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SECTORAL FACTOR REALLOCATION AND PRODUCTIVITY GROWTH: RECENT TRENDS IN THE CHINESE ECONOMY

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Based on the data of six major sectors and 13 industrial sectors of the Chinese economy, this study examines the impact of sectoral factor reallocation on productivity growth for the period 1986-2000. According to the results, the earlier post-reform high productivity growth was not sustained in more recent years. The overall performance of inter-sector reallocation was also disappointing. Limited improvements in productivity growth were observed for the industrial sectors as China beefed up reforms of state-owned enterprises in the late 1990s. This evidence highlights the huge potential gains for a developing economy like China to build sound market institutions in line with greater market openness and inter-sector factor mobility.

Keywords: The Chinese Economy, Total Factor Productivity, Inter-sector Reallocation
JEL classification: O47, O53, L52

1. INTRODUCTION

In the last two decades of the 20th century, the Chinese economy achieved remarkable growth that drastically changed the world economic geography. A substantial body of literature has analyzed the sources of the economic growth in China. One of the pioneering works was Chow (1993), which concluded that capital accumulation was the major source of pre-reform growth and technological progress (or productivity gain) was absent in China from 1952 to 1980. Complementary to Chow's paper, a study by Hu and Khan (1997) covers the period 1952-1994 and it reveals that, although capital accumulation was a dominant factor in China's economic growth, productivity improvements had assumed an increasingly important role. During 1979-1994 China's total factor productivity growth approached 4 percent per annum and

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contributed more than 40 percent of China's aggregate economic growth. The higher TFP rate in the post-reform period indicates considerable gains from market-oriented reforms after 1978. On the similar ground, a number of studies have discovered impressive productivity growth in the economy after China embarked on market-oriented reforms. Some of these findings arose from studies on China's state-owned industry. Jefferson and Rawski (1994) surveyed 13 of such studies, which indicated 2-6 percent annual productivity growth in the post-reform period up to the early 1990s.

World Bank (1997) confirms that China's growth residual was unusually large for the period 1978-95: 46 percent on the assumption of constant returns to scale and 30 percent on the assumption of increasing returns to scale. The report also estimates that 1.5 percentage points of GDP growth in the period 1978-95 could be explained by sectoral factor reallocation. World Bank (1996) attributes half a percentage point of GDP growth between 1985-1994 to reallocation of labor out of the state-owned sector and one additional percentage point of growth in the same period to transfer of labor out of the agricultural sector. Using the official estimates of the size of "floating population" (illegal or temporary rural-urban migration), Woo (1998) reports that the labor reallocation effect increased the GDP growth rate by 0.9-1.3 percentage points during 1979-93 while the net TFP growth was about 0.2-2.3 percent in the period. These findings provide evidence for the improvement of sectoral resource allocation as China underwent market-oriented transition. There still exist, however, significant barriers to inter-sector resource allocation in the economy. For instance, Jefferson, Rawski, and Zheng (1996) measured total factor productivity (TFP) for China's state and collective industry in the period 1980-1992 and evaluated the robustness of productivity results. They concluded that differential rates of capacity utilization and, in state industry, selection bias and an unresponsive system of investment finance might have in fact retarded the measured growth of productivity during 1988-1992.

Has the overall quality of growth and sectoral factor reallocation improved since then? So far, little study has been conducted to evaluate the quality of China's growth for the whole period of the 1990s, in particular, its productivity trends after 1992. Such studies are well due. In the 1990s, the Chinese economy went through some drastic institutional and policy changes, which should have profound impact on the economy's allocative efficiency. The year 1992 marked a watershed in China's two-decade transition from a centrally planned economy to a market economy. In October that year, the Fourteenth National Congress of the ruling Communist Party reached a consensus to establish the "socialist market economic system" as the goal of the reform. This event ended a decade-long controversy about the nature of reform and transformed economic reform from a largely locally-initiated, decentralized process towards a centrally-initiated and pre-designed institution-building process (Lu (2001)). In November 1993, the Party's Central Committee passed a 50-article "decision" on the strategies of further reforms. Aiming to make the market "a fundamental factor in the allocation of resources under state macro control", the "decision" covers ten broad areas dealing with the need to restructure the market system, state enterprises, government functions, taxation and social security, foreign trade and law. A series of centrally initiated reforms to build the bedrock of a modern market economy followed. These include: beginning of current account convertibility of China's currency (1994), fiscal reform to institutionalize a stratified tax revenue structure and to unify corporate tax rates between state and non-state sectors (1994), the promulgation of the central banking law and the commercial banking law (1995), taking off of the national stock exchanges which were set up in 1990 (1992-93), launch of an overall reform to restructure and turn around the ailing state-owned enterprises (1998) and the related social security reforms, and amending Constitution to grant full legal status to private businesses (1999).

The 1990s was also the first decade after China promulgated an explicit industrial policy package in 1989. The industrial policy regime was further refined around the mid-1990s to target the growth of the so-called "pillar industries" handpicked by the government. As summarized by Zhang and Long (1997), China relied on six types of industrial policy tools during the 1990s: central government financing and planning; empowering key industries with direct financing; preferential interest and tax rates and favorable financing for target industries; infant industry (trade) protection; pricing policies; and administrative means. In addition to these six tools, the regulatory authorities provide systematic guidelines to channel foreign direct investment into desired industries. Based on these guidelines, the government exercises licensing and approval of all foreign-funded projects. Meanwhile the government imposed restrictive controls on foreign ownership, business ranges and geographic scope of foreign-funded enterprises.

With these institutional and policy changes, China's GDP growth accelerated from 8.72 percent per annum in the period 1978-91 to 10.02 percent per annum in the period 1992-2000. However, it is not clear whether the impressive growth after 1992 was achieved mainly through extensive expansion of input usage or through enhancement in factor allocative efficiency. In this paper, we use the data of six major sectors and 13 industrial sectors of the Chinese economy for the period 1986-2000 to reveal (1) the productivity trends in the whole economy and in the industrial sector over the period under study; and (2) the gross-allocation-effect and total-reallocation-effect that measure sectoral allocative efficiency in the economy. The next section gives a brief review of literature and introduction to research methodology. Data description and findings are presented afterwards. The final section discusses the implications of the findings.

2. METHODOLOGY

The literature of growth accounting originated from works by Solow (1957) and Denison (1962). The classical Solow's model starts with the aggregate production function:

$$Y = A(t) f(X_1, X_2, \dots X_n), \tag{1}$$

where Y represents output and X_i denotes factor input such as capital and labor. This production function shifts up with technological progress on the assumption that the neutral technical change does not change marginal rates of substitution. Therefore the technological constant $A(t)$ measures the cumulated effect of shifts over time, t.

Suppose the production function is of Cobb-Douglas type:

$$Y = A(t)\Pi_i X_i^{b_i}, \tag{2}$$

where b_i denotes the elasticity of output corresponding to the i^{th} input. We can estimate (2) by fitting the following regression model to actual data:

$$\ln Y = a + \Sigma_i b_i \ln X_i + u, \tag{3}$$

where $\ln$ is the natural logarithm, a and b_i are parameters to be estimated, and u is a statistical random error. The growth accounting procedure treats the share of output not explained by inputs as total factor productivity (TFP):

$$\ln TFP = \ln Y - \Sigma_i b_i \ln X_i. \tag{4}$$

Differentiating with respect to time gives the TFP growth:

$$l = d \ln TFP / dt = (dTFP / TFP) / dt. \tag{5}$$

The methodology to evaluate the inter-industry allocative effects were developed by Syrquin (1986), who presented the relationship between aggregate and sectoral growth by defining total output, Y, as sum of outputs in all sector:

$$Y = \Sigma_i Y_i \tag{6}$$

and aggregate labor productivity, y, as employment-share weighted sum of sectoral labor productivity:

$$y = \Sigma_i \frac{Y_i}{L_i}\frac{L_i}{L} = \Sigma_i y_i g_i, \tag{7}$$

where g_i is the employment share in sector i. Differentiating with respect to time gives the relations between aggregate and sectoral growth rates:

$$G_Y = \Sigma_i r_i G_{Yi} \tag{8}$$

and $G_y = \Sigma_i r_i G_{yi} + \Sigma_i r_i G_{gi}$, (9)

where $r_i = Y_i / Y$ is the share of sector i in total output.

Equation (8) simply means that the growth rate of total output, G_Y, equals the sum of sectoral growth rates weighted by the sectoral output shares. Equation (9) divides the growth rate of aggregate labor productivity into two components. The first term averages the sectoral growth rates of output per worker. The second term measures the contribution to aggregate labor productivity growth of employment shifts among sectors with different labor productivities. Syrquin denotes this second term by $A(y)$ and label it the "gross allocation effect" (GAE). Thus we have:

$$A(y) = G_y - \Sigma_i r_i G_{yi} \,. \tag{10}$$

According to Syrquin, the gross allocation effect "measures the growth in aggregate labor productivity that would have taken place with the observed labor shifts, had the relative labor productivities remained constant." The GAE, however, "is a partial measure since it ignores factors other than labor and computes the gains and losses from employment shifts in terms of average and not marginal products" (Syrquin (1986, p. 252)).

To account for the full reallocation effects of both capital and labor, Syrquin also proposes the concept of total reallocation effect (TRE), following the same line of analysis:

$$TRE = l_a - \Sigma_i r_i l_i \,, \tag{11}$$

which is precisely the amount by which the aggregate growth rate of total factor productivity (l_a) exceeds the weighted average of the sectoral rates of TFP (l_i) , when the reallocation of resources leads to a reduction in the extent of disequilibrium (Syrquin (1986, p. 253)). A positive TRE indicates that, on average, sectors with above-average marginal products of capital or labor have increased their share in total capital or employment during the period under investigation.

3. DATA AND RESULTS

We apply the above approach to the analysis of two data sets from *China Statistical Yearbook*. The first consists of six sectors in China's GDP account (Table 1) from 1985 to 2000. The second includes 13 industrial sectors in three major categories, excavation, manufacturing, and public utilities from 1986 to 2000 (Table 2).

Table 1. Percentage Composition of China's GDP

		Gross Domestic Product					
		Primary Industry	Secondary Industry		Tertiary Industry		
			Industry	Construction	Transportation, Post and Telecom	Commerce & Catering Trade	Other Tertiary-Industry Services
Share of GDP	1985	28.4	38.5	4.7	4.5	9.8	14.2
	1990	27.7	37.0	4.6	6.2	7.7	17.4
	2000	15.9	44.3	6.6	5.5	8.2	19.6
Share of Jobs	1985	62.4	16.7	4.1	2.6	4.6	9.6
	1990	53.4	15.2	3.8	2.5	4.4	20.8
	2000	46.9	12.5	5.0	2.9	6.6	26.1
Percentage Point Change 1985-2000 GDP vs. Jobs		-12.5 vs. -15.5	5.8 vs. -4.2	1.9 vs. 0.9	1.0 vs. 0.3	-1.6 vs. 2	5.4 vs. 16.5

Note: Share of GDP is based on nominal value.

Source: China Statistical Yearbook, various issues.

Table 2. Composition of China's Industrial Employment, Net Value of Fixed Assets and Value Added

		Excavation	Manufacturing			Public Utilities
				Machinery	Non-machinery	
Share of Value-added	1986	14.4	82.7	25.9	56.8	2.9
	2000	14.3	78.8	23.6	55.2	6.9
Share of Jobs	1986	12.0	81.1	19.4	61.6	6.9
	2000	12.6	77.4	23.8	53.6	10.0
Percentage Point Change 1985-2000 GDP vs. Jobs		-0.2 vs. 0.6	-3.9 vs. -3.6	-2.4 vs. 4.4	-1.6 vs. -8.1	4.1 vs. 3.1

Notes: All monetary values are at constant prices. The 13 sectors included in this data set are: "Coal mining and processing", "Petroleum and natural gas extraction", "Other extractions", "Food, beverage, tobacco production and processing", "Textile, garments, leather", "Timber processing, paper, furniture", "Printing and record medium, cultural products", "Petroleum and chemical products", "Nonmetal mineral products", "Metal production and processing", "Machinery", "Other manufacturing", and "Power, gas, water supplies".

Source: China Statistical Yearbook, various issues.

For the first data set, we use the "number of employed persons" as a proxy for labor input (L) and the "consumption of total energy by sector (in tons of SCE)" for variable capital input (V).[1] Since the capital input data for the six major sectors are not readily available, we estimate the data by applying the standard perpetual inventory approach. We first find the annual investment amount (I) by summing the "investment in capital construction by sector" and the "investment in innovation and upgrading by sector". Then we sum up the "newly increased fixed assets through capital construction by sector" and the "newly increased fixed assets through innovation and upgrading by sector" to get the annual change of fixed capital $(\Delta K = K_t - K_t)$. Since

$$K_t = I_t + (1-d)K_{t-1}, \tag{12}$$

we have

$$K_{t-1} = (I_t - \Delta K_t)/d\ . \tag{13}$$

Using (13) to estimate the initial-year capital stock, we are able to derive the capital stock series for the consecutive years by adding in the respective ΔK. The resulting estimates for the "industry sector" match very close to the published statistics of the "average net value of fixed assets" for industrial enterprises in the period under study.[2]

For the second data set, we use the following proxies:

- "Staff and workers by branch of industry" for labor input (L)[3];
- "Average balances of net value of fixed assets" for fixed capital input (K);
- "Annual average balance of circulating funds" for variable capital input (V).

With these data, we may fit the regression model (3) to calculate the overall and sectoral rates of total factor productivity (TFP):

$$\ln Y_{ti} = a + b_{Li} \ln L_{ti} + b_{Ki} \ln K_{ti} + b_{Vi} \ln V_{ti} + u_{ti} \tag{14}$$

and

[1] The energy consumption statistics for 2000 is not yet available in the 2001 issue of *China Statistical Yearbook*. So we projected the 2000 energy figures based on the previous two years' average growth rate of energy use.

[2] We used $d = 3.6\%$ to estimate the capital stock. As noted by Hu and Khan (1997), this is the artificially low rate used by the Chinese planners. It is therefore suitable to estimate the official statistics, which we have consistently used for other inputs.

[3] The official definition for "staff and workers", *zhi gong*, refers to employees on the payroll. This statistical category is narrower than "employed persons", which refers to all persons employed (including those self-employed and the workers not on the regular payroll).

$$\ln TFP_{ti} = \ln Y_{ti} - \beta_{Li} \ln L_{ti} - \beta_{Ki} \ln K_{ti} - \beta_{Vi} \ln V_{ti} \,, \tag{15}$$

where β_{Li} is (computed) elasticity of labor, β_{Ki} (computed) elasticity of fixed capital, β_{Vi} (computed) elasticity of variable capital and α_i the constant term. The TFP growth rate is simply $\lambda_{ti} = \Delta \ln TFP_{ti}$. The length of time series ($t = 15$ in the first data set and $t = 14$ in the second data set), however, limits the statistical significance of estimates for the variables in (15). Alternatively, we use the following model to estimate the coefficients:

$$\ln Y_{ti} = \alpha_0 + \alpha_i D_i + \beta_L \ln L_{ti} + \beta_K \ln K_{ti} + \beta_V \ln V_{ti} + u_{ti} \,, \tag{16}$$

where D_i is dummy variable (=1 or =0 otherwise) for sector i, which captures the aggregate impact of sectoral differences in input elasticities and rectifies error structure with cross-sectional correlation. To avoid perfect collinearity, the dummy variables for "industry" in the first data set and "machinery" in the second data set were omitted from the regressions. To correct for first-order autoregressive disturbance of the industrial panel data, we applied Baltagi-Wu random-effects GLS model to estimate (16) (Baltagi and Wu (1999)). The results are displayed in Tables 3 and 4.

Table 3. Regression Results (1)

Data Set 1(6 sectors)	Coefficients	z-statistics	P-value
Intercept	0.2406	0.33	0.7430
Dummy			
-- Primary	1.5764	6.1	0.0000
-- Construction	0.7100	2.78	0.0050
-- Transportation, Post & Telecom	-1.1785	-5.26	0.0000
-- Commerce & Catering	0.7441	3.02	0.0020
-- Other Tertiary Sectors	-0.4313	-2.03	0.0420
Ln L	0.0781	1.30	0.1940
Ln K	0.7466	13.69	0.0000
Ln V	0.1241	2.2	0.0280

R^2 within	0.9143	Wald χ^2	769.88
R^2 between	0.9987	Prob > χ^2	0.0000
R^2 overall	0.9819	ρ	0.9244
No. of groups	6	No. of observations	96

Note: ρ is estimated autocorrelation coefficient.

Table 4. Regression Results (2)

Data Set 2 (13 industrial sectors)	Coefficients	z-statistics	P-value
Intercept	4.2876	6.44	0.0000
Dummy			
-- Coal Mining and Processing	-1.0702	-7.34	0.0000
-- Petroleum and Natural Gas Extraction	-0.6384	-2.66	0.0080
-- Other Extractions	-1.1883	-6.26	0.0000
-- Food, Beverage, Tobacco Production and Processing	-0.1646	-1.09	0.2750
-- Textile, Garments, Leather	-0.4009	-3.22	0.0010
-- Timber Processing, Paper, Furniture	-1.2695	-6.21	0.0000
-- Printing and Record Medium, Cultural	-1.5237	-6.02	0.0000
-- Petroleum and Chemical	-0.1796	-1.42	0.1550
-- Nonmetal Mineral Products	-0.7767	-4.94	0.0000
-- Metal Production and Processing	-0.4548	-3.37	0.0010
-- Other Manufacturing	-1.4504	-5.44	0.0000
-- Power, Gas, Water	-0.6721	-3.59	0.0000
ln L	-0.1028	-1.35	0.1780
ln K	0.2532	3.53	0.0000
ln V	0.2306	5.88	0.0000
R^2 within	0.8083	Wald χ^2	1888.71
R^2 between	0.9996	Prob > χ^2	0.0000
R^2 overall	0.9716	ρ	0.5788
No. of groups	13	No. of observation	195

The regression results report an insignificantly negative estimate (-0.10 with p-value 0.18) for the coefficient of labor input for the 13-industrial-sector data set, in contrast to the estimated coefficient of 0.08 for the six-major-sector data set. A likely cause of this discrepancy is the high concentration of employment by state-owned enterprises in the industrial sectors. In 1990, the share of state-owned units in total staff and workers in the industrial sector was 68.0 percent, in contrast to their 18.2-percent share in the national employment. In 2000, the share of state-owned units in the industrial payroll was 51.1 percent while their share in national employment was only 12.0 percent. Note that our proxy used for L input in the industrial-sector data is "staff and workers by branch of industry", which refers to the employees on the regular payroll. From the large-scale labour layoffs in the state sector in recent years, it is logical to infer that a large portion of those on the payroll in the industrial sectors were redundant workers, whose marginal productivity was very low and even negative.[4]

The trends of labor productivity and total factor productivity calculated from the two data sets are displayed in Figures 1 and 2.

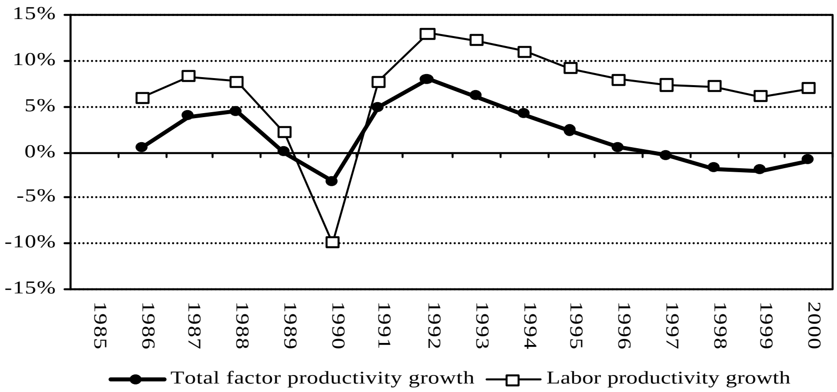

Figure 1. Productivity Growth in 6 Major Sectors (1986-2000)

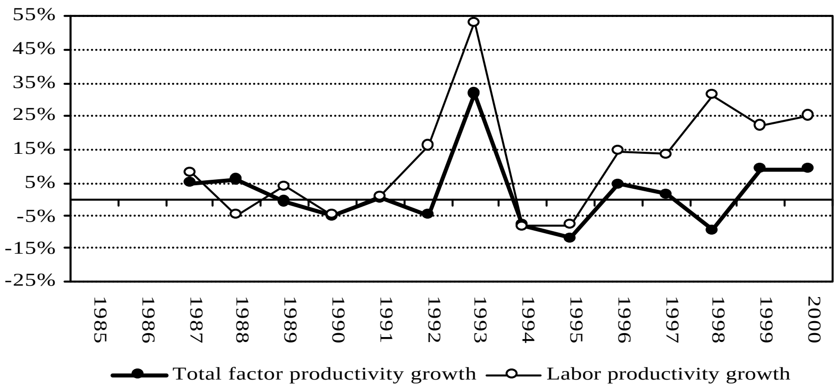

Figure 2. Productivity Growth in 13 Industrial Sectors (1986-2000)

[4] For instance, in Liaoning Province, redundant workers (who remain technically employed but receive no salary) at the end of 2000 made up 29% of the total workforce in the state sector (Economist (UK), June 13, 2002).

Within each data set, the two productivity indicators exhibit similar trends over years, with labor productivity growth being higher than the total factor productivity growth for most years. In the second half of the 1990s, the gap between the two productivity indicators grew larger for both data sets. Meanwhile, the 13 industrial sectors showed some improvement in total factor productivity growth after 1995 while the six major industries in national economy had their overall productivity declined in the same period.

Table 5 presents the results of gross allocation effects (GAE) calculated from the above two data sets. Both data sets show impressive labor productivity growth, especially in the 1990s. The 13-sector data set exhibits a labor productivity growth (11.6 percent per annum on average) almost twice of that of the 6-sector data set (6.8 percent). The 13 industrial sectors also had a better GAE performance than the six major sectors during the period. For the 6-sector data set, the gross allocation effect declined during the period 1989 to 1990 and sharply slumped between 1995 and 1998 before it recovered a bit in 1999-2000. That resulted in a negative mean GAE in the whole period under study (-1.8 percent). As shown in Figure 3, the GAE for the second data sector is not only higher (with a mean value of 0.6 percent) but also relatively more stable.

Table 5. Gross Allocation Effect (%)

	First Data Set (6 major sectors)			Second Data Set (13 industrial sectors)		
	G_y	$\Sigma_i r_i G_{yi}$	$A(y)$	G_y	$\Sigma_i r_i G_{yi}$	$A(y)$
1986	5.8	3.6	2.2			
1987	8.2	7.4	0.8	8.1	7.5	0.6
1988	7.6	7.8	-0.2	-4.8	-3.3	-1.5
1989	2.1	3.8	-1.6	4.1	3.5	0.6
1990	-10.0	-7.7	-2.3	-4.6	-6.1	1.5
1991	7.7	8.6	-0.9	1.0	0.4	0.5
1992	12.9	13.3	-0.5	15.8	14.9	0.9
1993	12.1	12.2	-0.1	52.8	50.9	2.0
1994	10.9	11.1	-0.2	-8.1	-7.6	-0.5
1995	9.0	9.5	-0.5	-7.6	-8.7	1.0
1996	7.8	10.1	-2.3	14.3	13.3	1.0
1997	7.3	10.5	-3.2	13.2	12.8	0.4
1998	7.1	18.9	-11.7	31.4	28.5	2.9
1999	6.0	9.7	-3.8	21.9	21.1	0.8
2000	6.8	10.0	-3.1	25.2	27.0	-1.8
Mean	6.8	8.6	-1.8	11.6	11.0	0.6

Source: Calculated from data in *China Statistical Yearbook*, various issues.

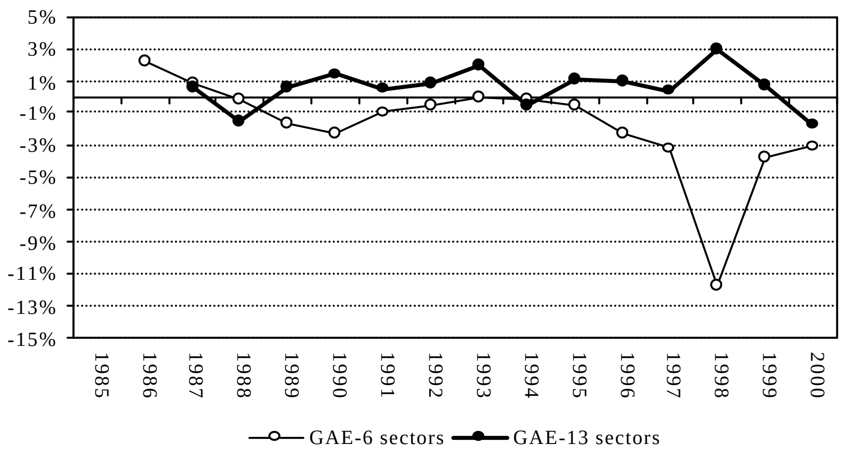

Figure 3. Gross Allocation Effect (1986-2000)

GAE measures the contribution to aggregate labor productivity growth of employment shifts among sectors with different labor productivities. The negative GAE rates among the six major sectors indicate biased inter-sector labor mobility. As shown in Table 1, from 1985 to 2000, the shares of "primary industry" (farming, forestry, animal husbandry, and fishery) in GDP and total employment dropped by 12.5 and 15.5 percentage points respectively. Most of the labor outflow from the primary industry was directed towards "other tertiary-industry services", of which the employment shares increased by 16.5 percentage points, much faster than the rise of the sector's share in GDP (by 5.4 percentage point) in the same period. The most glaring divergence between GDP and employment shares occurred in the "Industry" sector, which saw the rise of its share of GDP by 5.8 percentage points together with a drop of its share of employment by 4.2 percentage points.

In contrast, as shown in Table 2, among the three major industrial sectors, "Excavation", "Manufacturing" and "Public Utilities", the changing shares of value-added and jobs were quite consistent with each other in the period under study. This may indicate that labor reallocation across these industrial sectors was more efficient and less biased than that across the six major industries in the national economy. Within the "Manufacturing" sector, however, the "machinery" sector had increased its share of jobs (by 4.4 percentage points) but decreased its share of value-added (by 2.4 percentage points).

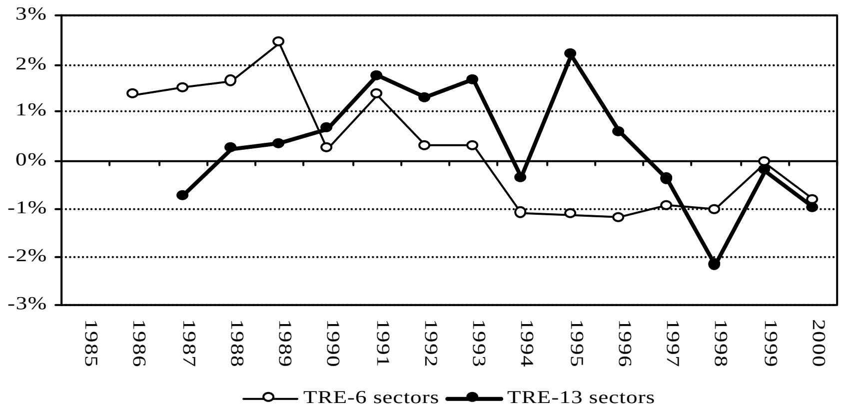

Figure 4. Total Reallocation Effect (1986-2000)

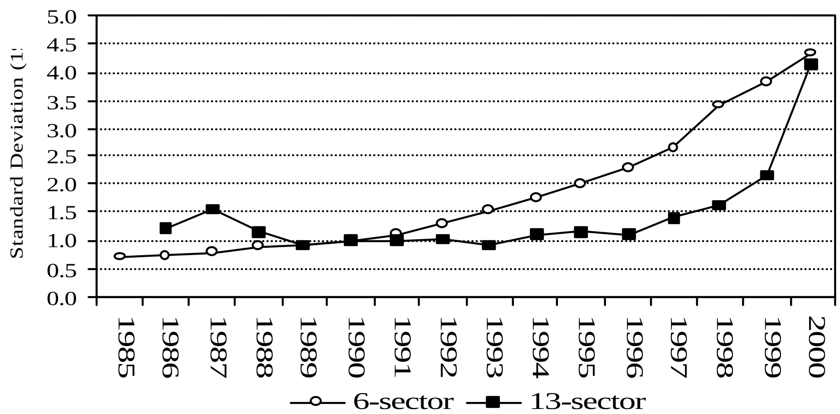

Figure 5. Standard Deviation of Labor Productivities (1986-2000)

The differences in labor mobility and GAE have impact on inter-industry differences of labor productivities. As shown in Figure 5, the standard deviation of sectoral labor productivities increased steadily all through the period under study for the six-sector data set. For the 13-sector data set, however, the standard deviation of labor productivities remained relatively stable before 1999.

Table 6 reports the total factor productivity (TFP) growth and total reallocation effect (TRE) calculated from the two data sets. Both data sets display similar results for the TRE statistics (0.3 percent). On average, the 13-sector data set exhibits only slightly higher growth rates for both the aggregate TFP and the weighted sum of sectoral TFP.

Table 6. Total Reallocation Effect (%)

	First Data Set (6 major sectors)			Second Data Set (13 industrial sectors)		
	l_a	$\Sigma_l r_l l_l$	TRE	l_a	$\Sigma_l r_l l_l$	TRE
1986	0.2%	-0.8%	1.0%			
1987	3.3%	1.9%	1.4%	4.8%	5.5%	-0.7%
1988	4.1%	2.4%	1.7%	5.7%	5.5%	0.2%
1989	-0.2%	-2.7%	2.5%	-0.8%	-1.2%	0.4%
1990	-3.1%	-3.1%	0.0%	-5.1%	-5.7%	0.7%
1991	4.5%	2.4%	2.1%	0.3%	-1.5%	1.7%
1992	7.7%	7.1%	0.5%	-4.6%	-5.9%	1.3%
1993	6.0%	5.3%	0.7%	31.8%	30.1%	1.7%
1994	4.2%	4.9%	-0.6%	-7.7%	-7.4%	-0.4%
1995	2.2%	3.4%	-1.2%	-11.8%	-14.0%	2.2%
1996	0.7%	1.4%	-0.7%	4.5%	3.9%	0.6%
1997	0.3%	1.5%	-1.1%	1.2%	1.6%	-0.4%
1998	-0.7%	0.3%	-0.9%	-9.5%	-7.3%	-2.2%
1999	-1.1%	-1.1%	0.0%	9.1%	9.3%	-0.2%
2000	-0.4%	0.4%	-0.8%	8.7%	9.7%	-1.0%
Mean	1.8%	1.5%	0.3%	1.9%	1.6%	0.3%

Source: Calculated from data in *China Statistical Yearbook*, various issues.

Figure 4 compares the TRE trends for the two data sets. The industrial sectors appeared to have performed better than the six major industries for most years in the 1990s. Both data sets, however, display by-and-large downward trends of TRE after 1990. It is worth noting that the six major sectors' TRE statistics drifted to the negative zone in 1994-2000. In other words, the total reallocation effect among the six major sectors knocked off about 0.6 to 1.2 percentage points from annual productivity growth in six out of the seven years in this period. As for the 13 industrial sectors, their TRE statistics also swung into the negative zone after 1996.

4. CONCLUDING REMARKS

Our updated documentation of China's productivity trends in the 1990s shows that the earlier post-reform high productivity growth was not sustained well in more recent years (Table 6 and Figure 1). Part of this slowdown in productivity growth can be attributed to the disappointing sectoral factor reallocation effects. As shown in Figure 3, the gross allocation effect (GAE) did not show much improvement, in particular for the six-sector data set. As for the total reallocation effect (TRE), while the six major sectors experienced negative TRE from 1994 to 2000, the TRE among the 13 industrial sectors moved below zero after 1996 (Figure 4).

Hardly was the allocative efficiency of the Chinese economy satisfactory in an international perspective. As identified by Syrquin (1986, pp. 251-252), resource reallocation is an important source of growth. According to his analysis of historical data, for economies undergoing the industrializing stage, acceleration of aggregate total factor productivity (TFP) growth may account as much as half of the real growth rate. The aggregate TFP growth reflects the acceleration of sectoral TFP rates plus the total reallocation effect, the contribution to growth of factor reallocation among sectors with different marginal productivities. For an economy that grows at about 6.0 - 6.5 percent per annum during rapid industrialization, the TRE may contribute about half to a full percentage point to aggregate growth. In the period under study (1986-2000), China achieved spectacular economic growth above nine percent per annum. The average annual contribution of reallocation effect during the period under study was, however, only 0.3 percent point for both the industrial sectors and the six major sectors in the whole economy.

Our results also reveal the difference in productivity growth performance between the industrial sectors and the rest of the economy, which was significant in more recent years. Comparison between Figures 1 and 2 suggests that the 13 industrial sectors performed better than the whole economy in total factor productivity growth during 1996-2000. Part of the difference can be explained by the normal industrialization effect that raises the industrial sectors' productivity more than that for other sectors. A more important source of this difference is nevertheless the improved efficiency in the state-owned sector after China implemented more reforms in the late 1990s for the state-owned enterprises, which are clustered in the industrial sectors. Our regression results in Table 4 indicate that the industrial sectors (with their larger share of state ownership) were burdened by over-employment, which would allowed much larger rooms for productivity improvement when the state-owned enterprises came under overall reforms.

Results from the two data sets also differ in their inter-sector reallocation effects. For industrial sectors, both the GAE and TRE results are better than those from the six-major-sector data set in the 1990s. The causes of such differences may link to some institutional features of the economy. Under China's industrial policy regime, the non-industrial sectors, in particular the service sectors, have been less open to foreign direct investment (FDI). Since 1993, China has become the No. 2 in the world for foreign capital inflow, next only to the US. Through the 1990s, China sucked in about half of all foreign direct investment that went to the developing economies. With such a huge amount of inflows of foreign capital and technology, it is no wonder that the inter-sector factor reallocation appeared more efficient among the industrial sectors, which hosted more than 70 percent of total FDI into the country. On top of that, China's draconian restriction on rural-urban migration through its household registration system, although weakened during the market-oriented reform, played a crucial role in blocking labor mobility between the urban and rural areas (ref. Solinger (1999) and Davin (1999)). This factor limited labor mobility across the six major sectors more effectively than it did to labor movement across industrial sectors. It therefore has contributed to the lower allocative efficiency in the first data set. The contrasting GAE statistics from the two data sets illustrate this observation.

In summary, the evidence provided by this study suggests huge potential gains for China to build sound market institutions and to revamp its industrial policy regime in line with greater market openness and inter-sector factor mobility. This lesson is revealing to other developing economies at the similar stage of growth.

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