growth and productivity, is about the structural change of the Chinese economy and the accompanying economic reforms in the post 1978-period.

Figure 1 plots annual average growth rates of GDP per capita over the period 1978-2005 against annual average growth rates over the period 1950-1977 for one hundred countries.[3] Data are in PPP-adjusted units, in 1990 Geary-Khamis dollars, to account for differences in relative price levels between countries and are from the 2014 version of the *Conference Board Total Economy Database*. China grew at an annual average rate of 2.59% during 1950-1977. Growth rates between 1978 and 2005 in Figure 1 range from a low of minus 4.68% per annum in Iraq to a high of 6.83% per annum in China. China is the fastest growing country in the sample between 1978 and 2005.

Major structural changes accompanied growth of the 1978-2005 period. More than 80% of the population was in agriculture when the People's Republic of China was founded in 1949. China, under the socialist government, chose the heavy-industry oriented development

[3] Appendix A lists the countries. The countries are selected so that there is no missing observation.

strategy with distorted factor and product prices.[4] For the purpose of mobilizing resources for heavy industries, the Stalinist planned system was implemented and great emphasis was put on investment and rapid development of heavy industry.[5] Naughton (2007, p. 55) labels this development strategy big push industrialization.

The resulting misallocation of resources through government planning, from 1949 to 1978, did not bring sustainable economic development to China.[6] Economic reform measures since the late 1970s improved the macroeconomic environment and reduced market distortions. China's economic reforms, initiated in the rural areas, succeeded in boosting growth rates in the rural economy. There has been a declining trend in the importance of agriculture since 1978. Market reforms were extended to urban areas and state-owned enterprises in 1984. China began further economic reforms, which focused on the manufacturing sector in urban areas. Along with the reform of the centralized planned allocation mechanism, prices for products and production factors were gradually readjusted or partially liberalized. This rapid growth has been accompanied by a rapid structural transformation from a primarily agrarian economy to a more industrial economy.

In this paper, we present a set of sectoral accounts for China. The accounts are used complementarily to the macroeconomic accounts. Use is also made of estimates of capital

[4] China started industrialization within a socialist camp with the *leaning-on-one-side* policy, which placed a heavy reliance upon trade with and the assistance from the Soviet Union. Soviet aid to China ceased in 1961.
[5] According to the Chinese statistical yearbooks, *heavy industry* refers to the industry that produces capital goods and provides material and technical basis to the various sectors. In 1949, more than 70% of the gross industrial output was valued in heavy industry. This ratio was around 33% at the end of 2004 (China Data Center).
[6] Li and Yang (2005) identify a major weakness in central planning, studying *the Great Leap Forward* disaster-a collapse in grain production between 1958 and 1961. According to the estimates of Li and Yang (2005), policies of resource diversion were responsible for more than 30% of the declines in grain output during 1958-1961.

stock by sector to obtain TFP estimates and growth accounting calculations. We find that high TFP growth rates in agriculture and industry are the primary factors driving growth in these sectors. On the other hand, the service sector experienced significant capital deepening-meaning that the capital-labor ratio increased between 1993 and 2005. Our paper is most closely related to the literature that investigates the economic development experience of China in detail. Accordingly, our study complements recent studies of, among some others, Brandt, Hsieh and Zhu (2008), Dekle and Vandenbroucke (2010, 2012), Xu (2011), Huang (2012), Zhu (2012), Brandt, Tombe and Zhu (2013). Our findings are in line with the view that sectoral heterogeneity matters for economic development (see, e.g., Bernard and Jones, 1996; Duarte and Restuccia, 2010; Herrendorf and Valentinyi, 2012).

We also find that most of the fluctuations in output per working-age person are due to changes in the TFP factor, rather than capital accumulation in the post-1978 period as opposed to the pre-1978 period in the Chinese economy. This result is consistent with the findings of Kehoe and Ruhl (2010) and Zhu (2012). Previous research has shown that TFP growth was absent in China in the pre-1978 era. For example, Chow (1993) finds that growth was driven by capital accumulation during 1952-1980 and TFP growth was absent. Borensztein and Ostry (1996) estimate that TFP growth was negative at about -0.7% average rate during 1953-1978. Similarly, Zhu (2012) finds that TFP deteriorated between 1952 and 1978, declining by 1.07% per year. Rosenberg (1994, pp. 105-106) argues that the Chinese government before 1978 did not give importance to the role of technological innovation and the engrossment with "big-ness" in industry created obstacles to technical change. According to Brandt and Rawski (2008), noneconomic policy objectives, weak institutions, and lack of incentives were the

most important factors for productivity stagnation in the pre-1978 era. Our finding is important for the sustainability of the Chinese growth in the long-run, since input-driven growth is inevitably limited. As Krugman (1994) states that an unceasing increase in TFP leads to a continual increase in national income for each unit of input. In that regard, the Chinese economy can grow further back on the sustained TFP growth.[7]

The rest of the paper is organized as follows. Section 2 examines the structural transformation of the Chinese economy between 1978 and 2005. In Section 3, we compute sectoral TFP growth rates. Section 4 engages a set of issues that attracts a great deal of attention with respect to economic development in China: productivity and economic reforms. This section lays out a sectoral growth accounting exercise and links changes in sectoral productivity to the institutional reforms. Section 5 concludes.

2. Structural Change in China

This section discusses concepts and sources used to obtain value added and employment by sector in China between 1978 and 2005. The Chinese economy is divided into three broad sectors: agriculture, industry, and services.[8] They are also known as primary sector, secondary sector, and tertiary sector, respectively. *Primary sector* refers to agriculture, forestry, animal husbandry and fishery. *Secondary sector* refers to mining and quarrying, manufacturing, production and supply of electricity, water and gas, and construction. *Tertiary sector* refers to all other economic activities not included in primary or in secondary sector. Data in this

[7] Perkins and Rawski (2008) argue that China can achieve real GDP growth at average rates of 6%-8% per annum between 2005 and 2025.

[8] We do not deal with the ownership aspect of the structural change, i.e., private versus public sectors. See Dekle and Vandenbroucke (2012) and the references therein for studies that are concerned with such issues.

section provide some information on the sectoral allocation of employment and output in China.

2.1 Reallocation of Labor from Agriculture

As China becomes more developed, there is a steady transfer of labor from rural to urban areas, and the percentage of the labor force engaged in agriculture falls dramatically. However, agriculture is still the dominant sector in China in terms of employment. We use two sources for employment data: *CSY* and Holz (2006). Holz (2006) and Brandt, Hsieh, and Zhu (2008) discuss the problems regarding the employment series reported in *CSY*. Brandt, Hsieh, and Zhu follow Holz's method to get the revised sectoral employment data. Holz (2006, Appendix 13) reports the revised employment values (end-year), adjusting the pre-1990 sectoral employment values. Data for the 1978-1989 period are obtained by applying the shares of the individual sectors in official total employment to the adjusted pre-1990 total employment values.

Figure 2 displays the sectoral employment shares based on revised employment data in China between 1978 and 2005. Agricultural employment fell rapidly in the early stages of economic reforms, causing rise to rapid increases in the share of non-agricultural sector in total employment. Even though the importance of agriculture in China's economy has fallen, it is still a large sector, accounting for more than 40% of employment in 2005. In 1978, 17.3% of the employment was in secondary sector (industry), and the employment share of this sector increased to about 24% in 2005. The employment share of the tertiary sector (services) increased from 12.2% in 1978 to 31.4% in 2005. The employment share of industry did not

rise as fast as that of services during 1978-2005. Brandt, Rawski, and Sutton (2008) argue that the relative stagnation of employment in the secondary sector is due to the result of the massive state-owned enterprise (SOE) layoffs since the mid-1990s. Banister (2005) discusses that manufacturing employment in China increased during the 1980s and early 1990s, peaked in about 1995/1996, declined during the late 1990s and increased again in 2002.

2.2 Sectoral Output and Measurement Issues

There has been a discussion on the reliability of the official Chinese GDP numbers as well as the implicit sectoral deflators (see, e.g., Ruoen, 1997; Young, 2003; Bosworth and Collins, 2008; and Dekle and Vandenbroucke, 2010, 2012). For output statistics in China, the deflators used to produce sectoral real output series are the major points of the discussion, since other things being equal, an overstatement/understatement of sectoral output growth could invalidate any productivity estimate.

Holz (2006) offers the following approach. Holz uses real growth rates calculated from the first published implicit deflator and nominal values whenever feasible. First, nominal values are post-economic census values across all sectors after 1993, all other nominal values are not revised, and the earlier published nominal values are used in those instances. Second, the output values are in 2000 prices, which imply applying real growth rates to the year 2000 (post-economic census) nominal value added in order to obtain time series of constant price output. First published implicit deflators are available for the three sectors after 1987. Figure 3 displays the value added shares, based on constant 2000 prices, during 1978-2005. Agriculture's share of value added declined from 40% in 1978 to 11.5% in 2005. The value

added share of the secondary (tertiary) sector increased from 31.8% (28.1%) in 1978 to 46.0% (42.5%) in 2005. China's real output in the secondary (tertiary) sector grew at an average annual rate of 11.6% (11.8%).

3. Productivity by Sector

We measure the sectoral productivity in China using the calculations of sectoral TFP growth rates. This is not an easy task, since we need data for capital by sector to calculate sectoral TFPs. In this section, we first explain our method for calculating sectoral physical capital input. Then, we provide a brief discussion for the sectoral factor income shares. Finally, using the constructed sectoral data, we provide our calculations for sectoral TFP growth rates in China between 1978 and 2005.

3.1 Capital by Sector

The Chinese official statistics provide no standard estimation of the capital stock at any industry level or by any category. The first issue is to allocate the nation-wide gross fixed capital formation (GFCF) to three main economic sectors. Sectoral GFCF data are available at the provincial level and for the 1978-1995 period. The provincial data are not always complete (but when values are missing, they are missing simultaneously for all three sectors). For the period 1978-1995, total sectoral provincial GFCF accounts for an average of around 79% of the annual value of national GFCF.

We follow Holz (2006) to construct the sectoral GFCF data for the period 1978-1995. Data for GFCF are divided into the three main economic sectors using sectoral shares available for the individual provinces. Holz (2006) uses GDP shares of the three sectors to allocate the nation-wide GFCF into these sectors. However, these shares seem to overstate investment in agriculture, since agriculture's share in production is very high compared to the capital formation rate. To avoid such a bias, we use the shares of 1995 that we compute from Hsueh and Li (1999) for the remaining years between 1996 and 2005.

We deflate nominal investment figures to obtain real investment figures. The ideal index to use for this purpose is the price index of investment in fixed assets. The *CSY*, however, began to provide this index only after 1993, and the starting year of this index is 1991 (1990=100). Jefferson et al. (1996) estimate China's price index of investment in fixed assets between 1979 and 1992. Zhang (2003) argues that the estimates of Jefferson et al. (1996) are consistent with the *CSY*'s numbers, since both sources estimate their indices by averaging the deflators of construction/installation and machinery/equipment purchases. Based on the data from both of these sources, Zhang constructs China's price index of investment in fixed assets between 1978 and 2000 (Zhang, 2003). Using the *CSY*, we extend this index to 2005.[9] Sectoral capital stock are estimated using real sectoral investment series from the GFCF data, employing the perpetual inventory method with 10% depreciation rate following Bai et al. (2006).

The initial capital stock in each sector is calculated by the formula $I_{j,0}/(g_j+\delta)$, where $I_{j,0}$ is the first year of the real investment in sector *j*, g_j is the average growth of the investment in

[9] Zhang (2003) does not report the value of the index for the year 1978. We take the 1979's value as the corresponding observation for 1978.

sector *j* in the first five years of the sectoral real GFCF series, and δ is depreciation rate. Given the relatively small capital stocks in 1978 and the high levels of investment, the estimates for later years are not sensitive to the initial values of the capital stocks (Fan et al., 2003). All series are valued at 2000 prices to be consistent with the sectoral output data.

Figure 4 plots the capital-output ratios for the whole economy, and by sector. The average *real* capital-output ratio for the entire economy is 1.96 for the sample period, where we calculate real output as the summation of the three sectors' value added to be consistent with our earlier calculations. The real capital stock of the primary sector grew by 3.69% per annum on average during 1978-2005. The corresponding figures for the secondary and the tertiary sectors are 7.12% and 11.9%, respectively. Capital formation increased the capital stock which, in turn, expanded production capacity. Bai et al. (2006) interpret this observation as a gradual restructuring of China's industrial sector, in favor of more capital-intensive industries, requiring higher aggregate investment rates, i.e., the investment rate increased from 31.8% in 1997 to 41.5% in 2005.[10]

The capital-output ratios of the primary and the tertiary sectors have demonstrated the U-shape and the capital-output ratio of the primary sector (the tertiary sector) increased after 1995 (1993). On the other hand, there was a reduction in the capital-output ratio in the secondary sector, starting with value of 4.91 in 1978 and falling to 1.63 in 2005, reflecting the higher efficiency of capital in this sector.

[10] We use the expenditure components of GDP as investment rate and follow Young (2003) by expressing it as the ratio of gross fixed capital formation to nominal GDP (see CSY, 2006, Table 3.12).

3.2 Sectoral Factor Shares

We specify the technologies at the sector level and employ the Cobb-Douglas functional forms. The question is which income shares we should assign to the factors of production at the sector level? There are no intermediate inputs and we do not include land in the production function of the primary sector to focus on the two basic factors of production: capital and labor.[11]

Holz (2006) reports the time series for the sectoral labor shares in the primary, secondary, and tertiary sectors in the Chinese economy during 1978-2002; calculating the labor share by sector as the share of labor remuneration in the sum of labor remuneration, depreciation, and operating surplus. Net taxes on production are split proportionally between labor and capital, where capital's share is measured by the sum of depreciation and the operating surplus. Since there is no national data on these sources of renumeration, all shares are based on the sum of provincial values. Holz's calculations show that the average labor shares in primary, secondary, and tertiary sectors are 0.884, 0.475, and 0.502, respectively during 1978-2002. We use these figures in our calculations.

3.3 TFP by Sector

To calculate TFP by sector, we need output, employment, and capital at the sector level, and the sectoral factor income shares. We use the following production function specification for each sector:

[11] Agricultural land has been almost a fixed quantity since 1952 in China. The average annual growth rates of cultivated land area and total sown land area were 0.35 and 0.18% during 1952-2005, respectively (China Data Center, production condition for agriculture of China).

$$Y_{j,t} = TFP_{j,t} K_{j,t}^{\alpha_j} E_{j,t}^{1-\alpha_j}, \quad j \in \{\text{primary, secondary, tertiary}\}. \tag{1}$$

Here $K_{j,t}$ and $E_{j,t}$ are the quantities of capital and labor employed in sector *j* at time *t*. $Y_{j,t}$ is sectoral output, $TFP_{j,t}$ is sectoral TFP at time *t*, and α_j denotes the capital share of sector *j*. In what follows, TFP series are calculated as follows:

$$TFP_{j,t} = Y_{j,t} \Big/ \left(K_{j,t}^{\alpha_j} E_{j,t}^{1-\alpha_j} \right), \quad j \in \{\text{primary, secondary, tertiary}\}. \tag{2}$$

Figure 5 shows the paths of sectoral TFPs in China between 1978 and 2005. TFP growth in Chinese agriculture averaged 4.55% per annum between 1978 and 2005.[12] The average growth rate of TFP in the secondary sector is the highest among the three sectors. TFP growth in the secondary sector averaged 6.11% per annum and TFP growth in the tertiary sector averaged 2.91% per annum between 1978 and 2005. There were declines in TFP growth rates in non-agricultural sectors during the late 1980s. These declines coincide with the violent repression of the student movement at Tiananmen Square in June of 1989, which put a temporary end to the steady liberalization of the Chinese economy and led to temporary recentralization of many economic activities (Naughton, 1995, p. 4). In order to measure the contribution made by factors of production relative to that made by TFP, next section conducts a growth accounting exercise at the sectoral level.

[12] We observe that agricultural TFP growth is not affected significantly in the presence of land. That's why we exclude the land, for the rest of the analysis, from the production function so that the agricultural production function looks like the other two sectors' production functions.

4. Growth Accounting

4.1. Sectoral Growth Accounting

We have a common framework for each sector and we consider the production function specified in Equation (1). In per-worker terms the production function can be rewritten as

$$y_{j,t} = TFP_{j,t} k_{j,t}^{\alpha_j}, \quad j \in \{\text{primary, secondary, tertiary}\}, \tag{3}$$

where y is the output per worker $y \equiv Y/E$, and k is the capital-labor ratio $k \equiv K/E$. We take logarithms of this expression and decompose the average annual growth rate of output per worker over a number of years, z, (from time t to time $t+z$) as follows:

$$\frac{log(y_{t+z}) - log(y_t)}{z} = \frac{log(TFP_{t+z}) - log(TFP_t)}{z} + \alpha \frac{log(k_{t+z}) - log(k_t)}{z}. \tag{4}$$

This expression decomposes changes in output per worker into changes in TFP (the first term on the right hand side), and changes in physical capital per worker (the second term on the right hand side). Table 1 reports the results of the sectoral growth accounting exercise for China between 1978 and 2005. Real GDP per worker of the primary sector grew by 5.72% on average during 1978-1984. For the primary sector, there was no increase in capital intensity: between 1978 and 1984, i.e., the capital-labor ratio declined. A high per-worker GDP growth rate was brought completely by very high growth rate of agricultural TFP (a 5.88% growth). This observation is consistent with earlier findings. For example, Stavis (1991) views

technological change as the engine of agricultural growth for the 1978-1984 period. What caused the high TFP growth rate, including the early reform period, in the primary sector?

Between 1978 and 1984 significant developments took place in agriculture. In the early reform period (1978-1984), the household responsibility system (HRS) replaced the production team system as the unit of production (and income distribution). This significantly increased agricultural productivity transferring the collective agricultural production system to individual farms by contracting land-use rights to individual rural households. In what follows, price and marketing reforms improved the peasants' work incentives in rural China.

Lin (1988) argues that the failure of the collectivization period was not due to its socialist nature but it was because of the difficulties inherent in supervising agricultural work. Farmers became the residual claimants in the HRS. The HRS gradually replaced the commune system since the end of 1978. By the end of 1983, less than 3% of households had not adopted the responsibility system. This suggests that the institutional transformation from a collective system to the HRS was essentially completed by the mid-1980s.[13]

There were important reforms in the non-agricultural sectors, such as gradual reduction of centralized controls on prices, inputs/outputs, and the rising share of production outside of the state enterprise sector; and the freedom of townships and villages to establish industrial enterprises outside of the central plan (Jian et al., 1996). Table 1 shows that China's real

[13] According to Johnson (1990, p.32), the two most important reforms of the early period from 1978 to 1984 were the introduction of the household responsibility system and the increase in prices received by farmers. McMillan et al. (1989) assess the relative importance of these two reforms for the post-1978 increase in China's agricultural productivity. Their results suggest that 22% of the increase in productivity in Chinese agriculture during 1978-1984 was due to higher prices and 78% to changes in the incentive scheme, the HRS.

output per worker in the secondary sector grew at an average annual rate of about 8% between 1978 and 2005. One of the major institutional features of the Chinese economy is the coexistence of the SOEs and the non-state sector. The non-state sector, including private enterprises, joint ventures, urban collectives, and township and village enterprises (TVEs), has crowded out SOEs in many markets.[14] Smyth and Shi (2002) argue that ownership reform was an important factor explaining TFP growth from 1980 to 1995. Table 1 shows that TFP growth in the secondary sector accounted for more than 70% of the output per worker growth in this sector between 1978 and 2005.

In the secondary sector, policies were introduced to increase the autonomy of enterprise managers, to reduce the dominance of planned quotas, and to allow enterprises to produce and sell goods in the market. Fung et al. (2000) argue that the real sector of the economy has been liberalized substantially and goods and factor markets have become increasingly competitive. More market-oriented policies have emerged with the growing importance of the urban private sector, as SOEs are being downsized. Decentralization has greatly stimulated the rural industrialization driven by the development of TVEs (Guthrie 2006, p.51). Beginning in the mid-1990s, the privatization and subsequent stock market listing of SOEs were integral parts of China's state enterprise reforms.

Table 1 displays that real GDP per worker of the tertiary sector grew by around 6% average annual growth rate during 1978-2005. During this period, 49.2% of this growth comes from

[14] TVEs are economic units which are either collectively owned by local residents in the rural areas of China or mainly owned and controlled by the peasants (Fu and Balasubramanyam, 2003). Brandt and Zhu (2001) clarify the definition of the non-state sector: although it does include private enterprises and joint ventures, until recently the non-state sector was primarily made up of urban collectives and TVEs.

TFP growth and 50.8% of this growth is due to the increases in the capital-labor ratio. For the tertiary sector, Table 1 shows that TFP growth was the dominant factor during 1984-1993 and capital deepening was the dominant factor during 1993-2005. The importance of the capital-deepening in services is obvious in the 1993-2005 era, since capital-deepening made up about 73% of the growth in output per worker in the tertiary sector. The production of services is likely to become increasingly important to China's overall economic development over the coming decades. Being a World Trade Organization member since 2001, increased market access has opened new economic opportunities for China, with an expected favorable impact on trade and investment for years to come. Services created more than 27 million new jobs, which was 85% of all employment creation, during the 9th Five-Year Plan, 1995-2000 (OECD, 2003).

4.2 Aggregate TFP and Growth Accounting

Here, we study the role of aggregate TFP growth in the post-1978 period. Aggregate labor, capital, and output are obtained as the summation of the sectoral figures that we discuss above. Labor is the single most important factor in determining national income in the Chinese economy. We set the capital share as 0.487 following Bai et al. (2006).[15] The factors that contribute to GDP per working-age population can be decomposed as follows:

$$Y_t / N_t = TFP_t^{1/(1-\alpha)} \times \left(K_t / Y_t\right)^{\alpha/(1-\alpha)} \times \left(E_t / N_t\right), \quad (5)$$

[15] Bai et al. (2006) discuss the changing nature of the importance of capital and labor in the aggregate economy, and argue that the average labor share between 1978 and 2005 is 0.513. Similarly, Islam et al. (2006) report that the average aggregate labor share in the Chinese economy is 0.52 during 1978-2002.

where N_t denotes economically active population (working-age population). Such a formulation, following Hayashi and Prescott (2008) and Kehoe and Ruhl (2010), provides a decomposition for real GDP per working-age person, Y_t/N_t into TFP factor, $TFP_t^{1/(1-\alpha)}$, capital-output ratio factor, $(K_t/Y_t)^{\alpha/(1-\alpha)}$, and employment rate, E_t/N_t.

We measure population as those who are aged 16 and over who are capable to work, rather than the total population based on the definitions of *CSY*. We take logarithms of this expression and decompose the average annual growth rate of output per worker over a number of years. Results are reported in Table 2. Aggregate TFP growth is the single most important factor behind the output growth in the Chinese economy between 1978 and 2005. Over the period 1978-2005, GDP per economically active person has grown at 7.19% per year, which is completely accounted for by a 9.24% growth rate in TFP factor.

TFP growth has played a major role in shaping aggregate growth between 1978 and 2005. Average annual growth in TFP between 1978 and 2005 is 4.85%. These results suggest that most of the fluctuations in output per working-age person are due to the changes in the TFP factor, rather than the input expansion. Our finding is in line with the results of Kehoe and Ruhl (2010) and Zhu (2012). These two studies also find that the most important factor in aggregate growth in the post-1978 era has been the TFP growth in China.

Our results do not reflect any adjustments for the contribution of human capital and other such related factors, such as fluctuations factor utilization (Heston and Sicular, 2008). Lee and Malin (2013) find that about 13% of aggregate growth in output per worker from 1978 to

2004 is accounted for by an increased education, with 11% coming from through the labor-reallocation channel and 2% attributable to increase within-sector human capital. Several previous studies find that TFP growth ranges around or above 3% per year since the beginning of the economic reforms and our findings are consistent with these studies as well. For example, Perkins and Rawski (2008) obtain TFP growth of 3.8% per year for 1978-2005, net of the contribution of rising education levels. Blanchard and Giavazzi (2006, Table 4) and Cao et al. (2009, Table 1) report the estimates of TFP growth computed by various studies.[16]

5. Concluding Remarks

In the last two decades or so, a considerable amount of interest in the Chinese economic development has been generated outside China. It is essential to understand the process and nature of Chinese economic development and structural transformation in order to evaluate better the dimensions of China's economic impact on international relations. China's recent economic growth is associated with large systematic changes in the structure of production, factor use, and a significant shift in the composition of economic activity. The agricultural sector has contributed to the development by supplying labor the secondary and the tertiary industries during the rapid economic growth.

This paper has focused on the role of sectoral performance in economic growth for China between 1978 and 2005. To provide empirical evidence (and to review the previous research) of the effect of sectoral change on economic growth in the post-1978 period in China, this

[16] These studies cover different periods and employ different methods, and a complete account of their differences and a reconciliation of their results with our findings are beyond the scope of this paper.

paper has analyzed the estimates of growth of output and productivity by sector of the Chinese economy. For this purpose, annual sectoral account on real output, employment, and capital, for three main sectors, have been obtained/constructed, which together constitute the total economy. The thesis of this paper is that a deeper understanding of the productivity growth is needed to develop a comprehensive understanding of China as an emerging giant.

There are many aspects of the growth process and international comparison, which are not touched upon in this paper. For example, we do not deal with the issues of openness in this paper (see Üngör (2010, Chapter 1) and the references therein for a review of the liberalization process of the Chinese foreign trade). Lastly, we shall say that China's economic development is a trail of unfinished business (Brandt and Rawski, 2008). Despite more than three decades of economic reforms, China still faces the challenge of reducing input-market distortions and removing various impediments in market structures. In that regard, China is still far from a highly functioning well-regulated market economy. The issues of property rights, governance, transparency, and income distribution will be topics of research on China and challenges of policy-makers in China.

Appendix A

Countries in Figure 1 are Albania, Algeria, Angola, Argentina, Australia, Austria, Bahrain, Bangladesh, Barbados, Belgium, Bolivia, Brazil, Bulgaria, Burkina Faso, Cambodia, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Côte d'Ivoire, Cyprus, Denmark, Dominican Republic, DR Congo, Ecuador, Egypt, Ethiopia, Finland, France, Germany, Ghana, Greece, Guatemala, Hong Kong, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel,

Italy, Jamaica, Japan, Jordan, Kenya, Kuwait, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Malta, Mexico, Morocco, Mozambique, Myanmar, the Netherlands, New Zealand, Niger, Nigeria, Norway, Oman, Pakistan, Peru, Philippines, Poland, Portugal, Qatar, Romania, Saudi Arabia, Senegal, Singapore, South Africa, South Korea, Spain, Sri Lanka, St. Lucia, Sudan, Sweden, Switzerland, Syria, Taiwan, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, the United Arab Emirates, the United Kingdom, the United States, Uruguay, Venezuela, Vietnam, Yemen, Zambia, and Zimbabwe.

Figure 1. Growth Rates of GDP per Capita (%): 1950-2005

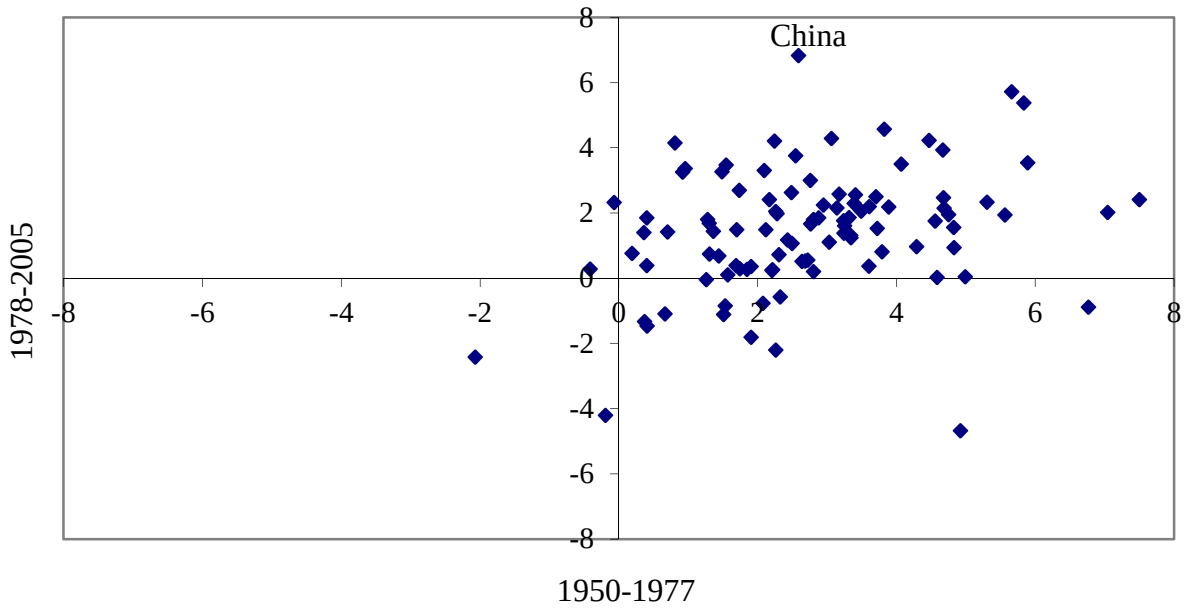

Figure 2. Sectoral Employment Shares (%): 1978-2005

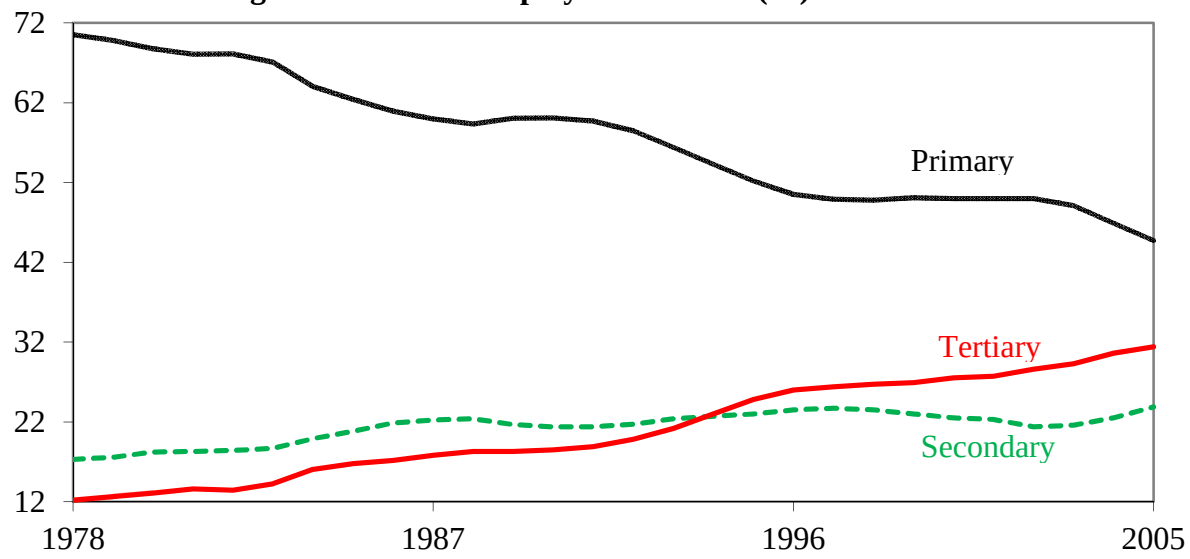

Figure 3. Real GDP Shares (%): 1978-2005

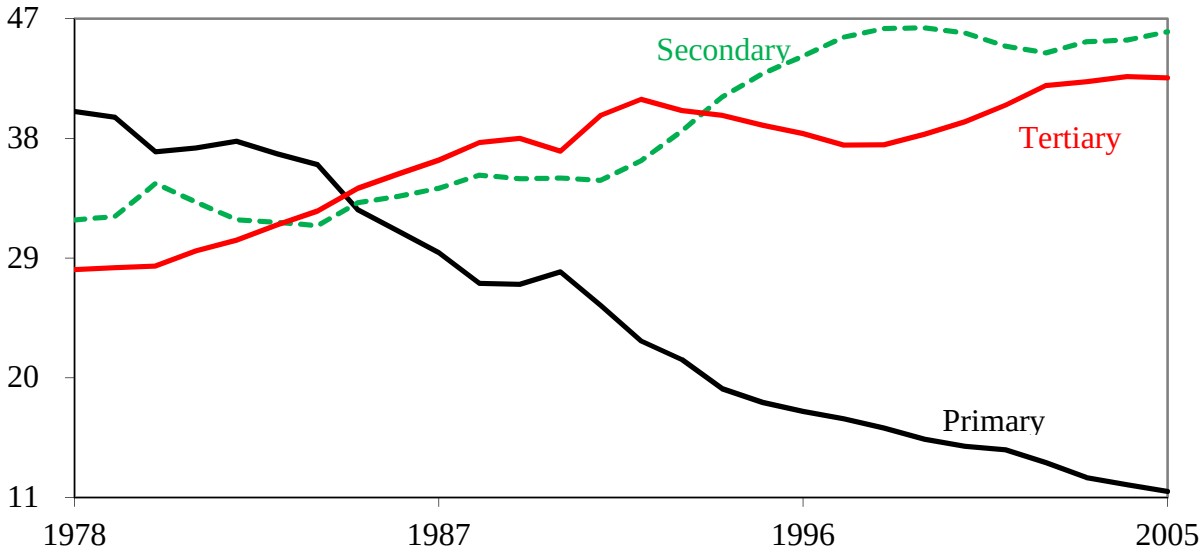

Figure 4. Capital-Output Ratios: 1978-2005

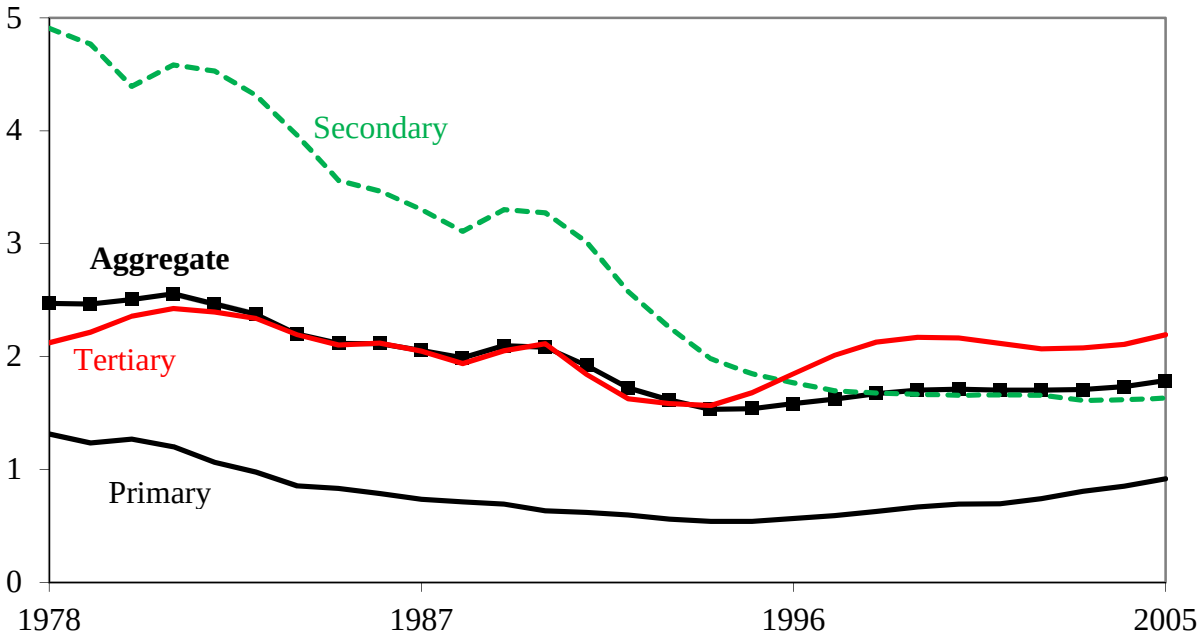

Figure 5. Sectoral TFPs (1978=1): 1978-2005

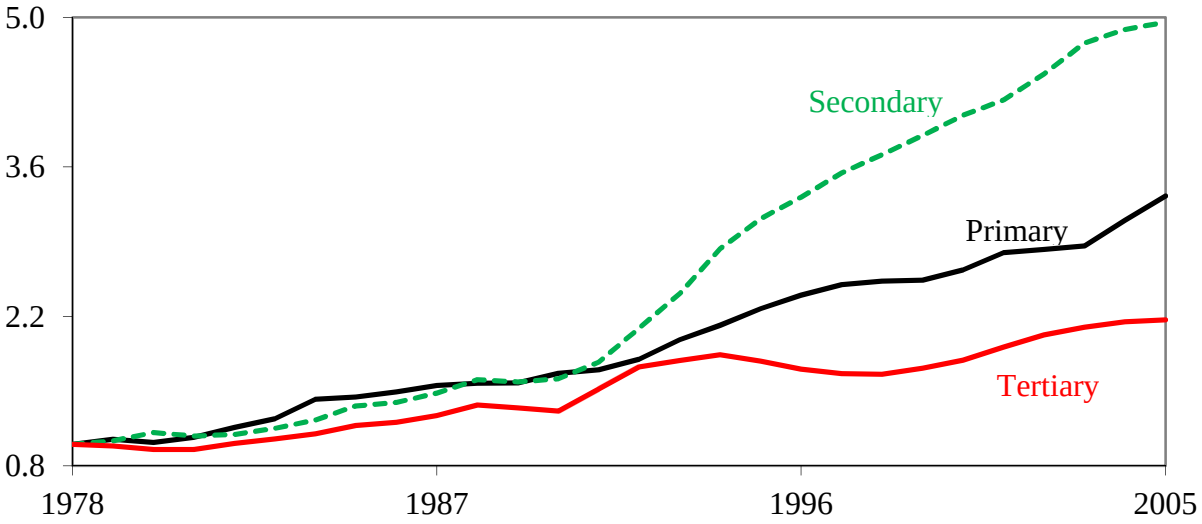

Table 1. Sectoral Growth in China (average annual changes, %): 1978-2005

Period	Output per worker	Contribution to output per worker of: Total factor productivity	Contribution to output per worker of: Physical capital per worker
Agriculture			
1978-1984	5.72	5.88	-0.17
1984-1993	3.54	3.67	-0.13
1993-2005	5.42	4.32	1.10
1978-2005	4.86	4.45	0.41
Industry			
1978-1984	3.31	3.45	-0.14
1984-1993	8.89	7.50	1.39
1993-2005	9.63	5.99	3.64
1978-2005	7.98	5.93	2.05
Services			
1978-1984	3.68	1.58	2.10
1984-1993	7.17	5.40	1.76
1993-2005	5.90	1.61	4.29
1978-2005	5.83	2.87	2.96

Table 2. Aggregate Growth in China (average annual changes, %): 1978-2005

Period	Output per working-age person	Contribution to output per working-age person: Total factor productivity factor	Contribution to output per working-age person: Capital-output ratio factor	Contribution to output per working-age person: Employment rate
1978-1984	5.87	8.55	-2.69	0.01
1984-1993	6.25	11.45	-3.51	-1.68
1993-2005	8.54	7.92	0.76	-0.14
1978-2005	7.19	9.24	-1.43	-0.62

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