Growth Accounting of China for National, Regional, and Provincial Economies: 1981-1995

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ABSTRACT

We have presented in this paper a new method of estimating total factor productivity (TFP) and capital stocks simultaneously at the same time, and applied it to the growth accounting of the Chinese economy in the national, regional, and provincial levels. The measurement and analysis of this paper can be summarized as follows. The rapid growth in China for the fifteen years since the Reform and Open-up Policy is mainly due to the high and stable level of capital input, the contribution of which is around 50% of GDP growth. The contribution of labor is small around 15% of GDP growth, and it has been declining steadily. The growth of TFP has been fairly high at the rate around 3~4% with a rising tendency, and its contribution to GDP growth is around 40%. The economic growth of regions and provinces in China also depends heavily on the input of capital. The higher growth in the East region is attributed also to the higher input of capital in the region compared with the Middle and West regions. Between the East and the other two regions, the gap in GDP growth has widened recently during the period of the 8th five-year plan. This is partly due to the capital input promoted further in the East region, but mainly due to the TFP growth accelerated drastically in the East region compared with the other two regions. Again between the East and the other two regions, the gap in per capita GDP has widened remarkable especially in the 1990s. The gap in income within rural households, especially between the West and the other two regions, is a crucial factor to explain this regional income disparity. The level of TFP is also quite important, together with the level of capital, to explain the income disparity in China between regions and provinces. The growth of TFP in each province in the 1990s is closely related with such common factors as the expansion of non-state enterprises, the increase in foreign direct investment and, to a lesser extent, the degree of human development, but it still depends much on the region-specific elements.

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1. Introduction

China has achieved average annual growth of 10% during the past 18 years. This rapid growth is anticipated to continue further, though with slight slowdown, by many institutions such as World Bank [1997], Economic Planning Agency of Japan [1997], Chinese Academy of Social Sciences [1994], and so on. Pessimistic views, however, are also found on the sustainability of rapid growth for China. A typical example is the view expressed by Krugman [1994], i.e., "The Myth of East Asia's Miracle," which means that China will also face the limit of growth sooner or later since it depends heavily on the massive increase in inputs with only small improvement in productivity as in the case of Asian NIEs.[1] Internally in China, the necessity to change the pattern of development toward the growth driven by technical progress has been stressed in the 1990s,[2] making the analysis of productivity and sources of growth a central concern of policy makers.

The purpose of this paper is to provide the growth accounting of GDP level for national, regional, and provincial economies of China, covering the period of 1981-1995 from the 6th to the 8th five-year plans. By the growth accounting, it is aimed at to quantitatively clarify the sources of growth and the role of productivity in the rapid growth period after the introduction of Reform and Open-up Policy in 1978. There already exist several researches on the productivity analysis of China.[3] Among others, special reference should be given to the joint research made by Chinese, American, and Japanese scholars (Li, Jorgenson, Zheng and Kuroda [1993], and Li et al. [1992]). It is also the purpose of this paper to compare our measurement with theirs. This paper is different from the existing studies above on the following three scores. First is the methodology. We have developed and used a new method of estimating both capital stocks and total factor productivity (TFP) simultaneously based on the framework of growth accounting. Second is the object of study. We have attempted to provide measurement and analysis not only for the aggregate national economy but also for three aggregate regions (i.e., East, Middle, and West) and thirty provinces (including three municipalities and five autonomous regions).[4] Third is the analysis of regional disparity by growth accounting. We have applied the framework of growth accounting across the thirty provinces to account for regional income disparity from productivity.

We will discuss the new method and the data processing for measurement in Section 2. Next, we will provide measurement and analysis of growth accounting for the national economy in Section 3 and for the regional and provincial economies in Section 4. Then, we will give an overview of regional income disparity in Section 5 and analyze it across provinces from the growth accounting point of view. Finally, we will provide concluding remarks in Section 7. A technical

note is given to the computational procedure of our new method in the appendix.

2. Methodology and Data

2.1. Simultaneous determination of capital stocks and TFP growth

It is not easy to get data on capital stocks for China as well as for many other countries. In this paper, we will try to estimate capital stocks in China directly on the basis of the growth accounting framework for the period of 15 years (1981-1995), targeting the 6th five-year plan (1981-1985), the 7th five-year plan (1986-1990), and the 8th five-year plan (1991-1995). The essence of our method is to determine both capital stock series and TFP growth consistently at the same time, first, by integrating growth accounting and capital accumulation (stock-flow relation) and, then, by adding to it annual flow data on real investment. We will explain below briefly our methodological framework.

Denoting growth rate of real GDP by *GY*, growth rate of labor by *GL*, growth rate of real capital stocks by *GK*, growth rate of TFP by *GT*, distribution share of labor by ω, real capital stocks by *K*, real investment by *I*, and rate of depreciation by δ, we can express:

(1) $GY = \omega\, GL + (1-\omega)\, GK + GT$ (growth accounting identity)

(2) $GK = I/K - \delta$ (capital accumulation identity)

By combining the two identities, we get the relationship between capital stocks (*K*) and investment flows (*I*):

(3) $K = [(1-\omega) / (GY - \omega\, GL - GT + (1-\omega)\, \delta)] \otimes I$

In this relation, we first select an arbitrary proper value of TFP growth rate (*GT*) for the target period of 15 years (1981-1995). Next we use the actual observed values of annual growth rates (*GY, GL*), distribution rate (ω), and depreciation rate (δ) averaged for the same 15 years. Finally, we apply the actual data on real investment (*I*) averaged again for the same 15 years. Then, we can calculate the level of real capital stocks (*K*) for the same target period. We regard it as the level of capital stocks at the mid-point of the target period (i.e., mid-year of 1988).

On the basis of this mid-1988 level of capital stocks, we accumulate actual real investment

of each year ($I(t)$) back and forth for 15 years by the following formula:

$$(4) \quad K(t+1) = (1 - \omega) K(t) + (I(t) + I(t+1)) / 2$$

$$(5) \quad K(t-1) = [K(t) - (I(t) + I(t-1)) / 2] / (1 - \omega)$$

Then we get a series of capital stocks for 15 years, from which we can calculate average annual growth rate (GK).[5] Applying this growth rate to the growth accounting formula (eq.(1)), we get a new average growth rate of TFP for the target period (GT), which is different from the initial value set at an arbitrary level at the beginning of the calculation. We, therefore, change the initial value of GT in the proper direction to start the same calculation again, resulting again a different GT at the end of the second calculation. We continue this iterative calculation process until GT at the beginning coincides with GT at the end.

We have explained our method by means of iterative calculation. In general, our method leads to a polynomial equation of high order with respect to the growth rate of TFP (say, x). For example, the polynomial equation will be of x^{16} for the sample period of 15 years.[6] We will obtain, therefore, several different solutions for the actual economy, of which only one solution will economically make sense judging from the levels of TFP growth and capital stocks, as can be seen from the measurement of Section 3 and the solution process in the Appendix.

2.2. Data processing (1980-1995)

We have applied the methodology above, first, to the national economy as a whole and, then, to three aggregate regions and thirty provinces. Prior to the presentation of measurement, we will briefly explain sources, concepts and processing of the data used in our measurement.

To begin with are the sources of data. The data used in this paper are all derived from such official publications as Statistical Yearbooks of the Government of China (especially of the State Statistical Bureau). Among others, we have intensively used *China Statistical Yearbook* (various issues), *China Statistical Yearbook on Investment in Fixed Assets: 1990-1995*, and *China Regional Economy: A Profile of 17 Years of Reform and Opening-Up*.

Next are the concepts and processing of data on the five parameters or variables (GY, GL, ω, δ and I) needed to estimate TFP growth rate (GT) and capital stocks (K). First, the rate of GDP growth (GY) depends on real GDP in all of the national, regional, and provincial levels. Second, the rate of labor input growth (GL) is based on "total number of employed persons" available in *China*

Statistical Yearbook 1996 for the national level.[7] For the regional and provincial levels, we have relied on both *China Statistical Yearbook* (since 1985) and *China Regional Economy* (before 19985). As a result, changes in working hours and labor quality are not allowed for in the growth accounting of this paper. Third, the distribution share of labor (ω) depends on "total wages of staff and workers" available in *China Statistical Yearbook*. Such data are available only for the 1993-1995 period in the provincial level, so that the 3-year averages for 1993-1995 are applied to the whole period 1981-1995. Labor shares for the national economy and the three aggregate regions are weighted averages of the component provincial shares. The share is estimated to be 0.515 for the national economy and regarded as common for the whole period. Fourth, the rate of depreciation (δ) is estimated to be 0.049, which is the rate of depreciation for state enterprises averaged for 1981-1992. This rate is assumed to be common to all levels of the economy for the whole period.

Fifth, and finally, real investment flows (I) are obtained by deflating "total investment in fixed assets" available in *China Statistical Yearbook*. The year 1995 is treated as the benchmark of investment deflator. The investment deflator is derived from "price index of investment in fixed assets" available in *China Statistical Yearbook* for the period 1990-1995 in all levels of the economy. For the period 1980-1989, the deflator in the aggregate national level is the weighted average of "producer price index of machine building industry" (available in *China Statistical Yearbook 1996*) and "total output price index of construction industry" (available in *China Statistical Yearbook of Construction Industry 1996*).[8] The deflators in the provincial level, on the other hand, are the weighted averages of "producer price index of machine building industry" and "producer price index of building materials," both are available in *China Statistical Yearbook 1996*, incorporating in the latter "real wage index of staff and workers" available in *China Regional Economy* to allow for the increase in wage cost in each province.[9]

We must note that "total investment in fixed assets" is the lump-sum data on total investment which do not allow for the composition and efficiency of component investment goods. Therefore, the capital stocks obtained by accumulating such total investment are also the lump-sum data on total capital, which allow neither for the composition and efficiency of component capital assets nor for the change in the utilization rate of capital caused by business cycle. The same is true for the data on labor as mentioned already. As a result, the TFP growth measured as residuals in this paper will include changes in the quality of capital and labor as well as variations in working hours and capital utilization.

3. Growth Accounting for the National Economy

Applying the method and data of Section 2 first to the national economy, we have obtained the estimates on TFP growth and capital stocks (at constant 1995 prices) for the period 1981-1995 as shown in Table 1. Part of the TFP estimates obtained by the joint study team of China, U.S. and Japan (Li, Jorgenson, Zheng and Kuroda [1993, Table 2-3]) are also listed in Table 1 to be compared with our results. Our estimates and theirs are quite similar in the light of both growth rate and variation pattern of TFP in spite of the difference in methodology adopted.[10]

In Table 1, the average annual rate of TFP growth (GT) is estimated to be 3.8% for the target 1981-1995 period. This is the estimate which is unique and economically makes sense, as can be seen by the process of deriving solutions shown in the Appendix. This is also the estimate obtained by setting the distribution share of labor (ω) and the rate of depreciation (δ) to be 0.515 and 0.049, respectively, for the whole 1981-1995 period. If ω is changed from 0.45 to 0.53, GT varies from 3.2% to 3.9% (while K in 1995 varies from 12212.9 to 12213.4 billion yuans). If δ is changed from 0.030 to 0.049, GT varies from 3.6% to 3.8% (while K in 1995 varies from 13790.5 to 12218.0 billion yuans). If the sample period is changed to the 8th five-year plan period (1991-1995) of 5 years, GT increases from 3.8% to 4.7% (while K in 1995 decreases from 12218.0 to 11018.6 billion yuans).[11] Judging from these sensitivity experiments, we can say that the long-term analysis of 15 years on the basis of the TFP estimates shown in Table 1 will not be affected much even if the labor share and the rate of depreciation are changed to some extent.[12]

As can be seen from Table 1, real GDP in China increased at the average 10.2% rate for 15 years since the Reform and Open-up Policy, reaching the average 12.0% rate in the 8th five-year plan period. Growth of labor, however, declined steadily. Real capital stocks increased in parallel with real GDP more or less at the same rate. During the 7th five-year plan period, however, real capital stocks continued to grow and achieved a high rate of 11.8% despite the slow down of real investment to a low 3.2% rate, exceeding the growth of GDP by almost 4%. TFP growth, on the other hand, maintained positive growth in most years, achieving the average 3.8% rate throughout the target period. TFP growth, however, became negative or close to zero especially in the years of recession such as 1981, 1986, 1989 and 1990.

Contributions to GDP growth by production factors are summarized in Table 2. As can be seen from Table 2, labor contribution remained at a low level throughout the period, with the average contribution of 13%, reaching the 30% level only in 2 years under recession of low GDP growth rates. Capital input, on the contrary, was the decisive factor to the growth of GDP

throughout the period. Its average contribution was 50%, reaching the level of 70% in the 7th five-year plan period. TFP contribution, on the other hand, was moderate seemingly with a slight upward trend though annual fluctuations were fairly large compared with labor and capital. Its average contribution was 36%, reaching the 50% level in the latest five-year plan period.

Our measurement and observation concerning Table 1 and Table 2 depends more or less on our treatment of business cycle during the sample period of 15 years. We have already noted that the data on labor and capital are lump-sum totals without allowing for such elements as quality, composition, working hours, utilization rate, etc. These elements are related, in general, to educational improvement, state enterprise reform, foreign direct investment, investment goods imports, and so on, all of which affect the level of TFP as well as its change. We will investigate these elements later in the cross provincial analysis. Here we concentrate only on the business cycle aspect, which is closely related with working hours and utilization rate of capital. Since the data on working hours and utilization rate of capital are not available for China, we have introduced a proxy variable, i.e., operation rate (OR) , to get a rough idea on the impact of business cycle on TFP growth. OR is defined as the ratio of actual GDP (Ya) to potential GDP (Yp), where the latter Yp is obtained by regressing Ya on labor (L) and capital (K) for the sample period 1980-1995. Then, we have modified the original TFP growth by subtracting from it the rate of change in OR. The results are presented also in Table 1 together with the estimated regression equation in the footnote. Contributions to GDP growth are also modified correspondingly and the modified results are also presented in Table 2.

We can derive several interesting observations from the modified results shown in Table 1 and Table 2. First, by eliminating business cycle effects, the TFP growth becomes quite stable at the level of 3% or more throughout the sample period with a small upward trend. Second, by eliminating business cycle effects, the capital contribution becomes quite stable at the level of 50% or more throughout the period. Third, the original and the modified results almost coincide on the TFP growth as well as on the relative contributions of labor, capital and TFP averaged for the whole sample period. We need, however, a reservation for the modified results especially on labor since the labor contribution is now negative in several years. The modification may have been done too much especially for labor.[13]

Observations on both original and modified results in Tables 1 and 2 may be summarized in the following way. China has achieved a good growth performance over the 15 years since the introduction of Reform and Open-up Policy. The main factor has been the stable and high level of capital inputs, the contribution of which is around 50% of GDP growth. The labor contribution is

small around the 10% level and declining steadily. The TFP growth has been fairly high at the level from 3% to 4% with a slight tendency of acceleration, and its contribution to GDP growth is around 40%. These are the observations on the aggregate national economy to be extended and elaborated further from the regional and provincial point of view.

4. Growth Accounting for Regions and Provinces

Table 3 presents the results obtained by applying the methodology and data of Section 2 to the 3 aggregate regions (East, Middle and West) as well as to the 30 provinces (including 3 municipalities and 5 autonomous regions). It also includes the results obtained for the national economy in the previous section. From Table 3 we can derive several observations and analysis on the economic growth of regions and provinces in China for the past 15 years covering the 6th, 7th and 8th five-year plans.

There exists a fairly big disparity in real GDP growth between regions as well as between provinces. In terms of the average growth rate of 15 years, the East coastal region is higher than the Middle and West regions by over 2%. In the provincial level, rapidly growing Guangdong (14.7%) and Fujian (14.2%) have achieved growth rate twice as high as slowly growing Heilongjiang (7.2%) and Qinghai (7.3%). In general, provinces with high growth rates concentrate in the East region, while provinces with low growth rates in the West region. We cannot say, however, that provinces in the East are all of high growth, and provinces in the West are all of low growth, since there are 4 provinces in the East growing at lower rates than the national average. In terms of the average growth rate of 5 years for the 3 five-year plan periods, the regional disparity between East, Middle and West has widened steadily. During the 6th plan period, growth of the East was higher than the Middle and the West by 1% only, but the disparity became more than 4% during the 8th plan period. From the 6th to the 8th plan, the growth speed of the Middle and West regions was almost unchanged or even declined, but the East region accelerated in growth not only as a region but also in all of its component provinces. Between 30 provinces, the maximum disparity in growth was twice in the 6th plan period but it became almost 3 times in the 8th plan period.

Despite the big disparity in real GDP growth, discrepancy in growth of labor is not large between the three regions. Furthermore, in all provinces, growth of labor declined from the 6th to the 8th plan period, resulting in the same tendency for the national economy. Contribution of labor to GDP growth declined more drastically in the East region.

Growth of capital, on the other hand, was always higher in the East by 4 to 5% than in the

Middle and the West. Discrepancy in stock level widened between the East and the other two regions steadily during the entire period of 15 years.[14] In the provincial level, provinces of high GDP growth are those of high capital growth, so that growth driven by capital is true also for the provincial economy. Contribution of capital to GDP growth was especially high in the East (65%) compared with the Middle (40%) and the West (49%) when averaged for the entire 15 years, but it declined in the East drastically from 71% in the 6th plan period to 43% in the 8th plan period, while it remained almost unchanged in the Middle (from 31% to 33%) and in the West (from 41% to 41%). Disparity in GDP growth has been widening between the East and the other two regions, while the capital contribution now differs little and the labor contribution is generally small. This indicates a significant role of TFP in the widening gap in growth especially in recent years.

TFP growth was higher in the Middle and West regions than in the East region during the period of the 6th and 7th five-year plans, but this relation was reversed in the recent period of the 8th five-year plan. In the provincial level, half or more of the provinces in the East region with negative TFP growth during the 6th and 7th five-year plans all achieved positive and high TFP growth in the recent 8th plan period. Correspondingly, TFP contribution to GDP growth in the East region, which was much lower than the Middle and West regions during the 6th and 7th five-year plans, attained almost the same level in the latest 8th plan period. In other words, the TFP contribution improved drastically in the East (from 12% to 51%) but not much in the Middle (from 51% to 57%) and in the West (from 42% to 49%).

In sum, at least three observations can be derived from Table 3 on the economic growth of China in the regional and provincial level. First, the economic growth of regions and provinces in China depends heavily on the input of capital as for the national economy. Second, the higher growth in the East region is attributed to the higher input of capital in the region compared with the Middle and West regions. Third, the gap in GDP growth widened between the East and the other two regions during the period of the 8th five-year plan. This is partly due to the capital input promoted further in the East, but mainly due to the TFP growth accelerated drastically in the East compared with the other two regions.

5. Regional Disparity: Overview

Regional disparity or the widening gap between regions is one of the key issues in the current Chinese economy.[15] The regional disparity discussed in the previous section has been concerned about the gap in GDP growth, which leads to the gap in economic size or economic

capacity between regions. This is an important filed of regional development strategy, but most of the researches on regional disparity in the past have focused on the widening gap in income between regions and provinces. Here we will also concentrate on the gap in income between regions and provinces, and analyze it on the basis of the growth accounting applied across the thirty provinces. Before the analysis, we will give an overview of the regional income disparity in China in terms of per capita GDP (Table 4), average wage of formal employees (Table 5), and income of urban and rural households (Table 6).

Table 4 presents, first, real per capita GDP of each province at constant 1995 prices for 1980 and 1995 in both absolute and relative levels. The table also provides changes in the relative levels of real per capita GDP from 1980 to 1995 (i.e., "1995 minus 1980") as well as its annual average growth rates for the 3 five-year periods and the entire fifteen-year period. Table 4 indicates the ongoing situation of regional income disparity in China seen from per capita GDP. Namely, the gap between the poorest Guizhou and the richest Shanghai was narrowing though to a very small extent, but the gap between the poorest Guizhou and the other provinces in the East region expanded mostly to a remarkable extent (See "1995 minus 1980", Guizhou=1). Also in the light of the relative levels to national average (China=1), the gap between provinces of the East and those of the West was widening in general. In terms of the growth rate, on the hand, the difference was small between regions and provinces during the 1980s, but there emerged a big difference in the 1990s.

Table 5 presents similar data on income disparity in terms of the real wage of formal employees at constant 1995 prices. When seen from wage data or as far as formal employees are concerned, the income disparity is far smaller between regions and provinces compared with the case seen from per capita GDP. From 1980 to 1995, the gap in average wage increased to some extent between the East and the other two regions ("1995 minus 1980", China=1) with trend acceleration in the 1990s as can be seen from the growth rates. Also for the same period, almost all provinces in China increased their relative positions to Guizhou. Wage here is more or less related to urban income in Table 6.

Table 6 compares annual per capita income between urban and rural households in each region or in each province. To put it in another way, Table 6 provides data on income disparity between regions and provinces either within urban households or within rural households. From the table, we can derive three observations with interesting implications on the regional income disparity in China. First, the gap in per capita income between regions and provinces was bigger for the rural households than for the urban both in 1980 and 1995, especially in the latter. Second, from

1980 to 1995, this income gap widened little for the urban households, but much for the rural, resulting especially from the relative decline in rural income of almost all provinces in the West. Third, the urban-rural income gap narrowed in many provinces of the East and Middle regions, but widened mostly in the West region. Table 6, therefore, indicates a crucial role of the rural households and the West region in explaining the regional income disparity in China.

In sum, we can say on the regional disparity in China the following two scores. First, the gap in per capita GDP widened remarkably between the East and the other two regions especially in the 1990s. Second, the income gap within rural households especially between the West and the other two regions was crucial to explain the regional disparity in the 1990s.

6. Regional Disparity: Growth Accounting Analysis

The regional income disparity overviewed in the previous section can be analyzed on the basis of the growth accounting framework applied to the cross section data of thirty provinces. The target here is the disparity in per capita GDP between provinces in 1995, i.e., GDP/N (1995) in Table 4 or *Y/N* in Table 7.[16] In other words, we will compare per capita GDP of each province with the national average and try to account for the discrepancy in per capita GDP in terms of the discrepancy in labor, capital and total factor productivity for each region. The growth accounting formula applied to the cross section data can be expressed as:

$$(6) \quad \Delta y / yo = \omega \ \Delta l / lo + (1-\omega) \ \Delta k / ko + \Delta TFP / TFPo$$

where $\Delta y = y - yo$, $\Delta l = l - lo$, $\Delta k = k - ko$, $\Delta TFP = TFP - TFPo$, $y = Y/N$ = per capita GDP, $l = L/N$ = per capita labor input, $k = K/N$ = per capita capital input, TFP = total factor productivity, ω = labor share, N = population, Y = GDP, L = labor input, and K = capital input. Note that the suffix *o* means the national average, and *yo, lo, ko* and *TFPo* are all set equal to one (1.0).

All necessary data for 3 aggregate regions and 30 provinces are listed in the first half of Table 7, while the results of growth accounting are presented in the remaining half, the last three columns of which give percentage contributions of labor, capital and TFP to the gap in per capita GDP computed by using eq.(6). Note that *TFP/TFPo* is derived from $\Delta TFP/TFPo$ where *TFPo*=1, indicating the absolute level of TFP with the national average as the base.

From Table 7, we can point out, first, on the disparity between three aggregate regions. In the aggregate regional level, capital input is the common key factor to account for regional

disparity. That is to say, the higher income in the East is due to the higher input of capital (by 45%), while the lower income in the Middle and the West due to the lower input of capital (by 67% and 50% respectively). TFP is also the key factor, but not common, with the exception of the Middle region. That is to say, the higher income in the East is due to the higher level of TFP (by 53%), while the lower income in the West due to the lower level of TFP (by 57%). Labor input, in general, does not account much for the income disparity either positively or negatively.

Second, within the East region, the capital input factor is dominant for Beijing, Tianjin, Shanghai and Liaoning, while the TFP factor is dominant for Shandong, Jiangsu, Zhejiang and Fujian, to account for the higher per capita GDP than the national average. For Guangdong, the capital and TFP factors are both important, while for Hainan, the lower input of labor is substituted by the higher input of capital. The lower income in Hebei and Guangxi, on the hand, can be expained mainly by the lower input of capital. Next, in the case of the Middle region where per capita GDP is generally lower, both capital and TFP explain the lower income in many provinces, while labor and capital in some provinces, and labor and TFP in another province. In Heilongjiang, the higher level of TFP offsets the lower level of labor input, resulting in the higher income than the national average. Finally, in the case of the West region, the low level of TFP or the low level of both TFP and capital input is the major factor to account for the much lower level of per capita GDP.

We can see from Table 7 that the level of TFP is quite important in explaining the income disparity in China between regions and provinces. Then, the problem is what accounts for the difference in TFP level between regions and provinces. Table 8 is an attempt to answer this question based again on the cross section data of 30 provinces, though indirectly by explaining the growth of TFP, not the level, in the 1990s for the 8th plan period (1991-1995). Table 8 presents the results of regression where growth of real GDP (g(Y)) is explained by growth of production factors (g(L) and g(K)), level of human development (HDI), degree of market economy (Inon-s/I), degree of openness (FDI/I and Trade/GDP), and region-specific factors (Dummy-M and Dummy-W). Note that the coefficients of labor and capital (i.e., share parameters) are constrained to add up to one. It is assumed in the regression that the TFP growth corresponds to the GDP growth unexplained by the growth of labor and capital inputs, i.e., the explanatory variables other than g(L) and g(K). From Table 8, we can see that the non-state enterprises, foreign direct investment and, though to a weaker degree, social development are the important common factors to explain TFP growth in each province.[17] Still many, however, may be left unknown since the two region-specific dummy variables are estimated to explain the large gap (1.9~3.6% or 1.1~2.2%) in residuals or TFP growth

between provinces in the East and the Middle and West regions.

7. Summary and Conclusion

We have presented in this paper a new method of estimating total factor productivity (TFP) and capital stocks simultaneously at the same time, and applied it to the growth accounting of the Chinese economy in the national, regional, and provincial levels. The measurement and analysis of this paper can be summarized as follows. The rapid growth in China for the fifteen years since the Reform and Open-up Policy is mainly due to the high and stable level of capital input, the contribution of which is around 50% of GDP growth. The contribution of labor is small around 15% of GDP growth, and it has been declining steadily. The growth of TFP has been fairly high at the rate around 3~4% with a rising tendency, and its contribution to GDP growth is around 40%. The economic growth of regions and provinces in China also depends heavily on the input of capital. The higher growth in the East region is attributed also to the higher input of capital in the region compared with the Middle and West regions. Between the East and the other two regions, the gap in GDP growth has widened recently during the period of the 8th five-year plan. This is partly due to the capital input promoted further in the East region, but mainly due to the TFP growth accelerated drastically in the East region compared with the other two regions. Again between the East and the other two regions, the gap in per capita GDP has widened remarkable especially in the 1990s. The gap in income within rural households, especially between the West and the other two regions, is a crucial factor to explain this regional income disparity. The level of TFP is also quite important, together with the level of capital, to explain the income disparity in China between regions and provinces. The growth of TFP in each province in the 1990s is closely related with such common factors as the expansion of non-state enterprises, the increase in foreign direct investment and, to a lesser extent, the degree of human development, but it still depends much on the region-specific elements.

The research of this paper must be extended and elaborated in the following direction. First is the data improvement. Measurement of TFP and capital stocks here depends heavily on the estimates of real investment, namely, of investment deflator, which must be improved especially for the provincial level in accordance with the improvement in data availability. The same is true also for the quality of capital and labor, including more rigorous treatment of working hours and utilization rate of capital. Second is the content of TFP. The analysis of TFP itself must be extended theoretically and empirically especially for the provincial level, clarifying also the region-specific

elements. Third is the application of our new method to other fields. One possible field of application is the growth accounting of industry level to analyze industrial structure as well as to supplement the analysis of the aggregate national level. Another field is to apply the method to other developing countries especially in the East and South Asia to analyze the productivity in China from the point of view of the international comparison. After accomplishing these tasks, the analysis of growth accounting in this paper will shift to more practical problems of the Chinese economy such as evaluation of growth potentials, analysis of international competitiveness, and so on.[18]

Appendix: Computation of Solutions

The method developed in Section 2 to simultaneously determine TFP growth and capital stocks can be applied to the numerical calculation on the actual economy quite easily by using ordinary PC software such as Microsoft Excel. Table A1, Figure A1, Table A2, and Figure A2 illustrate concrete computation procedure when the method is applied to the national data of the Chinese economy (Section 3, Table 1). Table A1 and Figure A1 illustrate the iterative calculation (with 13 iterations in this case) for the economically meaningful range of TFP. From Table A1 and Figure A1, we can see that the gap (GTB-GTE) between the initial value of TFP growth rate (GTB) at the beginning of calculation and the end value of TFP growth rate (GTE) at the end of calculation becomes zero at the point GTB=0.03746 during the process in which GTB is changed bit by bit from 0.025 to 0.112. That is to say, the solution for TFP of the simultaneous determination system is 3.75% (average growth rate for 1981-1995), and the corresponding capital stocks in 1995 and 1980 (K95, K80) are, respectively, 12216.8 and 2705.5 billion yuans.

Table A1 and Figure A1 may give an impression that GTB=0.111 is another solution, but this is a solution which is economically meaningless as seen from Table A2, since K95 and K80 which corresponds to GTB=0.111 are abnormally large and K95 becomes smaller than K80 (i.e., K95<K80). From Table A2 and Figure A2, we can see that there exist at least 5 points, other than GTB=0.0347, which satisfy the condition for solution (GTB=GTE), but all of them are economically meaningless since their stock levels in 1980 (K80) become either negative or positive but abnormally large. Therefore, the estimates in Table 1 of Section 2 can be said to correspond to the solution which is unique and economically meaningful. Generally speaking, some process of trial and error will be needed to search the solution which is economically meaningful and to confirm it to be unique.

Notes:

1. Krugman [1994] admits the improvement in productive efficiency for the transition economy of China, but regards it basically as the once-for-all occurrence without being repeated again. Generally speaking, the Krugman's view on "the Myth of East Asia's Miracle" can be contrasted with the view of Hayami and Ogasawara [1995] or Hayami [1996 (Ch.6)], according to which the Modern Economic Growth (MGE) of Japan since the Meiji era had two phases in sequence: the Marx phase of input-led growth and the Kuznets phase of productivity-led growth. Hsiao and Hsiao [1998] gives a comprehensive evaluation of the Krugman's view on East Asia.

2. "The most urgent task to realize the targets for the coming 15 years is to realize comprehensive and fundamental transformation in two directions. One is the transformation from traditional centrally planned economic system to socialist market economy, and another is the transformation from extensive growth to intensive growth." See "Proposals on the 9th Five-Year Plan of Economic and Social Development and on the Long-Term Targets for the Year 2010" submitted to the 5th National Convention of the Chinese Communist Party in the 14th Session held in 1995. According to Wu [1995], the extensive growth means growth led by increasing factor inputs, while the intensive growth means growth led by increasing productivity.

3. See Li, Jorgenson, Zhen and Kuroda [1993], Zhen and Rawski [1993], Jefferson, Rawski and Zhen [1995], etc.

4. Thirty provinces are as of 1995. Chongqing was recently designated as the fourth municipality under the direct control of the State.

5. If the data period is even in number, *e.g.*, 10 years for 1986-1995, we regard K as the stock at the mid-point of the target period, *i.e.*, stock at the end of 1990, and accumulate back and forth for 10 years by the following formula:

$$(4') \quad K(t+1) = (1 - \delta) K(t) + I(t)$$

$$(5') \quad K(t-1) = (K(t) - K(t-1)) / (1 - \delta)$$

Then we can calculate growth rate of capital stocks based on the mid-year level: $(K(t)+K(t+1))/2$.

6. If the actual average data are used for GY, GL, ω, δ and I, the mid-point capital stock K is determined by eq. (3) as a function of TFP growth rate x only (denoted by $K(x)$). Then, the actual annual investment I is accumulated back and forth on the basis of this $K(x)$ by using eqs. (4) and (5), so that its average growth rate GK will also be a function of x only (denoted by $GK(x)$). This $GK(x)$ must satisfy the first identity of growth accounting (eq. (1): $GY = \omega\ GL + (1-\omega)\ GK(x) + x$). If the sample period is n years, the growth rate of capital $GK(x)$ can be expressed as a rational function with the polynomial of x^n on both numerator and denominator, resulting in the growth accounting identity of the polynomial of x^{n+1}.

7. Data on labor in China Statistical Yearbook are observed at the end of each year, but the original data are used in growth accounting without converting them to the mid-year levels. Gaps between mid-year and year-end levels are small, affecting little the TFP measurement.

8. Weights are 1/3 for the former and 2/3 for the latter.

9. Weights are 1/3 for the former and 2/3 for the latter, while 1/3 for building materials and 2/3 for wage cost in the latter.

10. Data on the level of capital stocks are not made public in Li, Jorgenson, Zheng, and Kuroda [1993]. Data on the rate of increase in capital stocks are available, and their estimates are lower than ours by 1-2%.

11. As shown at the bottom of Table 1, the average TFP growth for the period of the 8th five-year plan is 6.1%, which indicates acceleration from the period of the 6th or 7th five-year plan. In this sense, Table 1 based on the 1981-1995 period is consistent with the result based on the 5-year data of the 8th five-year plan period.

12. TFP growth and capital stocks in 1995 become 3.41% and 14599.9 billion yuans, respectively, if inventory investment is included in the data for investment in addition to the investment in fixed assets. The data source of this estimation is SSR-HU [1997] (Table A.21 and Table A22). According to Young [1994] (footnote 9), the level of real capital stocks in the benchmark year (Ko) can be estimated by the formula: $Ko = Io / (g + \delta)$, where Io = real investment in the benchmark year, g = average growth rate of real investment (I) for the 5 years prior to the benchmark year, and δ = rate of depreciation. Applying this formula to the data of Table 1 for the national economy of China, we get Ko = 3186.4 billion yuans for the benchmark year 1986, while Ko = 9416.3 for the benchmark year 1995. These stock estimates are fairly small compared with our estimates in Table 1, and their ratios to GDP become abnormally small.

13. It is assumed in the calculation of modified contributions that the change in working hours and the change in capital utilization are the same and equal to the change in operation rate. This assumption may be too strong especially on labor.

14. Compare between regions the capital stocks in 1995 (the last column of Table 3) and the average growth rates of capital over 15 years.

15. Nakagane [1996] gives a comprehensive and thoughtful review on the regional disparity in China. Minematsu, Sakata, Tei and Yamada [1997] discusses the regional development strategy in China, covering the issue of disparity.

16. Per capita GDP in Table 4 is different from per capita GDP in Table 7. The former is obtained directly from *China Statistical Yearbook*, while the latter by computing the ratio of GDP to population in *China Statistical Yearbook*.

17. We have attempted in the regression analysis to use alternatives for each of the explanatory variables in several ways, but the results are not better than the variables listed in Table 8, except HDI for which the health index is better. HDI consists of health, education and income, and the data for HDI as well as its components are available in Minematsu, Sakata, Tei and Yamada [1997].

18. See Economic Planning Agency [1997] for the evaluation of growth potentials. See Ezaki and Itakura [1996] and Ezaki, Ito, Wang and Itakura [1996] for the analysis of competitiveness.

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Table 1. Growth Accounting of China (1981-1995): National Economy

Year	Growth Rate (%)							Cap.Stocks** (Billion nYuan)
	GDP	Labor	Capital	TFP	TFP(Li)*	OR*	TFP(OR)*	
1981	5.2	3.2	7.4	-0.1	-0.6	-2.0	1.9	2908.2
1982	9.3	3.6	8.2	3.4	4.4	1.1	2.3	3146.2
1983	11.2	2.5	9.6	5.3	3.4	2.0	3.3	3447.0
1984	15.3	3.8	10.8	8.1	7.8	4.4	3.7	3819.6
1985	12.9	3.5	12.8	4.9	4.9	0.7	4.2	4307.1
1986	8.9	2.8	13.8	0.7	0.7	-3.5	4.2	4900.8
1987	11.6	2.9	13.8	3.4	4.5	-1.1	4.5	5575.3
1988	11.3	2.9	13.5	3.2	4.4	-1.1	4.3	6326.5
1989	4.1	1.8	10.5	-2.0	-1.7	-5.1	3.1	6989.8
1990	3.8	2.6	7.4	-1.1	-0.1	-3.0	2.0	7504.3
1991	9.2	2.9	7.1	4.3		2.2	2.1	8035.9
1992	14.2	1.9	8.5	9.2		5.9	3.2	8717.5
1993	13.5	1.3	10.7	7.6		3.5	4.1	9652.5
1994	12.7	2.1	12.4	5.6		1.2	4.4	10846.1
1995	10.6	1.5	12.6	3.7		-0.8	4.4	12218.0
1981-1995	10.2	2.6	10.6	3.8		0.3	3.4	6559.7
1981-1985	10.8	3.3	9.7	4.3	4.0	1.3	3.1	3525.6
1986-1990	7.9	2.6	11.8	0.9	1.6	-2.7	3.6	6259.3
1991-1995	12.0	1.9	10.3	6.1		2.4	3.7	9894.0

* TFP(Li) = Estimates obtained by China, US and Japan team (Li, Jorgenson, Zhen and Kuroda [1993]).
OR = Operation Rate = Actual GDP (Ya)/Potential GDP (Yp)
where ln(Yp) = -2.010 + 0.245 ln(L) + 0.875 ln(K) (L=labor, K=capital, R2=0.992, Sample:1980-1995)
TFP(OR) = TFP - OR
** Capital stocks are measured in real terms at constant 1995 prices.

Table 2. Contributions to GDP Growth: National Economy

Year	Contributions to GDP Growth (%)			Contributions GDP Growth (%)*			Real Investment**	
	Labor	Capital	TFP	Labor+OR	Capital+OR	TFP-OR	(growth, %)	(Billion Yuan)
1981	32	69	-1	13	51	36	2.5	336.9
1982	20	43	37	26	49	25	25.9	424.2
1983	12	41	47	21	50	30	14.5	485.7
1984	13	34	53	28	48	24	23.0	597.3
1985	14	48	38	17	51	32	25.9	752.0
1986	16	75	8	-4	57	47	14.0	857.6
1987	13	58	29	8	53	39	13.3	971.7
1988	13	58	29	8	53	38	10.8	1076.9
1989	23	125	-48	-41	65	75	-19.2	869.8
1990	34	93	-27	-6	55	50	-3.0	844.1
1991	16	37	47	28	49	23	13.1	954.7
1992	7	29	64	28	49	23	25.3	1196.0
1993	5	39	56	18	51	31	27.8	1528.3
1994	8	47	44	13	52	35	18.1	1804.8
1995	7	58	35	4	55	42	10.9	2001.9
1981-1995	13	50	37	11	52	37	13.5	980.1
1981-1985	16	44	40	21	50	29	18.4	519.2
1986-1990	17	72	11	-7	57	50	3.2	924.0
1991-1995	8	41	50	18	51	31	19.0	1497.1

* Growth of operation rate is added to labor and capital growth but subtracted from TFP growth
** Measured in real terms at constant 1995 prices.

Table 3. Growth Accounting for National, Regional and Provincial Economies of China: 1981-1995

		Averaged for 15 years (1981-1995)							Averaged for the 6th plan period (1981-1985)							Averaged for the 7th plan period (1986-1990)							Averaged for the 8th plan period (1991-1995)							1995
		Growth rate (%)				Contribution (%)			Growth rate (%)				Contribution (%)			Growth rate (%)				Contribution (%)			Growth rate (%)				Contribution (%)			Cap. Stocks
		GDP	Labor	Capital	TFP	Labor	Capital	TFP	GDP	Labor	Capital	TFP	Labor	Capital	TFP	GDP	Labor	Capital	TFP	Labor	Capital	TFP	GDP	Labor	Capital	TFP	Labor	Capital	TFP	(Bilioon Yuan)
	National	10.2	2.6	10.6	3.7	13	50	37	10.8	3.3	9.7	4.3	16	44	40	7.9	2.6	11.8	0.9	17	72	11	12.0	1.9	10.3	6.1	8	41	50	1221.7
	East	12.0	2.5	15.1	3.0	10	65	25	11.3	3.8	15.7	1.4	16	71	12	8.6	2.0	16.2	-0.7	11	96	-8	16.0	1.8	13.5	8.2	5	43	51	687.4
	Middle	9.8	2.8	8.7	4.3	16	40	44	10.9	3.5	7.6	5.5	18	31	51	6.8	2.8	10.1	0.7	23	66	10	11.6	2.1	8.5	6.7	10	33	57	289.4
	West	9.5	2.7	10.5	3.4	16	49	36	10.5	3.2	9.8	4.5	17	41	42	7.6	2.9	12.1	0.7	21	70	9	10.4	1.9	9.7	5.1	10	41	49	160.6
	Beijing	9.8	2.2	13.3	1.9	11	70	19	9.4	3.5	12.4	1.3	18	68	14	8.2	2.4	15.7	-1.0	14	99	-12	11.8	0.8	11.7	5.4	3	51	46	46.2
E	Tianjin	8.8	1.5	8.6	3.5	7	54	39	9.4	3.1	8.4	3.4	14	49	36	5.2	0.1	8.4	0.6	1	89	11	11.9	1.2	8.9	6.4	5	42	54	26.1
	Hebei	11.1	2.9	9.2	5.3	14	38	48	10.2	3.8	8.5	4.3	20	38	42	8.4	2.9	10.8	1.9	18	59	22	14.6	2.2	8.2	9.7	8	26	66	55.5
	Liaoning	9.1	2.3	8.8	3.3	12	53	36	9.4	4.1	6.6	4.0	20	38	42	7.6	1.4	11.6	0.7	8	83	9	10.3	1.5	8.3	5.1	7	44	50	73.4
A	Shanghai	9.3	0.3	14.7	-0.3	1	102	-3	9.1	0.9	17.8	-2.6	4	125	-29	5.7	0.0	14.0	-3.3	0	158	-57	13.0	0.1	12.3	5.1	0	61	39	72.8
	Jiangsu	13.5	2.0	14.2	5.2	7	54	39	13.2	3.8	13.4	4.4	14	52	34	10.2	1.7	15.0	1.6	8	76	16	17.1	0.4	14.1	9.6	1	43	56	92.0
	Zhejiang	13.9	2.5	24.1	-0.1	9	92	0	14.9	4.4	28.7	-2.4	14	102	-16	7.7	2.0	25.2	-6.6	12	173	-85	19.1	1.2	18.4	8.8	3	51	46	62.4
S	Fujian	14.2	3.3	20.5	2.8	12	68	20	13.3	3.7	24.7	-0.3	15	87	-2	9.8	3.2	19.1	-0.9	17	92	-9	19.4	3.1	17.6	9.5	8	43	49	29.2
	Shandong	12.4	2.7	11.0	5.1	10	49	42	11.9	3.2	9.7	5.2	12	44	44	8.4	2.6	13.4	-0.1	14	87	-1	16.8	2.3	10.1	10.3	6	33	61	90.2
	Guangdong	14.7	3.0	23.6	1.5	10	79	10	12.3	5.3	29.2	-4.8	22	117	-39	12.6	1.1	22.1	1.1	5	87	9	19.1	2.6	19.5	8.2	7	50	43	117.6
T	Guangxi	10.4	2.9	11.4	4.7	19	36	45	8.3	3.5	10.5	2.5	28	41	31	6.1	2.8	12.2	0.3	30	65	4	16.7	2.5	11.6	11.2	10	23	67	23.2
	Hainan	14.5	2.2	41.1	-3.7	9	117	-26								9.5	2.5	47.0	-11.3	16	204	-119	18.4	2.0	36.3	2.3	6	81	13	8.9
	Shanxi	9.3	2.5	4.4	5.8	14	23	63	11.8	3.3	2.8	8.7	14	12	74	5.9	2.5	5.8	1.8	22	48	30	10.1	1.8	4.7	6.9	9	23	68	30.9
W	Mongolia	10.4	2.6	12.3	3.5	14	52	34	14.5	3.8	13.5	6.4	15	41	44	7.0	1.9	10.8	1.2	15	68	17	9.6	2.1	12.5	3.0	12	57	31	15.9
	Jilin	10.2	3.9	10.1	3.7	22	41	37	10.9	5.3	9.0	4.1	28	34	37	8.6	4.8	11.6	1.0	32	56	12	11.1	1.6	9.7	6.1	8	36	55	24.1
E	Heilongjiang	7.2	2.5	7.2	2.1	15	56	29	7.2	3.5	6.2	2.2	21	48	30	6.6	2.2	8.5	0.8	14	73	12	7.9	1.7	6.8	3.3	9	49	42	40.1
	Anhui	11.5	3.2	6.2	6.9	15	26	60	14.3	4.0	4.3	10.2	15	14	71	5.9	3.0	8.4	0.3	27	68	5	14.4	2.6	6.0	10.1	9	20	71	37.3
S	Jiangxi	10.5	2.8	10.7	4.8	17	38	45	10.4	2.9	10.6	4.6	18	38	45	7.4	2.9	11.5	1.3	25	58	18	13.8	2.7	9.9	8.4	12	27	61	19.3
	Henan	10.9	3.2	10.0	5.0	18	35	46	11.9	3.9	8.5	6.2	20	28	52	7.7	3.2	12.2	1.0	25	61	13	13.0	2.5	9.2	7.9	12	27	61	49.4
T	Hubei	10.5	2.1	10.6	4.3	10	49	41	12.3	2.9	10.5	5.7	12	42	46	6.3	1.9	10.9	0.0	16	85	-1	13.0	1.4	10.4	7.2	6	39	55	38.8
	Hunan	8.9	2.6	9.7	3.7	18	41	41	9.1	2.7	8.5	4.2	19	35	46	6.7	3.0	10.9	0.7	28	62	10	11.1	2.0	9.6	6.2	11	33	56	36.0
	Sichuan	9.1	2.4	12.0	2.7	15	56	29	9.7	2.8	11.2	3.4	17	49	35	6.4	2.8	13.9	-1.1	25	92	-17	11.3	1.5	10.9	5.8	8	41	51	53.7
M	Guizhou	9.3	3.5	7.2	4.4	24	29	48	12.5	3.8	6.3	7.8	19	19	62	6.8	4.3	8.4	0.9	40	46	14	8.7	2.4	6.9	4.6	17	30	53	12.5
I	Yunnan	10.5	3.0	12.6	2.2	13	66	21	11.8	3.8	12.7	3.2	15	59	27	9.4	2.9	13.3	0.9	14	77	9	10.2	2.3	11.8	2.7	10	63	27	22.7
D	Tibet	7.9	0.8	9.1	5.4	8	24	68	11.3	0.9	8.7	8.8	6	16	78	2.5	0.4	9.7	0.2	13	80	7	9.8	1.1	9.1	7.1	9	19	72	2.4
D	Shaanxi	9.8	2.9	8.2	4.8	18	33	49	11.1	3.8	6.9	6.1	21	25	55	8.9	2.8	10.4	3.1	19	46	35	9.4	2.1	7.4	5.3	14	31	56	24.7
L	Gansu	9.2	2.5	6.5	4.8	14	35	51	8.5	3.1	4.7	4.6	19	27	54	9.6	2.8	8.7	3.9	15	45	41	9.7	1.8	6.1	5.8	9	31	60	14.2
E	Qinghai	7.3	2.4	4.6	4.0	19	27	54	9.1	3.3	3.4	5.8	21	16	63	5.3	2.2	5.6	1.6	24	45	31	7.6	1.8	4.7	4.5	14	27	59	5.5
	Ningxia	9.2	3.4	9.0	3.2	20	45	35	11.6	3.8	6.4	6.5	18		56	8.0	3.5	11.8	0.6	24	68	8	8.1	2.9	8.7	2.6	19	49	32	4.9
	Xinjiang	11.3	1.8	14.2	3.8	9	57	34	12.5	1.9	16.0	4.1	8	58	33	9.7	1.7	13.9	2.4	10	66	25	11.8	1.8	12.8	5.0	8	49	42	21.3

*1 Sum of capital stocks by province or by region is smaller than national total (5.8% or 7.8%) because of the investment in unseparable regions.

*2 Hainan became the thirtyth province in March 1998. Average for 1981-1995 means that for 1986-1995.

Table 4. Per Capita GDP (at Constant 1995 Prices) by Province: 1980-1995

		1980			1995			1995 minus 1980		Growth Rate (%)			
		GDP/N*	China=1	Guizhou=1	GDP/N*	China=1	Guizhou=1	China=1	Guizhou=1	1981-85	1986-90	1991-90	1981-95
	National	1393	1.00	2.29	4854	1.00	2.62	0.00	0.32	9.3	6.3	10.7	8.7
	East	1552	1.11	2.56	6870	1.42	3.71	0.30	1.15	9.8	6.8	15.0	10.5
	Middle	1116	0.80	1.84	3721	0.77	2.01	-0.03	0.17	9.5	5.1	10.6	8.4
	West	919	0.66	1.51	2985	0.62	1.61	-0.04	0.10	9.3	6.1	9.3	8.2
	Beijing	3695	2.65	6.09	13073	2.69	7.06	0.04	0.97	7.9	6.5	12.5	9.0
E	Tianjin	3527	2.53	5.81	10308	2.12	5.56	-0.41	-0.25	7.9	3.7	10.9	7.5
	Hebei	1160	0.83	1.91	4444	0.92	2.40	0.08	0.49	8.6	6.2	13.6	9.5
	Liaoning	2203	1.58	3.63	6880	1.42	3.71	-0.16	0.08	8.2	6.1	9.7	8.0
A	Shanghai	6433	4.62	10.59	18943	3.90	10.22	-0.71	-0.37	5.6	4.5	12.7	7.6
	Jiangsu	1331	0.96	2.19	7299	1.50	3.94	0.55	1.75	12.2	8.4	16.0	12.2
	Zhejiang	1347	0.97	2.22	8074	1.66	4.36	0.70	2.14	13.7	6.6	18.4	12.9
S	Fujian	1220	0.88	2.01	6965	1.43	3.76	0.56	1.75	11.4	8.1	17.9	12.5
	Shandong	1210	0.87	1.99	5758	1.19	3.11	0.32	1.11	10.7	6.3	16.2	11.1
	Guangdong	1348	0.97	2.22	7973	1.64	4.30	0.67	2.08	10.5	10.6	16.9	12.7
T	Guangxi	1052	0.75	1.73	3543	0.73	1.91	-0.03	0.18	6.4	4.2	15.0	8.6
	Hainan	801	0.58	1.32	5225	1.08	2.82	0.50	1.50	16.8	7.5	16.6	13.6
	Shanxi	1192	0.86	1.96	3569	0.74	1.93	-0.12	-0.04	10.5	4.4	8.3	7.7
M	Mongolia	869	0.62	1.43	3639	0.75	1.96	0.13	0.53	13.0	5.6	11.9	10.2
I	Jilin	1208	0.87	1.99	4414	0.91	2.38	0.04	0.39	10.0	7.4	10.1	9.2
D	Heilongjiang	2225	1.60	3.66	5465	1.13	2.95	-0.47	-0.71	6.2	5.4	6.9	6.2
D	Anhui	830	0.60	1.37	3357	0.69	1.81	0.10	0.44	13.0	4.2	12.8	10.0
L	Jiangxi	838	0.60	1.38	3080	0.63	1.66	0.03	0.28	8.9	5.6	13.1	9.2
E	Henan	900	0.65	1.48	3313	0.68	1.79	0.04	0.31	10.3	5.7	11.7	9.2
	Hubei	1157	0.83	1.91	4142	0.85	2.24	0.02	0.33	10.9	4.4	11.6	9.0
	Hunan	1167	0.84	1.92	3470	0.71	1.87	-0.12	-0.05	7.7	4.9	10.1	7.6
	Sichuan	990	0.71	1.63	3201	0.66	1.73	-0.05	0.10	8.8	5.2	10.8	8.3
W	Guizhou	607	0.44	1.00	1853	0.38	1.00	-0.05	0.00	11.0	5.0	7.4	7.8
	Yunnan	861	0.62	1.42	3044	0.63	1.64	0.01	0.22	10.2	7.6	8.7	8.8
E	Tibet	1067	0.77	1.76	2392	0.49	1.29	-0.27	-0.47	8.9	0.7	8.2	5.9
	Shaanxi	834	0.60	1.37	2843	0.59	1.53	-0.01	0.16	9.9	7.5	8.5	8.6
S	Gansu	784	0.56	1.29	2288	0.47	1.23	-0.09	-0.06	7.1	7.9	7.7	7.6
	Qinghai	784	0.56	1.29	2288	0.47	1.23	-0.09	-0.06	7.1	7.9	7.7	7.6
T	Ningxia	1238	0.89	2.04	3328	0.69	1.80	-0.20	-0.24	9.2	5.3	6.2	6.9
	Xinjiang	1291	0.93	2.13	4819	0.99	2.60	0.07	0.48	11.3	7.4	9.0	9.2

* N = population

Table 5. Average Wage of Formal Employees (at Constant 1995 Prices) by Province: 1980-1995

		1980			1995			1995 minus 1980		Growth Rate (%)			
		Real Wage	China=1	Guizhou=1	Real Wage	China=1	Guizhou=1	China=1	Guizhou=1	81-85	86-90	91-95	81-95
	National	2993	1.00	1.00	5500	1.00	1.23	0.00	0.23	4.4	2.5	5.8	4.2
	East	3043	1.02	1.02	6380	1.16	1.43	0.14	0.41	5.3	3.3	7.0	5.2
	Middle	2955	0.99	0.99	4453	0.81	0.99	-0.18	0.00	3.1	1.7	3.8	2.9
	West	3174	1.06	1.06	4873	0.89	1.09	-0.17	0.02	4.3	1.9	2.9	3.0
	Beijing	3908	1.31	1.31	8144	1.48	1.82	0.18	0.51	5.1	2.8	7.6	5.2
E	Tianjin	3144	1.05	1.05	6501	1.18	1.45	0.13	0.40	5.6	4.4	5.3	5.1
	Hebei	2670	0.89	0.90	4839	0.88	1.08	-0.01	0.19	4.5	3.6	4.4	4.2
	Liaoning	3505	1.17	1.18	5434	0.99	1.21	-0.18	0.04	3.2	3.3	2.7	3.1
A	Shanghai	3104	1.04	1.04	9279	1.69	2.07	0.65	1.03	6.8	3.9	12.7	7.8
	Jiangsu	2764	0.92	0.93	5943	1.08	1.33	0.16	0.40	7.9	1.8	6.7	5.5
	Zhejiang	3171	1.06	1.06	6619	1.20	1.48	0.14	0.42	5.6	2.1	7.9	5.2
S	Fujian	2035	0.68	0.68	5857	1.06	1.31	0.38	0.63	7.0	5.8	9.5	7.4
	Shandong	2142	0.72	0.72	5145	0.94	1.15	0.22	0.43	6.1	4.4	8.3	6.3
	Guangdong	3590	1.20	1.20	8520	1.55	1.90	0.35	0.70	5.8	3.1	9.2	6.1
T	Guangxi	2966	0.99	0.99	5105	0.93	1.14	-0.06	0.15	3.9	6.7	2.7	4.4
	Hainan	3440	1.15	1.15	5340	0.97	1.19	-0.18	0.04	2.8	0.7	6.2	3.2
	Shanxi	2983	1.00	1.00	4721	0.86	1.05	-0.14	0.05	4.6	2.7	2.5	3.3
M	Mongolia	2841	0.95	0.95	4134	0.75	0.92	-0.20	-0.03	2.9	1.7	3.3	2.6
I	Jilin	3032	1.01	1.02	4430	0.81	0.99	-0.21	-0.03	2.4	0.8	4.8	2.7
D	Heilongjiang	3336	1.11	1.12	4145	0.75	0.93	-0.36	-0.19	1.4	0.2	3.0	1.5
D	Anhui	2609	0.87	0.87	4609	0.84	1.03	-0.03	0.16	4.0	3.0	5.0	4.0
L	Jiangxi	2819	0.94	0.95	4211	0.77	0.94	-0.18	0.00	3.0	0.8	4.8	2.9
E	Henan	2563	0.86	0.86	4344	0.79	0.97	-0.07	0.11	3.7	2.3	5.0	3.7
	Hubei	2966	0.99	0.99	4685	0.85	1.05	-0.14	0.05	3.9	2.7	3.1	3.2
	Hunan	3165	1.06	1.06	4797	0.87	1.07	-0.19	0.01	3.7	2.0	3.1	2.9
	Sichuan	3052	1.02	1.02	4645	0.84	1.04	-0.17	0.01	3.9	2.5	2.6	3.0
W	Guizhou	2983	1.00	1.00	4475	0.81	1.00	-0.18	0.00	3.1	1.9	3.8	2.9
	Yunnan	2822	0.94	0.95	5149	0.94	1.15	-0.01	0.20	5.6	2.4	5.1	4.3
E	Tibet	4218	1.41	1.41	7382	1.34	1.65	-0.07	0.24	7.8	-2.4	8.4	4.6
	Shaanxi	3185	1.06	1.07	4396	0.80	0.98	-0.26	-0.09	4.1	1.7	1.2	2.3
S	Gansu	3462	1.16	1.16	5493	1.00	1.23	-0.16	0.07	5.5	1.1	3.5	3.3
	Qinghai	3462	1.16	1.16	5493	1.00	1.23	-0.16	0.07	5.5	1.1	3.5	3.3
T	Ningxia	3399	1.14	1.14	5079	0.92	1.13	-0.21	0.00	3.2	1.9	3.4	2.8
	Xinjiang	3427	1.14	1.15	5348	0.97	1.20	-0.17	0.05	4.3	2.0	2.9	3.1

Table 6. Annual Per Capita Income (at Constant 1995 Prices) of Urban and Rural Households by Province: 1980-1995

		Urban Households									Rural Households								Urban-Rural Disparity		
		1980		1995		1995	Growth Rate (%)				1980		1995		1995	Growth Rate (%)				1980	1995	1995
		Income	China=1	Income	China=1	minus 80	81-85	86-90	91-95	81-95	Income	China=1	Income	China=1	minus 80	81-85	86-90	91-95	81-95	Urbn/Rur	Urbn/Rur	minus80
	National	1721	1.00	3892	1.00	0.00	5.0	4.3	7.8	5.7	618	1.00	1578	1.00	0.00	12.3	2.9	4.5	6.6	2.79	2.47	-0.32
	East	1842	1.07	4832	1.24	0.17	6.8	4.9	8.6	6.7	833	1.35	2364	1.50	0.15	12.7	3.1	6.3	7.3	2.21	2.04	-0.17
	Middle	1432	0.83	3173	0.82	-0.02	6.4	3.4	6.9	5.5	561	0.91	1432	0.91	0.00	12.4	3.0	4.6	6.7	2.55	2.21	-0.34
	West	1565	0.91	3453	0.89	-0.02	7.6	2.0	7.1	5.6	551	0.89	1056	0.67	-0.22	10.3	2.9	0.7	4.6	2.84	3.27	0.43
	Beijing	2312	1.34	5868	1.51	0.16	1.8	11.0	9.1	7.3	897	1.45	3224	2.04	0.59	19.1	3.5	4.9	9.2	2.58	1.82	-0.76
E	Tianjin	1884	1.09	4626	1.19	0.09	7.2	3.8	8.2	6.4	1027	1.66	2531	1.60	-0.06	12.0	4.1	3.3	6.5	1.84	1.83	-0.01
	Hebei	1473	0.86	3674	0.94	0.09	5.9	7.0	6.4	6.4	504	0.81	1669	1.06	0.24	14.3	-0.3	12.7	8.9	2.92	2.20	-0.72
	Liaoning	1885	1.10	3307	0.85	-0.25	2.8	5.1	3.9	3.9	788	1.27	1757	1.11	-0.16	11.1	3.0	3.5	5.9	2.39	1.88	-0.51
A	Shanghai	2214	1.29	6822	1.75	0.47	9.2	3.9	11.0	8.0	1710	2.77	4246	2.69	-0.08	11.8	4.4	4.0	6.7	1.30	1.61	0.31
	Jiangsu	1668	0.97	4209	1.08	0.11	9.0	2.2	8.5	6.6	718	1.16	2547	1.61	0.45	15.2	1.1	11.4	9.2	2.32	1.65	-0.67
	Zhejiang	1936	1.13	5718	1.47	0.34	9.3	4.1	9.7	7.7	728	1.18	2966	1.88	0.70	17.5	5.4	7.5	10.1	2.66	1.93	-0.73
S	Fujian	1686	0.98	4326	1.11	0.13	6.6	6.0	10.7	7.8	553	0.89	2049	1.30	0.40	15.5	2.9	9.9	9.4	3.05	2.11	-0.94
	Shandong	1451	0.84	3953	1.02	0.17	8.1	4.4	8.6	7.0	655	1.06	1715	1.09	0.03	11.3	0.5	9.1	7.0	2.22	2.30	0.09
	Guangdong	2078	1.21	6850	1.76	0.55	7.9	5.7	11.7	8.5	947	1.53	2699	1.71	0.18	9.6	5.0	7.2	7.3	2.20	2.54	0.34
T	Guangxi	1686	0.98	4289	1.10	0.12	7.1	4.8	8.0	6.6	675	1.09	1446	0.92	-0.18	9.1	1.7	5.2	5.3	2.50	2.97	0.47
	Hainan	1829	1.06	4345	1.12	0.05	7.9	2.9	8.2	6.3	799	1.29	1520	0.96	-0.33	9.6	1.1	3.0	4.6	2.29	2.86	0.57
	Shanxi	1368	0.79	2927	0.75	-0.04	6.2	4.4	5.3	5.3	495	0.80	1208	0.77	-0.04	15.3	1.2	3.1	6.6	2.76	2.42	-0.34
M	Mongolia	1270	0.74	2587	0.66	-0.07	7.2	1.9	5.9	5.0	594	0.96	1300	0.82	-0.14	12.6	1.3	3.7	5.9	2.14	1.99	-0.15
I	Jilin	1744	1.01	2914	0.75	-0.26	0.2	3.8	7.5	3.8	497	0.80	1610	1.02	0.22	12.1	9.1	6.2	9.1	3.51	1.81	-1.70
D	Heilongjian	1576	0.92	2968	0.76	-0.15	6.9	-0.7	7.1	4.4	545	0.88	1766	1.12	0.24	12.0	8.3	7.1	9.1	2.89	1.68	-1.21
D	Anhui	1384	0.80	3406	0.88	0.07	7.1	4.8	7.1	6.3	506	0.82	1303	0.83	0.01	13.9	1.4	6.0	7.1	2.73	2.61	-0.12
L	Jiangxi	983	0.57	3046	0.78	0.21	12.7	3.9	7.7	8.1	503	0.81	1537	0.97	0.16	14.6	3.2	6.0	7.9	1.96	1.98	0.02
E	Henan	1155	0.67	3030	0.78	0.11	7.9	5.2	7.1	6.7	444	0.72	1232	0.78	0.06	12.7	3.2	5.8	7.2	2.60	2.46	-0.14
	Hubei	1474	0.86	3606	0.93	0.07	7.9	4.3	6.6	6.3	690	1.12	1511	0.96	-0.16	12.7	3.3	1.5	5.8	2.14	2.39	0.25
	Hunan	1930	1.12	4070	1.05	-0.08	4.7	3.3	7.6	5.2	778	1.26	1425	0.90	-0.36	10.2	-0.8	3.4	4.3	2.48	2.86	0.37
	Sichuan	1477	0.86	3586	0.92	0.06	8.6	4.6	5.4	6.2	516	0.84	1158	0.73	-0.10	9.0	4.7	3.4	5.7	2.86	3.10	0.23
W	Guizhou	1235	0.72	3427	0.88	0.16	10.0	3.4	8.2	7.2	277	0.45	1087	0.69	0.24	14.7	8.2	5.9	9.6	4.45	3.15	-1.30
	Yunnan	1501	0.87	3684	0.95	0.07	8.0	3.8	7.1	6.3	408	0.66	1011	0.64	-0.02	13.6	2.2	3.6	6.5	3.67	3.64	-0.03
E	Tibet	2413	1.40	4460	1.15	-0.26	7.6	0.2	6.1	4.6	668	1.08	1200	0.76	-0.32	9.0	9.5	-2.1	5.4	3.61	3.72	0.10
	Shaanxi	1561	0.91	3048	0.78	-0.12	5.5	5.4	3.3	4.7	532	0.86	963	0.61	-0.25	13.5	0.2	-0.5	4.4	2.93	3.17	0.23
S	Gansu	905	0.53	2894	0.74	0.22	8.0	-2.5	24.6	10.1	573	0.93	880	0.56	-0.37	5.9	0.5	2.7	3.0	1.58	3.29	1.71
	Qinghai	905	0.53	2894	0.74	0.22	8.0	-2.5	24.6	10.1	573	0.93	880	0.56	-0.37	5.9	0.5	2.7	3.0	1.58	3.29	1.71
T	Ningxia	1656	0.96	3027	0.78	-0.18	5.5	2.7	4.7	4.3	601	0.97	1037	0.66	-0.32	10.0	2.3	-0.3	4.0	2.75	2.92	0.16
	Xinjiang	1580	0.92	3841	0.99	0.07	8.9	2.2	7.8	6.3	733	1.19	1137	0.72	-0.46	11.7	2.3	-3.9	3.4	2.16	3.38	1.22

Table 7. Growth Accounting across Provinces: 1995 *

		N ('0000ps)	GDP (Y) (100m¥)	L ('0000ps)	K (100m¥)	ω (L share)	Y/N=y (¥/psns)	L/N=l	K/N=k (¥/psns)	Ratio to National Average (China=1)				Gap Rate to National Average (%)				Contribution to Gap Rate (%)		
										y/yo	l/lo	k/ko	TFP/TFPo	Δy/yo	Δl/lo	Δk/ko	ΔTFP/TFPo	Δl/lo	Δk/ko	ΔTFP/TFPo
	National	121121	58260	62388	122160	0.515	4810	0.515	10086	1.000	1.000	1.000	1.000	0.0	0.0	0.0	0.0			
	East	49350	33615	25718	68741	0.499	6812	0.521	13929	1.416	1.012	1.381	1.222	41.6	1.2	38.1	22.2	1	45	53
	Middle	42901	15868	21145	28941	0.554	3699	0.493	6746	0.769	0.957	0.669	0.946	-23.1	-4.3	-33.1	-5.4	-10	-67	-23
	West	27413	8150	14767	16055	0.580	2973	0.539	5857	0.618	1.046	0.581	0.783	-38.2	4.6	-41.9	-21.7	7	-50	-57
	Beijing	1251	1395	665	4620	0.484	11150	0.532	36930	2.318	1.032	3.662	0.970	131.8	3.2	266.2	-3.0	1	101	-2
E	Tianjin	895	920	515	2614	0.445	10284	0.576	29216	2.138	1.118	2.897	1.095	113.8	11.8	189.7	9.5	5	87	8
	Hebei	6437	2850	3252	5548	0.539	4427	0.505	8619	0.920	0.981	0.855	0.999	-8.0	-1.9	-14.5	-0.1	-13	-86	-1
	Liaoning	4037	2793	2028	7337	0.458	6919	0.502	18174	1.439	0.975	1.802	1.039	43.9	-2.5	80.2	3.9	-3	94	9
A	Shanghai	1301	2463	794	7279	0.358	18922	0.610	55932	3.934	1.185	5.546	1.292	293.4	18.5	454.6	29.2	3	87	10
	Jiangsu	7066	5155	3650	9196	0.482	7296	0.517	13014	1.517	1.003	1.290	1.370	51.7	0.3	29.0	37.0	0	28	72
	Zhejiang	4389	3525	2621	6241	0.470	8031	0.597	14220	1.670	1.159	1.410	1.383	67.0	15.9	41.0	38.3	12	31	57
S	Fujian	3165	2161	1567	2924	0.530	6827	0.495	9240	1.419	0.962	0.916	1.479	41.9	-3.8	-8.4	47.9	-5	-10	114
	Shandong	8705	5002	4358	9022	0.457	5747	0.501	10364	1.195	0.972	1.028	1.194	19.5	-2.8	2.8	19.4	-7	7	100
	Guangdong	6838	5382	3551	11761	0.507	7870	0.519	17199	1.636	1.008	1.705	1.287	63.6	0.8	70.5	28.7	1	54	45
T	Guangxi	4543	1606	2382	2323	0.671	3535	0.524	5113	0.735	1.018	0.507	0.925	-26.5	1.8	-49.3	-7.5	4	-76	-28
	Hainan	723	364	335	894	0.589	5037	0.463	12365	1.047	0.898	1.226	1.002	4.7	-10.2	22.6	0.2	-119	215	4
	Shanxi	3077	1092	1425	3093	0.508	3550	0.463	10051	0.738	0.899	0.997	0.792	-26.2	-10.1	-0.3	-20.8	-20	-1	-80
M	Mongolia	2284	833	1029	1586	0.560	3646	0.451	6943	0.758	0.875	0.688	0.969	-24.2	-12.5	-31.2	-3.1	-28	-60	-13
I	Jilin	2551	1129	1271	2410	0.584	4427	0.498	9448	0.920	0.967	0.937	0.967	-8.0	-3.3	-6.3	-3.3	-23	-36	-42
D	Heilongjiang	3701	2015	1543	4010	0.435	5443	0.417	10835	1.132	0.809	1.074	1.183	13.2	-19.1	7.4	18.3	-69	30	139
D	Anhui	6000	2004	3207	3734	0.524	3339	0.535	6223	0.694	1.038	0.617	0.859	-30.6	3.8	-38.3	-14.1	6	-60	-46
L	Jiangxi	4063	1205	2101	1926	0.630	2966	0.517	4741	0.617	1.004	0.470	0.841	-38.3	0.4	-53.0	-15.9	1	-59	-41
E	Henan	9100	3003	4509	4936	0.614	3300	0.495	5424	0.686	0.962	0.538	0.909	-31.4	-3.8	-46.2	-9.1	-7	-64	-29
	Hubei	5772	2391	2594	3885	0.514	4143	0.449	6731	0.861	0.872	0.667	1.088	-13.9	-12.8	-33.3	8.8	-47	-116	64
	Hunan	6353	2196	3467	3604	0.621	3456	0.546	5673	0.719	1.060	0.562	0.874	-28.1	6.0	-43.8	-12.6	12	-67	-45
	Sichuan	11163	3534	6301	5369	0.577	3166	0.564	4810	0.658	1.096	0.477	0.843	-34.2	9.6	-52.3	-15.7	15	-69	-46
W	Guizhou	3420	630	1812	1250	0.627	1843	0.530	3656	0.383	1.029	0.362	0.640	-61.7	2.9	-63.8	-36.0	3	-44	-58
	Yunnan	3990	1207	2149	2271	0.453	3025	0.539	5692	0.629	1.046	0.564	0.831	-37.1	4.6	-43.6	-16.9	6	-61	-45
E	Tibet	236	56	115	238	0.794	2372	0.488	10085	0.493	0.947	1.000	0.528	-50.7	-5.3	-0.0	-47.2	-7	0	-93
	Shaanxi	3513	1000	1748	2475	0.608	2847	0.498	7045	0.592	0.966	0.699	0.743	-40.8	-3.4	-30.1	-25.7	-5	-32	-63
S	Gansu	2438	553	1483	1422	0.509	2270	0.608	5833	0.472	1.181	0.578	0.585	-52.8	18.1	-42.2	-41.5	18	-39	-79
	Qinghai	481	165	242	553	0.571	3435	0.502	11492	0.714	0.974	1.139	0.664	-28.6	-2.6	13.9	-33.6	-5	22	-117
T	Ningxia	512	170	241	494	0.541	3315	0.471	9648	0.689	0.914	0.957	0.755	-31.1	-8.6	-4.3	-24.5	-15	-7	-79
	Xinjiang	1661	835	676	2134	0.544	5025	0.407	12848	1.045	0.790	1.274	1.027	4.5	-21.0	27.4	2.7	-249	289	60

* N=population (10000 persons). Y=real GDP (100 million yuans). L=labor (10000 persons). K=real capital stocks (100 million yuans). Y/N here is computed, while Y/N in Table 4 is from *Statistical Yearbook*.

Table 8. Factors of TFP Growth: Regressions across Provinces (1991-1995)*

g(Y), %	(1)	(2)	(3)	(4)	(5)	(6)
Constant	3.3244 (1.367)	1.9696 (3.456)	1.8901 (1.098)	1.7973 (1.020)	9.2139 (2.886)	5.4239 (3.914)
g(L), %	0.6313 (4.451)	0.7144 (4.155)	0.7102 (4.163)	0.7104 (4.093)	0.7480 (3.891)	0.7292 (4.223)
g(K), %	0.3687 (4.451)	0.2856 (4.155)	0.2898 (4.163)	0.2896 (4.093)	0.2520 (3.891)	0.2708 (4.223)
HDI, %	0.068 (1.625)		0.0202 (0.726)	0.0235 (0.801)	-0.0458 (-1.313)	
I_{non-s}/I, %		0.1395 (6.535)	0.1380 (6.375)	0.1371 (6.207)	0.1022 (4.302)	0.1128 (4.966)
FDI/I, %		0.0861 (2.336)	0.0749 (1.862)	0.093 (1.590)	0.0415 (1.060)	0.0408 (1.028)
Trade/GDP, %				-0.0108 (-0.432)		
Dummy-M (Middle)					-1.8982 (-1.828)	-1.1333 (-1.299)
Dummy-W (West)					-3.5612 (-2.716)	-2.2365 (-2.470)
R2 DW	0.513 1.328	0.830 2.141	0.833 2.194	0.834 2.213	0.875 2.269	0.866 2.221

* g(・) = average annual growth rate for 1991-1995.
HDI = Human Development Index, level in 1990.
Inon-s/I = investment of non-state enterprise / total investment, average for 1991-1995.
FDI/I = foreign direct investment / total investment, average for 1991-1995.
Trade/GDP = (exports+imports)/GDP, average for 1991-1995.
Dummy-M = dummy variable for the provinces in the Middle region.
Dummy-W = dummy variable for the provinces in the West region.
R2 = coefficient of determination. DW = Durbin-Watson ratio. ( ) = t-ratio.
Data sources: *China Statistical Yearbook*, *China Regional Economy*, etc.

Table A1. Iteration for National Data
(Economically Meaningful Range of TFP)

GDP95	58260	GDP80	13606
GTB	GTB-GTE	K95	K80
0.025	0.010907	115841	13612
0.03	0.005095	118150	18518
0.035	0.001345	120758	24059
0.03746	7.19E-06	122168	27055
0.04	-0.00111	123724	30362
0.05	-0.00362	131079	45987
0.06	-0.00423	141228	67552
0.07	-0.00379	156141	99236
0.08	-0.00281	180196	150347
0.09	-0.00163	225523	246651
0.1	-0.00059	342691	495594
0.111	-3.4E-06	2143673	4322093
0.112	1.84E-06	5483111	11417310

Figure A1. Iteration for National Data
(Economically meaninful Range of TFP)

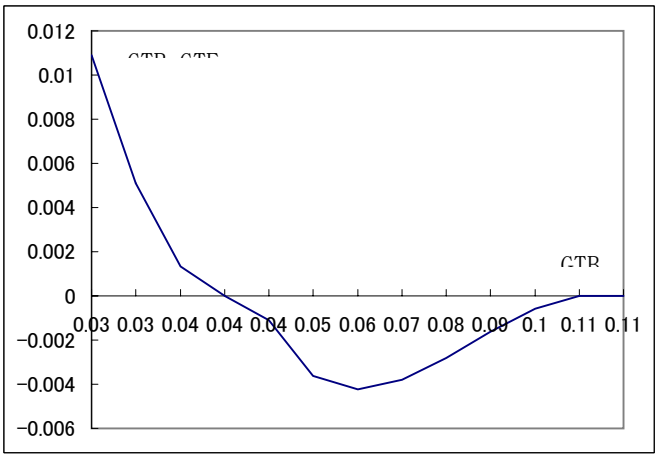

Figure A2. Iteration for National Data (Possible Range of TFP)

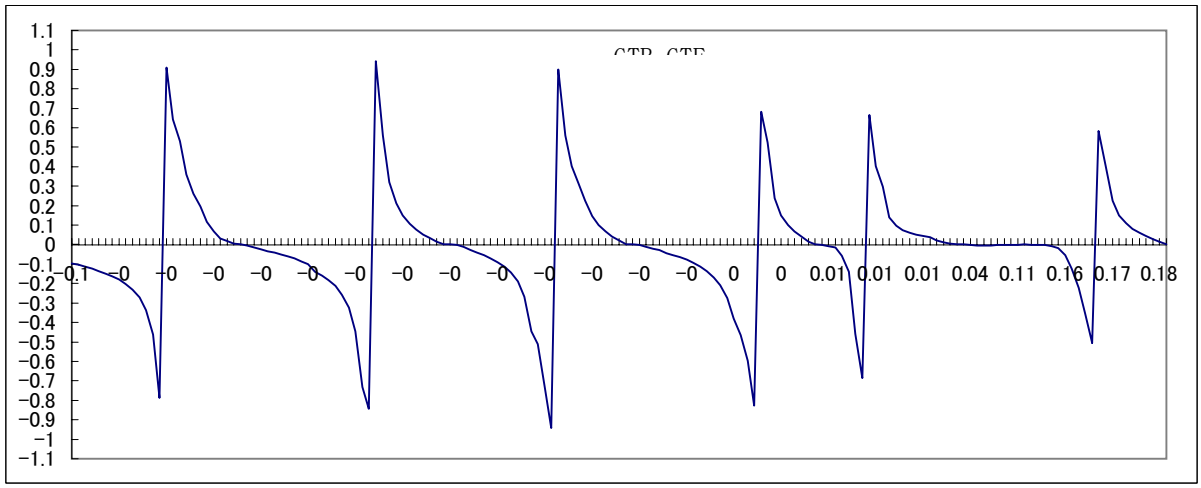

Table A2. Iteration for National Data (Possible Range of TFP)

	GTB	GTB-GTE	K95	K80	GTB	GTB-GTE	K95	K80	
	-0.05	-0.09551	98238	-23789	Continued				
	-0.049	-0.10474	98365	-23518	-0.002	0.00074	106850	-5491	
	-0.048	-0.11433	98494	-23245	-0.001982	0.00002	106854	-5481	0
	-0.047	-0.12453	98624	-22967	-0.0019	-0.00328	106875	-5437	
	-0.046	-0.13567	98756	-22687	-0.0017	-0.01141	106926	-5328	
	-0.045	-0.14818	98890	-22403	-0.0015	-0.01980	106978	-5219	
	-0.044	-0.16268	99026	-22115	-0.0013	-0.02858	107029	-5110	
	-0.043	-0.18012	99163	-21823	-0.001	-0.04286	107107	-4945	
	-0.042	-0.20202	99302	-21528	-0.0008	-0.05346	107159	-4835	
	-0.041	-0.23106	99443	-21229	-0.0006	-0.06528	107211	-4724	
	-0.04	-0.27247	99585	-20926	-0.0004	-0.07875	107263	-4613	
	-0.039	-0.33801	99730	-20619	-0.0002	-0.09449	107315	-4502	
	-0.038	-0.46107	99876	-20308	0	-0.11343	107368	-4390	
∞	-0.037	-0.78882	100025	-19992	0.0002	-0.13704	107421	-4278	
∞	-0.035	0.90977	100327	-19349	0.0004	-0.16775	107474	-4165	
	-0.0347	0.64274	100374	-19251	0.0006	-0.21004	107527	-4052	
	-0.0345	0.53151	100404	-19185	0.0008	-0.27300	107580	-3939	
	-0.034	0.35929	100482	-19021	0.001	-0.37855	107634	-3825	
	-0.0335	0.26027	100560	-18855	0.0011	-0.46439	107661	-3768	
	-0.033	0.19559	100639	-18688	0.0012	-0.59627	107688	-3711	
	-0.032	0.11529	100797	-18350	0.0013	-0.82582	107715	-3653	∞
	-0.031	0.06633	100958	-18008	0.0019	0.68173	107878	-3307	∞
	-0.03	0.03231	101122	-17661	0.002	0.52429	107905	-3249	
	-0.0295	0.01859	101204	-17486	0.0025	0.23950	108042	-2958	
	-0.029	0.00635	101287	-17310	0.003	0.14864	108181	-2663	
0	-0.02872	0.00001	101334	-17210	0.0035	0.10047	108320	-2366	
	-0.0285	-0.00475	101371	-17132	0.004	0.06767	108462	-2067	
	-0.028	-0.01501	101455	-16953	0.0045	0.04086	108604	-1764	
	-0.0275	-0.02464	101540	-16772	0.005	0.01496	108748	-1459	
	-0.027	-0.03383	101626	-16591	0.005265	0.00001	108824	-1296	0
	-0.0265	-0.04274	101712	-16408	0.0053	-0.00210	108835	-1274	
	-0.026	-0.05153	101798	-16224	0.0054	-0.00833	108864	-1212	
	-0.0255	-0.06034	101886	-16038	0.0055	-0.01495	108893	-1151	
	-0.025	-0.06932	101974	-15851	0.006	-0.05774	109039	-840	
	-0.024	-0.08854	102151	-15473	0.0065	-0.14104	109187	-526	
	-0.0235	-0.09923	102241	-15282	0.007	-0.45782	109336	-209	
	-0.022	-0.14006	102515	-14701	0.0071	-0.68589	109366	-145	∞
	-0.0215	-0.15888	102608	-14504	0.0076	0.66453	109517	176	∞
	-0.021	-0.18247	102701	-14306	0.0078	0.40351	109578	305	
	-0.0205	-0.21353	102795	-14106	0.008	0.29658	109639	434	
	-0.02	-0.25722	102890	-13905	0.009	0.14052	109947	1090	
	-0.0195	-0.32466	102985	-13702	0.01	0.09727	110262	1758	
	-0.019	-0.44537	103081	-13498	0.011	0.07544	110582	2439	
	-0.0185	-0.73193	103178	-13292	0.012	0.06165	110909	3134	
∞	-0.0184	-0.84505	103198	-13250	0.013	0.05187	111243	3843	
∞	-0.0173	0.94140	103414	-12791	0.014	0.04445	111583	4566	
	-0.017	0.56201	103473	-12665	0.015	0.03854	111931	5305	
	-0.0165	0.31982	103573	-12452	0.02	0.02043	113780	9234	
	-0.016	0.21105	103674	-12239	0.025	0.01091	115841	13612	
	-0.0155	0.14821	103775	-12023	0.03	0.00510	118150	18518	
	-0.015	0.10648	103878	-11806	0.035	0.00134	120758	24059	
	-0.0145	0.07612	103981	-11587	0.03746	0.00001	122168	27055	0
	-0.014	0.05249	104085	-11366	0.04	-0.00111	123724	30362	
	-0.0135	0.03306	104189	-11143	0.05	-0.00362	131079	45987	
	-0.013	0.01634	104295	-10919	0.06	-0.00423	141228	67552	
	-0.0125	0.00133	104401	-10693	0.07	-0.00379	156141	99236	
0	-0.012455	0.00004	104411	-10673	0.08	-0.00281	180196	150347	
	-0.0124	-0.00153	104423	-10648	0.09	-0.00163	225523	246651	
	-0.012	-0.01270	104509	-10465	0.1	-0.00059	342691	495594	
	-0.0115	-0.02635	104617	-10236	0.111	0.00000	2143673	4322093	
	-0.011	-0.04017	104726	-10004	0.112	0.00000	5483111	11417310	0
	-0.0105	-0.05477	104836	-9771	0.115	-0.00005	-1326651	-3051212	
	-0.01	-0.07092	104946	-9535	0.12	-0.00038	-375384	-1030079	
	-0.0095	-0.08974	105058	-9298	0.13	-0.00242	-114726	-476268	
	-0.009	-0.11303	105171	-9059	0.14	-0.00759	-44460	-326974	
	-0.0085	-0.14408	105284	-8818	0.15	-0.01971	-11787	-257556	
	-0.008	-0.18987	105398	-8575	0.16	-0.05582	7094	-217440	
	-0.0075	-0.26838	105514	-8329	0.165	-0.12490	13831	-203126	
	-0.007	-0.44534	105630	-8082	0.167	-0.22045	16179	-198138	
	-0.0069	-0.51255	105654	-8032	0.168	-0.35268	17289	-195778	
	-0.0067	-0.73535	105701	-7933	0.1685	-0.50415	17829	-194630	∞
∞	-0.0066	-0.94141	105724	-7883	0.1706	0.58499	19997	-190025	∞
∞	-0.0059	0.90047	105890	-7531	0.171	0.40731	20392	-189186	
	-0.0057	0.56223	105937	-7429	0.172	0.22584	21357	-187136	
	-0.0055	0.40341	105985	-7328	0.173	0.15080	22289	-185154	
	-0.0053	0.31064	106033	-7226	0.174	0.10857	23192	-183237	
	-0.005	0.22592	106106	-7072	0.175	0.08050	24065	-181382	
	-0.0045	0.14675	106227	-6814	0.176	0.05964	24911	-179585	
	-0.004	0.10001	106349	-6554	0.177	0.04275	25730	-177843	
	-0.0035	0.06761	106473	-6292	0.178	0.02806	26525	-176155	
	-0.003	0.04241	106597	-6027	0.179	0.01445	27295	-174518	
	-0.0025	0.02087	106723	-5760	0.18	0.00110	28043	-172930	