Regional Disparities of Industrial Productivity Growth in China*

Yuk-shing CHENG**

Abstract

Since the resurgence of interests in economic growth theories in the 1980s, a large body of literature has emerged to test empirically the validity of various theories. Various criticisms have been raised towards the methodologies used by early studies of growth convergence (or conditional convergence), notably those utilized by Barro (1992) and Mankiw, Romer and Weil (1992). One line of investigation has been proposed by Färe (1994, *American Economic Review*), who decompose the Malmquist Productivity index into two components, namely, technical change and technological catch-up. In this approach, whether the growth rates of economies converge can be examined by the distance of the economies to the production frontier. More recently, Kumar and Russell (2002, *American Economic Review*) extend their framework to decompose the labor productivity into technical change, technological catch-up and capital deepening. This paper applies the method of Kumar and Russell (2002) to the industrial sector of China, using provincial-level data. After estimating the sources of growth of Chinese industries, the growth patterns of major regions of China are identified, from which implications for China's regional policies are drawn.

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** Associate Professor, Department of Economics, Hong Kong Baptist University, Kowloon Tong, Kowloon, HONG KONG. Email address: ycheng@hkbu.edu.hk; Tel no.: (852) 3411 7550; Fax no.: (852) 3411 5580.

1. Introduction

The rising regional income disparity in China since economic reform has aroused much concern. In the past decade, a large body of empirical studies has emerged using provincial-level data. Most of the studies follow two approaches of investigation. The first one is the use of inequality indexes to examine the extent and the trend of regional inequality in China. Examples include Lyons (1991), Tsui (1993, 1996), Cai and Dou (2000) and Chen and Chu (2004). The second approach is to use regression model to detect whether there is convergence or conditional convergence in income level across regions. This approach has been inspired by the cross-country studies of Barro (1991), Barro and Sala-i-Martin (1992), and Mankiw, Roemer and Weil (1992). For instance, Chen and Fleisher (1996) and Cai and Dou (2000) have used this kind of Barro-regressions.

Although this empirical literature has grown large, a lot of issues regarding China's regional disparities remain unexamined. This paper attempts to further enrich our understanding in this regard. We have two major differences with the previous studies. First, we concentrates on the industrial sector. While previous studies of regional disparities in GDP per capita or GDP per labour undeniably make important contributions, cross-country studies indicate that sectoral patterns could be very different from the whole economy in the disparities across countries. For instance, Bernard and Jones (1996) find that, in contrast to the common belief, the convergence of labour productivity across countries is not driven by the manufacturing sector. In fact, an increasing number of studies have placed efforts in studying whether there are convergence of labour productivity in particular sectors across regions in a country.[1]

The second difference is related to the methodology. Although the Barro-regressions might provide some insights in looking at the income convergence across economies, there are also limitations in this approach. Quah (1993, 1996a, 1996b and 1997) has argued forcefully that the results arising from Barro-regressions could be misleading.[2] He thus suggests that the intra-distribution should be carefully analyzed in order to see how disparity in income growth across countries evolved over time. More recently, Kumar

[1] For instance, Carre, Klomp and Thuri (2000) study the productivity of the manaufacturing sector in OECD countries. Bernstein , Mamuneas and Pashardes (2004) study the manufacturing sector in the United states, while Togo (2002) study the convergence of productivity in industrial sector in Japan.

[2] For instance, when some middle-income economies could over-take high-income economies while low-level income economies remained to be growing slowly, it is easy to obtain the result of convergence using the Barro-regressions (which is originally referred to the inverse relationship between growth and initial income level).

and Russell (2002) extends the decomposition method of Färe et al. (1994) to investigate the issue of technical progress and catch-up in a novel way. They further study the changes in the distribution of income (productivity) in the spirit of Quah (1997). This paper follows the approach of Kumar and Russell (2002) in decomposing labour productivity into three components, namely, technical progress, technological catch-up and capital deepening. As will be shown below, applying the approach of Kumar and Russell (2002) to provincial data of China's industry yields interesting insights.

2. Methodology

2.1 Measurement and decomposition of the total factor productivity growth

To assess the performance of China's industrial sector, this paper constructs the production frontier using provincial level data. To facilitate the discussions in the later part of this paper, we starts with the measurement of technical efficiency. In our production function, the output is represented by *Y*. The inputs include labour and capital, represented by *L and K* respectively. Then $\left(Y_t^j, L_t^j, K_t^j\right)$ denotes the input-output relationship of province *j* in period *t*, where *j=1,…,J*, and *t=1,…,T*. Under the assumption of constant returns to scale, the production technology can be represented by

$$T_t = \left\{ (Y, L, K) \in R_+^3 \middle| Y \le \sum_j z^j Y_t^j, L \ge \sum_j z^j L_t^j, K \ge \sum_j z^j K_t^j, z^j \ge 0 \forall j \right\} \tag{1}$$

In this construction, every point in the technology set is dominated by a linear combination of observed points, with z^j representing the linear process. In reality, the provinces may or may not be producing on the frontier. The (output-oriented) technical efficiency can be measured by the ratio of the actual output and the frontier output given the level inputs. This can be represented by the following output distance function

$$E_t\,(Y_t^j, L_t^j, K_t^j) = \min\left\{ \lambda \middle| \left\langle Y_t^j / \lambda, L_t^j, K_t^j \right\rangle \in T_t \right\} \tag{2}$$

where λ is the technical efficiency. Note that when λ is minimized, *Y/*λ is maximized. To estimate λ, Data Envelopment Analysis (DEA) can be used. Specifically, we need to solve the following linear program for each observation:

$$\min_{\lambda, z^1, \ldots, z^J} \lambda \textit{ subject to}$$

$$Y^j/\lambda \le \sum_k z^k Y_t^k\ ,\ \ L^j \ge \sum_k z^k L_t^k\ ,\ \ K^j \ge \sum_k z^k K_t^k\ ,\ \ z^k \ge 0, \forall k\,.$$

It is noteworthy, however, that some problem may arise in using this traditional procedure of constructing the frontiers of different years. In our case, it is found that part of the frontier of the 1997 so constructed lies under that of the frontier of 1993. Conceptually, the production frontier represents the maximum possible output using a certain level of inputs given the existing technology. The shrinkage of the production frontier means that there is technological regress (instead of progress). This is difficult to explain why we could lose a technology even after we have adopted it. Nin, Arndt and Preckel (2003) suggest that we should avoid this awkward situation by using the concept of the "sequential production technology". Under this approach, the production frontier should be constructed using the observation points of all the previous years. This paper has also adopted this approach.

To analyse the total factor productivity growth, we need to compute how much the production frontier has shifted. We use *b* and *c* to denote variables of the base year and the current year respectively. Caves, Christensen and Diewert (1982a, 1982b) suggest that the production frontier of the base year be used as the benchmark. TheTFP growth can be represented by

$$m^b_{CCD} = \frac{E_b(Y_c^j, L_c^j, K_c^j)}{E_b(Y_b^j, L_b^j, K_b^j)} \tag{3}$$

Certainly, we can also use the production frontier of the base year as the benchmark. Then, the TFP growth can be represented by

$$m^c_{CCD} = \frac{E_c(Y_c^j, L_c^j, K_c^j)}{E_c(Y_b^j, L_b^j, K_b^j)}\,. \tag{4}$$

Färe *et al.* (1994) suggest that it is most desirable to use the geometric mean of the above two indexes to measure TFP growth. This is the Malmquist Productivity Index, which is now very popular,

$$m^j = \frac{E_c(Y_c^j, L_c^j, K_c^j)}{E_b(Y_b^j, L_b^j, K_b^j)} \times \left[\frac{E_b(Y_c^j, L_c^j, K_c^j)}{E_c(Y_c^j, L_c^j, K_c^j)} \times \frac{E_b(Y_b^j, L_b^j, K_b^j)}{E_c(Y_b^j, L_b^j, K_b^j)}\right]^{1/2}, \tag{5}$$

In the above equation, the first term on the right hand side is the ratio of the technical efficiencies of the two period. If the ratio is larger (respectively, smaller) than one, it means the production unit is getting closer (respectively, farther) to the frontier during the period under study. The term captures the effect of technological catch-up. The second term measures the shift of the production frontier, representing the technological progress of the economies. Thus, we have the following relationship:

TFP index	=	technological catch up	×	technical change
(*TFP*)		(*EFF*)		(*TECH*)

2.2 Measurement and decomposition of labour factor productivity

Kumar and Russell (2002) suggest that labour productivity can be decomposed into several components. Figure 1 illustrates the idea. Assuming constant returns to scale, the output per capita (i.e. labour productivity) and capital per capita (capital intensity) can be represented by the two axes. Let y=Y/L and k=K/L. Suppose we want to analyze the growth of labour productivity. T_b and T_c are the production frontiers of the base year and current year respectively. If a production unit produces at point A (i.e. (k_b, y_b)) in the base year and at point B (i.e. (k_c, y_c)) in current year. Then, the frontier outputs are $\overline{y_b}(k_b) = y_b / e_b$ and $\overline{y_c}(k_c) = y_c / e_c$ respectively, where e_b and e_c are the technical efficiencies. The growth of labour productivity can be represented by

$$\frac{y_c}{y_b} = \frac{e_c \times \overline{y_c}(k_c)}{e_b \times \overline{y_b}(k_b)}. \tag{6}$$

Multiply both the nominator and denominator by $\overline{y_b}(k_c)$, we have

$$\frac{y_c}{y_b} = \frac{e_c}{e_b} \times \frac{\overline{y_c}(k_c)}{\overline{y_b}(k_c)} \times \frac{\overline{y_b}(k_c)}{\overline{y_b}(k_b)}. \tag{7}$$

In the above equation, the growth of labour productivity is decomposed into three components: (i) the change in the technical efficiency; (ii) technical change, i.e. the shift of production frontier (here the frontier outputs of k_c in two different periods are used for comparison); (iii) capital deepening (the change in the capital per capita), i.e. the increase in labour productivity due to the movement from k_b to k_c along T_b. However, it should be noted that the above decomposition is based on the level of k in the current period (k_c) and that the measurement of capital deepening is based on the production frontier in the base year ($\overline{y_b}$). We can alternatively used k_b and ($\overline{y_c}$), and multiplying the nominator and denominator by $\overline{y_c}(k_b)$, we can have

$$\frac{y_c}{y_b} = \frac{e_c}{e_b} \times \frac{\overline{y_c}(k_b)}{\overline{y_b}(k_b)} \times \frac{\overline{y_c}(k_c)}{\overline{y_c}(k_b)}. \tag{8}$$

The interpretation of this equation is similar to that of equation (7). Since the choice of Equations (7) and (8) is arbitrary, Kumar and Russell (2002) follow Caves et al. (1982) and Färe et al. (1994) to take the geometric mean of the two as a measure of the labour productivity growth. This is represented by

$$\frac{y_c}{y_b} = \frac{e_c}{e_b} \times \left(\frac{\overline{y_c}(k_c)}{\overline{y_b}(k_c)} \times \frac{\overline{y_c}(k_b)}{\overline{y_b}(k_b)} \right)^{0.5} \times \left(\frac{\overline{y_b}(k_c)}{\overline{y_b}(k_b)} \times \frac{\overline{y_c}(k_c)}{\overline{y_c}(k_b)} \right)^{0.5} . \qquad (9)$$

Labour productivity ($LABP$)	=	technological catch-up (EFF)	×	technical progress ($TECH$)	×	capital deepening ($KACC$)

3. Data issues

As mentioned before, this paper employs provincial data of China's industry for investigation. However, there was a change in the coverage of the data published by the Chinese government. Before 1997, China's industrial data covers all industrial enterprises with the status of independent accounting units. Since 1998, however, the data covers all state-owned industrial enterprises and those non-state enterprises that are above a certain scale.[3] Besides, the labour figure of 1998 was missing and the data of Xichang is incomplete. Therefore, we try to investigate the changes within two periods, i.e. 1993-97 and 1999-2002. Note that the data within each period are comparable. Since Chongqing was part of Sichuan before 1997 and has been established as a centrally-administered municipality, we have 29 units in the investigation of the first period and 30 units in the second period.

We have one output in our estimation. We use the value-added of the industrial sector as a measure. There are two inputs, capital and labour. The net value of fixed assets is used as a measure of capital while the average employees is the measure of labor. To eliminate the effects in the change of prices, the industrial value-added and the capital are converted into 1990 prices. For capital, we used the deflator of fixed asset investment to convert the data into the 1990 prices. For industrial value-added, we use the deflator of the secondary sector of GDP.

4. Results and discussions

[3] The major difference lies in the coverage of small enterprises. In 1997, the number of small enterprises covered by the statistics is 444,568. However, the number decreased to 141,672 in the new system of 1998. This is possibly due to the exclusion of a large number of small non-state enterprises.

4.1 Decomposition of labour productivity growth

Table 1 reports the results of the estimations. The two periods of growth exhibit clear differences. In 1993-97, annual industrial growth is 10.2%, but the annual TFP growth was only 1.9%. This means that the source of growth came mainly from the increase of inputs. Note that the number of employees during this period actually decreased, suggesting further that the source of growth came mainly from the expansion of capital. In contrast, the annual growth rate during 1999-2002 accelerated to 16.9%, with a high annual TFP growth of 12.7%. This suggests that the contribution of input growth to China's industrial growth during this period was not so important. This should be a desirable change.

Applying the decomposition method of Färe *et al.* (1994), it can be found that the technical progress grew by 3.7% annually. However, the element of technological catch-up was negative, meaning that the provinces were on average farther away from the production frontier. They were "falling behind" rather than "catching up" with those provinces on the frontier. The situation of the period 1999-2002 was even more dramatic. While the element of technological catch-up remained negative, the technical progress was as much as 15.6% annually. This is due to the push-up of the production frontier by leading provinces while the technological diffusion has been so slow that many provinces have been falling behind.

The performance of the provinces are depicted by Figure 2. It can be seen that the frontier of 1993 is formed by Zhejiang, Guangdong and Shanghai. As mentioned above, the sequential frontier approach has been used. The frontier of 1997 is formed by the frontier outputs of 1993 plus the new data point of Shanghai. As for the second period (1999-2002), the frontier of 1999 is formed by Shandong, Guangdong and Shanghai, while that of 2002 is formed by Shandong and Shanghai. Table 2 reports the results of the decomposition of labour productivity growth following the method of Kumar and Russell (2002). In the first period, labour productivity increased annually by a respectable rate of 10.4%. However, most of them was the result of capital deepening, i.e. the increase in the capital-labour ratio (growth of 8.4% annually). In the period of 1999-2002, while the labour productivity growth almost doubled to 19.2% annually, the contribution of capital deepening was much less striking (growth of 5.8% annually). The most important factor that drove up the labour productivity was the rapid technical progress during this period.

4.2 Disparities among the three broad regions

To see how the patterns of industrial growth differed across regions, we have calculated the averages of the major indexes of the coastal, central and western regions of China. This is a classification used in many studies of regional disparities of China.[4] In the period of 1993-1997, the industrial growth of the three regions stepped down gradually from the eastern to the central and then to the western regions, with annual growth rates of 11.1%, 9.9% and 7.1% respectively. However, it is interesting to note that the ranking of three regions in industrial growth changed in the second period. While the annual growth of eastern regions was as high as 18.7%, that of central was only 12.3%, falling short of the 14.6% in the coastal region. The relatively rapid growth of the western region was probably the result of the central government's policy to boost the development of the western region starting from 2000. In light of the slower growth of the central region, some Chinese scholars even coined this phenomenon "the collapse of the central China". The central government has recently shown more concern on how to boost the growth of the central region.

It can be noticed that while of growth of inputs in the central region was no less favourable than the western region in both periods, the TFP growth of the former was slower than that of the latter. In the first period, the annual TFP growth rates of central and western regions were very low, amounting to 0.3% and 0.6% respectively. In the second period, the respectively rates were 8.8% and 14.8%, showing a widening gap in favour of the western region. The weakness of the central regions is also reflected in the factor of technological catch-up. It registered an annual decrease of 6.7%, much bigger than the decline of the other two regions. Interestingly, the central region recorded the largest increase in capital deepening, reaching an annualized rate of 9.9%, which was much higher than the 3.5% in the eastern region and 5.3% of the western region. Since the two factors were balancing out, the difference between the growth rate of the central and western regions were not big in the second period (19.6% and 20.8% respectively).

4.3 Disparities among the eight regions

While analyses of regional disparities follows the above 3-region classification, more and more scholars and policy researchers are argues that a more informative picture can be obtained if classified into smaller regions, each with higher level homogeneity in economic

[4] The classification was first adopted officially in 1985. However, the Chinese government has changed the classification slightly in 2000. We have adopted the classification, which is as follows:

Region	Provincial units
Eastern	Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Hainan
Central	Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan
Western	Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang

development. We follow Li and Hou (2003) to classify China into eight regions.[5] The averages of varies indexes are reported in Table 4. During 1993-97, the industrial growth of Northeastern China was the lowest among the eight regions. The performance of the Southwestern and Northwestern regions was worse than the national average. During 1999-2002, however, the slowest growth was seen in the Middle Yellow River and Middle Yangzi River regions. The Northeastern and Northwester improved a lot in this period, but their annual growth rate of 13.1% was still lower the national average of 16.1%. Consistent with this was the low TFP growth of Middle Yellow River and Middle Yangzi River regions, which was the slowest among the eight regions. Not surprisingly, the growth of the element capital deepening was very high in these regions. Consequently, their growth of labour productivity was not particularly slow. If the central government wants to help the central region, it is not just to inject more capital. More important is perhaps to boost the technological catch-up of this region.

Concluding remarks

The methodology of Kumar and Russell (2002) has opened up a new dimension of investigation in the disparity of economic growth across economies. This paper provides some preliminary results in the study of regional disparities in industrial growth in China. much more work can be done to improve the analysis. In particular, after obtaining different elements in the decomposition of labour productivity, we can investigate the changes in their distribution, for example, to check whether there is convergence, divergence or any other patterns of change. However, due to the relatively small number of observations in each year, bootstrapping is needed for reliable statistical inference to be obtained. This is left for future work.

[5] The classification of Li and Hou (2003) is as follows:

Region	Provincial units
1 Northeastern	Liaoning, Jilin, Heilongjiang
2 North coastal	Beijing, Tianjin, Hebei, Shantong
3 East coastal	Shanghai, Jiangsu, Zhejiang
4 South coastal	Fujian, Guangdong, Hainan
5 Middle Yellow River	Shanxi, Inner Mongolia, Henan and Shaanxi
6 Middle Yangzi River	Anhui, Jiangxi, Hubei, Hunan
7 Southwestern	Guangxi, Sichuan, Guizhou, Yunnan
8 Northwestern	Gansu, Qinghai, Ningxia, Xinjiang

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Figure 1 Decomposition of labour productivity growth

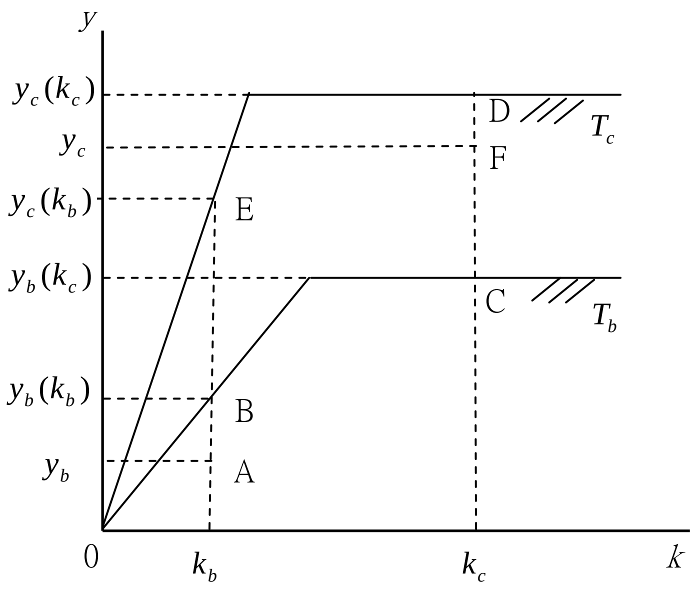
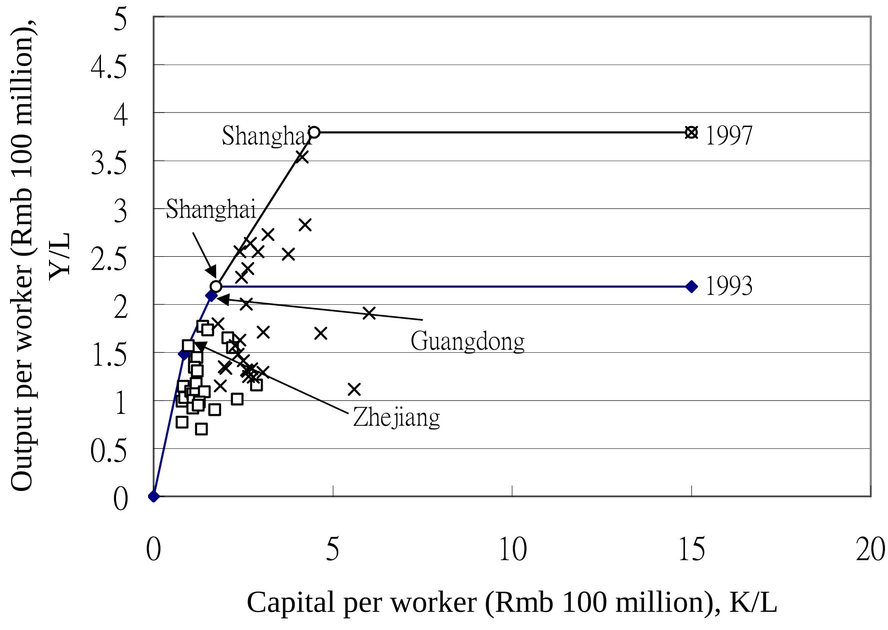


Figure 2 Frontiers of Chinese industry

(a) Frontiers of Chinese industry (1993 and 1997)



(b) Frontiers of Chinese industry (1999 and 2002)

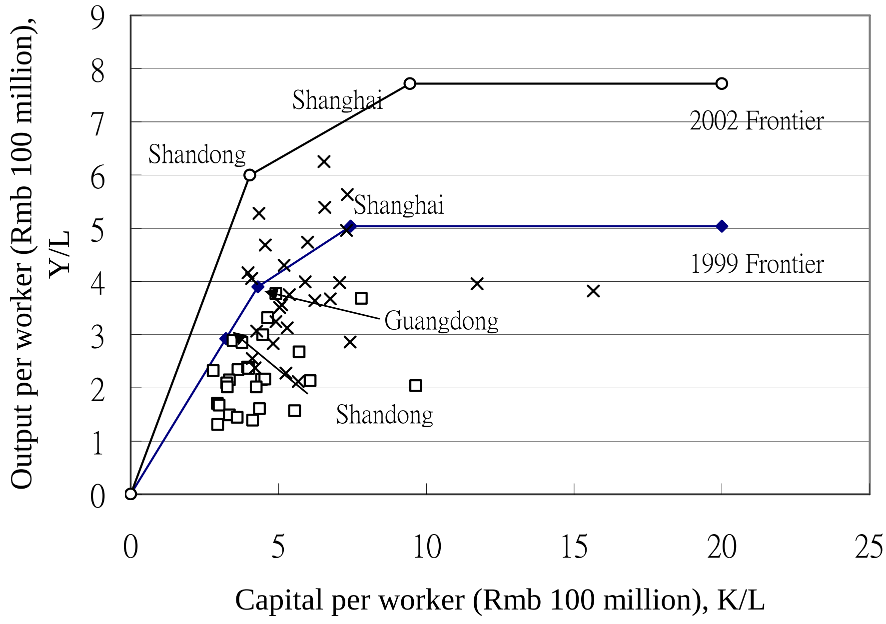


Table 1 Growth indexes China's industrial sector

	(I) 1993-1997						(II) 1999-2002					
	Industrial value-added *(INDVA)*	Total factor productivity *(TFP)*	Labour productivity (*LABPROD*)	Technological catch-up (*EFF*)	Technical change (*TECH*)	Capital deepening (*KACCUM*)	Industrial value-added *(INDVA)*	Total factor productivity *(TFP)*	Labour productivity (*LABPROD*)	Technological catch-up (*EFF*)	Technical change (*TECH*)	Capital deepening (*KACCUM*)
1 Beijing	1.292	1.386	1.716	1.031	1.345	1.238	1.436	1.490	1.659	1.005	1.482	1.114
2 Tianjin	2.107	1.460	2.367	1.176	1.241	1.622	1.756	1.679	1.854	1.161	1.446	1.104
3 Hebei	1.789	1.348	1.873	1.218	1.107	1.390	1.402	1.236	1.501	0.784	1.577	1.214
4 Shanxi	1.319	1.018	1.374	0.915	1.113	1.350	1.515	1.266	1.573	0.806	1.571	1.242
5 Inner Mongolia	1.587	1.338	1.769	1.184	1.130	1.322	1.586	1.624	1.825	1.122	1.447	1.124
6 Liaoning	1.046	0.812	1.121	0.733	1.107	1.381	1.481	1.553	1.846	1.046	1.485	1.189
7 Jilin	1.199	0.931	1.357	0.835	1.115	1.458	1.557	1.703	2.003	1.097	1.552	1.177
8 Heilongjiang	1.240	1.095	1.438	0.998	1.097	1.314	1.320	1.158	1.708	0.756	1.532	1.475
9 Shanghai	1.437	1.317	1.735	1.000	1.317	1.317	1.464	1.467	1.532	1.000	1.467	1.044
10 Jiangsu	1.494	1.079	1.626	0.994	1.085	1.507	1.570	1.319	1.623	0.829	1.591	1.231
11 Zhejiang	1.471	1.075	1.777	0.959	1.121	1.653	1.967	1.386	1.460	0.844	1.641	1.054
12 Anhui	1.598	1.030	1.569	1.023	1.007	1.524	1.526	1.203	1.750	0.738	1.631	1.454
13 Fujian	2.200	1.290	1.893	1.126	1.146	1.468	1.737	1.366	1.436	0.893	1.529	1.051
14 Jiangxi	1.114	0.723	1.161	0.713	1.015	1.605	1.449	1.297	1.817	0.804	1.613	1.401
15 Shandong	1.527	1.134	1.371	1.020	1.112	1.209	2.134	1.640	2.051	1.000	1.640	1.251
16 Henan	1.725	1.130	1.574	1.057	1.069	1.392	1.348	1.078	1.497	0.663	1.627	1.388
17 Hubei	1.646	1.170	1.625	1.072	1.091	1.389	1.286	1.376	1.569	0.877	1.569	1.140
18 Hunan	1.508	1.074	1.749	1.043	1.030	1.629	1.570	1.324	1.835	0.824	1.606	1.387
19 Guangdong	1.683	1.261	1.689	0.984	1.282	1.339	1.575	1.351	1.355	0.867	1.559	1.002
20 Guangxi	1.211	0.825	1.185	0.710	1.163	1.436	1.422	1.501	1.681	1.000	1.500	1.121
21 Hainan	1.289	0.990	1.232	0.709	1.395	1.244	1.624	1.553	1.530	1.094	1.419	0.986
22 Chongqing							1.589	1.823	1.946	1.192	1.529	1.068
23 Sichuan	1.239	0.912	1.441	0.845	1.079	1.580	1.649	1.759	1.979	1.155	1.523	1.125
24 Guizhou	1.229	0.933	1.248	0.860	1.085	1.338	1.436	1.155	1.553	0.731	1.580	1.344
25 Yunnan	1.509	1.134	1.541	0.963	1.178	1.359	1.404	1.429	1.624	0.959	1.490	1.137
26 Shaanxi	1.300	0.877	1.221	0.847	1.036	1.391	1.479	1.301	1.767	0.827	1.574	1.357
27 Gansu	1.205	0.959	1.219	0.853	1.125	1.271	1.703	1.463	1.904	0.924	1.583	1.301
28 Qinghai	1.044	0.834	0.963	0.555	1.503	1.155	1.349	1.875	1.875	1.224	1.532	1.000
29 Ningxia	1.434	1.218	1.435	1.048	1.163	1.178	1.297	1.348	1.519	0.871	1.547	1.128
30 Xinjiang	1.653	1.372	1.680	0.970	1.415	1.224	1.251	1.634	1.855	1.091	1.497	1.136

Table 2 Decomposition of Labour productivity

(Annualized growth, %)

		Industrial VA *(INDVA)*	Capital *(K)*	Labour *(L)*	Total Factor productivity *(TFP)*	Labour productivity (*LABPROD*)	technological catch-up (*EFF*)	Technical change (*TECH*)	Capital deepening (*KACCUM*)
(I)	*1993-1997*	10.2	21.3	-1.3	1.9	10.4	-1.7	3.7	8.4
(II)	*1999-2002*	16.9	7.8	-1.7	12.7	19.2	-2.5	15.6	5.8

Note: INDVA, K and L are simple averages while other variables are geometric means of provincial figures.

Table 3 Decomposition of Labour productivity (3-region analysis)

(Annualized growth, %)

	Industrial VA *(INDVA)*	Capital *(K)*	Labour *(L)*	Total Factor productivity *(TFP)*	Labour productivity (*LABPROD*)	technological catch-up (*EFF*)	Technical change (*TECH*)	Capital deepening (*KACCUM*)
	(I) 1993-1997							
1 Eastern	11.1	22.1	-1.4	4.2	13.2	-0.4	4.7	8.6
2 Central	9.9	20.0	-1.1	0.3	10.1	-1.3	1.6	9.8
3 Western	7.1	21.0	-1.5	0.6	7.8	-3.5	4.2	7.2
	(II) 1999-2002							
1 Eastern	18.7	8.1	1.2	13.2	17.2	-1.7	15.2	3.5
2 Central	12.3	8.3	-5.2	8.8	19.6	-6.7	16.6	9.9
3 Western	14.6	6.3	-5.8	14.8	20.8	-0.5	15.4	5.3

Note: INDVA, K and L are simple averages while other variables are geometric means of provincial figures.

Table 4 Decomposition of Labour productivity (8-region analysis)

	Industrial VA *(INDVA)*	Capital *(K)*	Labour *(L)*	Total Factor productivity *(TFP)*	Labour productivity (*LABPROD*)	technological catch-up (*EFF*)	Technical change (*TECH*)	Capital deepening (*KACCUM*)
	(I) 1993-1997							
1 Northeastern	3.2	17.9	-2.6	-1.6	6.7	-4.0	2.6	8.4
2 North coastal	12.5	18.9	-0.5	7.3	15.8	2.6	4.6	7.9
3 East coastal	10.1	23.1	-3.3	3.6	14.4	-0.4	4.0	10.4
4 South coastal	15.2	27.5	0.9	4.1	12.1	-2.0	6.2	7.7
5 Middle Yellow River	10.9	20.3	0.6	1.9	10.1	-0.2	2.1	8.1
6 Middle Yangzi River	11.1	21.4	-1.0	-0.4	10.8	-1.3	0.9	11.3
7 Southwestern	6.4	23.4	-2.3	-1.4	7.7	-4.3	3.0	9.3
8 Northwestern	7.8	18.1	-0.1	1.8	6.7	-4.5	6.6	4.8
National	10.2	21.3	-1.3	1.9	10.4	-1.7	3.7	8.4
	(II) 1999-2002							
1 Northeastern	13.1	10.0	-7.7	13.2	22.7	-1.6	15.0	8.4
2 North coastal	22.2	8.1	-0.6	14.5	20.6	-0.7	15.3	5.3
3 East coastal	17.8	8.8	2.4	11.6	15.4	-3.9	16.1	3.4
4 South coastal	17.0	6.7	5.4	12.4	12.9	-1.8	14.5	0.4
5 Middle Yellow River	12.8	8.8	-3.4	9.2	18.4	-5.7	15.8	8.4
6 Middle Yangzi River	12.6	5.4	-5.8	9.1	20.3	-6.8	17.1	10.2
7 Southwestern	15.1	5.1	-5.4	14.8	20.5	-0.2	15.1	4.9
8 Northwestern	13.1	8.0	-7.0	16.2	21.2	0.6	15.5	4.3
National	16.9	7.8	-1.7	12.7	19.2	-2.5	15.6	5.8

Note: INDVA, K and L are simple averages while other variables are geometric means of provincial figures.