# What Effect does the Size of the State-Owned Sector Have on Regional Growth in China?

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April 2003

Keywords: growth, provinces, empirical, panel-data

JEL codes: H1, O0

* The financial support of the David M. Kennedy Center for International Studies and of the College of Family Home and Social Science at Brigham Young University is gratefully acknowledged. Thanks are also due to Tonja Bowen for invaluable research assistance.

**Abstract**

This paper tests the contributions of the size of state-owned enterprises as a determinant of China's economic growth. The methodology is discussed in papers by Levine and Renelt (1992) and Sala-i-Martin (1997). We estimate regressions with growth of output and total factor productivity as the dependent variable and a variety of other factors, including measures of the size of the state-run sector, as regressors.

We find that controlling for a variety of other factors, the greater the importance of state owned enterprises, as measured by the proportion of total industrial production they produce, the lower the provincial growth rate. The average estimate is that a decrease in the SOE share of industrial production by ten percentage points increases real GDP growth the following year by 1.14%.

The average impacts of a reduction in the SOE share in employment are smaller in absolute magnitude and different for large provinces than they are for small ones. Large provinces actually have higher growth rates if this share rises, while smaller provinces have higher growth rates when it falls.

## 1. Introduction

One of the phenomena that confront economists interested in East Asia in general and China in particular, is the episodes of very rapid growth that have occurred and are occurring here. From an empirical and theoretical standpoint, this phenomenon cries out to be understood, especially since it contrasts so sharply with the experience in other parts of the world. From a welfare perspective, as well, the issue looms very large indeed. When one begins to grasp the potential size of the Chinese economy if it were more fully developed and the numbers of people that would be affected, it is difficult to think of other areas of economics where a clearer understanding yields greater potential benefits.

Growth rates in China since 1978 have been nothing short of phenomenal. According to official statistics, real GDP grew at an annual rate of 9.64% from 1978 through 1999. In per capita terms it grew 8.21% per annum. Our measures of capital growth put the growth rate of total factor productivity (TFP) at 6.86%.[1] By contrast, over the same period US GDP and per capita GDP grew 3.02% and 1.91% per annum, respectively.

One potential way to gain a better understanding of the growth process in China is to look at differences in growth across regions or provinces in China. In the past two decades of double digit annual growth for China, much of the growth has occurred in the coastal provinces, of Jiangsu, Zhejiang, Fujian, & Guangdong. Growth in other parts of China has been respectable, but nowhere near as strong. This is another phenomenon that needs to be explained

The disparities between provinces are almost as striking as the high growth rates. Table 1 shows real GDP per capita in 1998 by province/administrative area. The highest per capita GDP was Shanghai with 23,844 RMB (measured in constant 1995 RMB). Guizhou's per capita GDP was a mere 2168 RMB. Evan allowing for substantial deviations from PPP, this difference by a factor of eleven is huge. Table 3 illustrates this further by calculating inter-provincial Gini coefficients for China. These are calculated on the assumption that all individuals within a province have the same share in total GDP. The figures are thus meaningless for measuring income inequality for the country as a whole, but they are informative when looking at regional income inequality. The Gini coefficients range from a low of .2103 in 1990 to a high of .2609 in 1996. For comparison, identical calculations

[1] See Figure 1 for an illustration.

across the fifty US states in 2000 gave an inter-state Gini coefficient of .084. The fifteen European Union countries had an inter-country Gini coefficient of .050 in 2001.

Not only is there a great disparity in the levels of GDP per capita, but the growth rates vary substantially as well. Figure 5 plots the log-levels of GDP by region. It clearly shows that the East and South Central regions grew at a faster rate than the rest of the country over this period.

All of this raises many interesting questions. Why are the regional differences in per capita GDP so large? Why are the regional differences in growth rates so large? Undoubtedly there are many causes and the answers are not likely to be simple. This paper focuses narrowly on just one question: what role has the persistence of state-owned enterprises played in accentuating or reducing this regional disparity in economic growth?

State owned enterprises (SOEs) have been and remain major actors on China's economic stage. Though their role has lessened somewhat as economic liberalization has taken place, they still loom large, especially in the northwest and some interior provinces. Nationwide, well over half of all employees classified as "staff & workers" are employed by SOEs. SOE shares in industrial production vary widely across provinces. In the interior, where growth has been slower and per capita GDP is still relatively low, SOE shares are close to 50%. In contrast the faster growing, higher GDP costal provinces have shares that are much lower. In 1998, for example, less that seven percent of industrial production in Zhejiang province was attributed to SOEs.

While these correlations are of interest, they do not, by themselves, prove anything. The correlation may be spurious, or related to other important factors, such as the location of resources or transportation infrastructure. In this paper we examine the correlation while controlling for many other potential factors driving the growth process. Section 2 discusses our dataset. Section 3 discusses methodology. Section 4 presents the results of our estimation. Section 5 draws conclusions and makes suggestions for further inquiry.

## 2. Data Set

Our dataset consists of various data taken from Chinese statistical publications and which are complied at the provincial level every year. Our sample runs from 1978 to 1999 and includes 30 provinces, autonomous regions and independently administered cities. The city of Chongqing was made independent from Sichuan province in 1996. We aggregate these two regions for 1996-98 making it consistent with earlier observations.

We are able to gather a reasonably complete set of data for the variables listed in table 2. We have double checked this data for accuracy and in cases where there are obvious, yet uncorrectable errors, we have omitted the observations. With 22 years and 30 provinces we have potentially 660 observations, though we have less than that in practice.

Our major sources of data are all ultimately traceable to the National Bureau of Statistics, though they have come to us in a variety of methods. Some are from yearbooks published in China and available at Nanjing University. Others come from Hsueh et. al. (1993); an excellent source of provincial data up to 1989. Additional sources include the English/Chinese language China Statistical Yearbook in various printed and CD-ROM editions. Finally, the CD-ROM on Fifty Years of Chinese Statistical Data was also a useful source.

We gathered data on as many series as we could find that could be argued are important for economic growth and development. There are, of course, literally thousands of kinds of data that fit this criterion. However, the need for consistently reported data from all or most provinces for the bulk of the sample period turns out to be a great winnower of data. We end up with the 22 series reported in table 3.

The first two are our dependent variables, the growth rate of real GDP and the growth rate of total factor productivity for a given province in a given year. To calculate real GDP we simply divided the nominal GDP number for each province by the national-level GDP deflator. This is the correct way only if prices are the same in each province, which they clearly are not. Price indices by province are available, but they all use the same base year, making it impossible to adjust for price differences across provinces.

Total factor productivity was calculated by using these real GDP figures, the reported employment figures, and a very rough measure of the capital stock, calculated by using the perpetual inventory method. The initial capital stocks for each province and the depreciation rate were chosen such that the sum of the provincial stocks followed a path as similar as possible to the national capital stock reported by Chow (????). We calculated TFP using capital shares in output of .25. Other formulations we tried did not produce capital stock series that were very different from this method.

Our dependent variables are grouped into the following categories:

<u>Baseline Regressors</u>

These are regressors included in every regression. We choose these to match as closely as possible the baseline regressors used in Levine & Renelt (19??), discussed in the next section. These are real GDP per capita in the previous year, real investment per capita in the previous year, and the growth rate of the population from the previous year.

Measures of the size of State Owned Enterprises

Here we use the share of staff and workers employed by SOES, and the share of SOEs in industrial production; again both from the previous year.

Education/Human Capital

We use three measures of education: the primary school enrollment rate, secondary school enrollment rate and higher education enrollment rate. All are taken as a percentage of the total population, since we could not find figures on the number of school-age children. We also have doctors per capita.

Infrastructure

As rough measures of infrastructure we use the total length of railroad lines adjusted by the land are of the province. We calculate similar measures for highways. Finally, we include the number of telephones per capita.

Miscellaneous

Here we include various other demographic measures that could impact on growth rates. These include: the population density, the percentage of the population classified as "urban", and the percentage of males in the population. As a measure of the role of financial markets we include the ratio of bank deposits to GDP.

## 3. Methodology

In the past two decades, there has been a blossoming of research in economics concentrating on economic growth. Much of this work has been empirical in nature, and the bulk of it has used data from cross-country regression analysis. Advances in statistical analysis and increases in available computing power have made it possible to move away from cross-sectional studies which use long-run (30-year averages) growth across a sample of several dozen countries. Instead, focus has begun to shift to panel regressions that utilize data from several countries observed at several points in time.

We test contributions to economic growth using the methodology discussed in Levine and Renelt (1992) and Sala-i-Martin (1997). We estimate regressions of the form shown in (3.1)

$$g_{it} = \mathbf{y}_{it}\boldsymbol{\beta}_y + \mathbf{x}_{it}\boldsymbol{\beta}_y + \varepsilon_{it} \tag{3.1}$$

with $g_{it}$ as the dependent variable and $\mathbf{y}_{it}$ and $\mathbf{x}_{it}$ as vectors of regressors. $g_{it}$ is the per capita growth rate in province i over time period t, $\mathbf{y}_{it}$ is the set baseline regressors introduced in the previous section and $\mathbf{x}_{it}$ is a set of three variables drawn from the list of additional regressors.

The strategy is to estimate (3.1) for all possible combinations of $x_{it}$. Once this is done we examine the significance of each of the regressors and how the coefficient estimates and their significance changes as various other regressors are included. Levine & Renelt use the "extreme bounds test" proposed by Leamer (1983). This test runs the full set of regressions; if a regressor is found to be insignificant once in any of the permutations its significance is said to be "fragile". The extreme bound used is ± two standard errors.

Using this criterion, the study by Levine & Renelt (1992) cited above showed that very few things can be said to robustly explain growth, namely that small set included in the vector $y_{it}$. Other variables can be shown to be sometimes significant and other times insignificant, depending on exactly what set of explanatory factors are used.

While many variables are found to lack robust effects on growth, they do find the following robust relations: 1) There is a robust positive relation between growth & investment. 2) There is a robust negative relation between growth and initial GDP per capita.

Other than this they conclude that collectively there are many things that are highly correlated with growth, but they are also highly correlated with each other, making determinations of causality very problematic.

Sala-i-Martin (1997) points out that the extreme bounds criterion can be extremely restrictive when a large number of potential regressors are available. With three regressors included out of a set of $N$ possible regressors, the number of regressions to be run is given by:

$$r = N(N-1)(N-1)/6$$

For $N$=40 this amounts to 9880 regressions. The extreme bounds test concludes that a variable does not have a robust impact if it is found to be insignificant in any one of these regressions.

He shows that when a less restrictive (but arguably more reasonable) criterion is used, many of these variables can be said to have robust effects on growth. He uses a criterion which takes a weighted average of the coefficients across the various regressions. The weights are proportional to the value of the likelihood function for each regression, so that regressions which explain the data better have higher weights.

Many of the variables he finds to be robustly important are national in nature, however. That is, their effects impact roughly equally on all regions within a country. Examples are: variability of inflation rates, degree of property right enforcement, financial market efficiency, etc.

So, while we use Sala-i-Martin's methodology, his results from cross-country regressions to not offer a tremendous amount of guidance when running cross-region or cross-province regressions.

**4. Results of Estimation**

We estimate the following version of (3.1):

$$g_{it} = SOE_{it-1}\beta_1 + RGDPPC_{it-1}\beta_2 + RINVPC_{it-1}\beta_3 + \mathbf{D}_{it-1}\boldsymbol{\beta}_D + \mathbf{x}_{it-1}\boldsymbol{\beta}_x + \varepsilon_{it}$$

For $g_{it}$ we use both the growth rate of real per capita GDP and the growth rate of total factor productivity. For $SOE_{it}$ we use both SOEEMP, the SOE share in employment of staff and workers, and SOEIP, the SOE share in industrial production. Dit is a matrix of time and country dummies, which estimate the usual fixed-effects for panel regressions. We lag all regressors by one year to preclude any joint-causality problems.

Table 4 presents the results of this estimation. The only robustly significant case is that the share of state-owned enterprises in total industrial production has a robustly negative effect on the growth rate of GDP per capita the next period. The average value of this coefficient is -.11433, while the value weighted by regression likelihoods is -.11249. This means an decrease in the SOE share in output by 10 percentage points is associated with an increase in the per capita GDP growth rate of 1.12 to 1.14%. The effect of SOE share in employment on TFP is significant at the 90% confidence level and has a large positive point estimate of .23919.

We realize that omitting missing observations from out dataset discards useful information. If we discard an observation because secondary school enrollment is missing, we are unable to exploit the observed covariance between growth and SOE size which that observation contained. To address this issue we include a dummy variable for each right-hand-side regressor which takes on a value of 1 if the regressor is missing and 0 otherwise. We set the value of the regressor to zero if this dummy is 1. This has the effect of using an estimate of the missing regressor conditional on the other observable regressors whenever it is missing. We report the results of this estimation in table 5. As can be seen this gives the result that SOE size has no robust impact on growth.

We also recognize that the provinces in the sample have very different sizes. The largest is the combined province of Sichuan and city of Chongqing, with a population of 116 million in 1999. In contrast, Tibet's population was 2.6 million. We run the same set of regressions as above using weighted least squares. Here the assumption is that the variance of the error terms is proportional to the inverse of the square root of the population. This puts proportionally more weight in each regression on larger provinces.

Table 6 shows the results with missing observations omitted and table 7 shows them with missing observations proxied by dummy variables. These results are strikingly different from those reported using OLS. The SOE share in employment has a robustly positive effect on growth of both GDP and TFP, while the SOE share in industrial production is robustly negative. This would seem to indicate that the effects of SOE employment are different for provinces with large populations than they are for smaller provinces.

To test this, we split our sample into two halves, one with the fifteen largest provinces and one with the fifteen provinces. These are listed in table 8. We run the same regressions as above using OLS for set of provinces. The results of these regressions are reported in tables 9 & 10.

For the 15 biggest provinces, an increase in the SOE share in employment robustly increases both the growth rate of GDP and the growth of TFP. The average estimates are 0.52819 and 0.36069 for GDP, depending on how missing observations are handled. The average estimates for TFP are 0.59532 and 0.42371. Since the average annual change in SOE employment for these large provinces is a drop of .002978, this translates into a reduction in real per capita GDP growth rates of 0.1773% to 0.1262% per year. Put another way, the average difference between the share of SOE employment between 1999 and 1978 is a drop of 6.25 percentage points, which implies growth rates for these provinces average 3.72% to 2.65% lower in 1999 than they would have if SOE employment had remained constant.

For the smallest provinces the coefficients are not robustly significant on TFP growth, but they are for GDP growth, at least at the 90% level of confidence. Here the estimates are -0.28432 and -0.25794. Since SOE employment shares fell an average of .004422 in these provinces, the corresponding increase in annual GDP growth is 0.1257% to 0.1140% per year. The average difference between 1999 and 1978 is a drop 9.19 percentage points; implying growth rates were 2.61% to 2.37% higher than if SOE employment had remained unchanged.

Returning to table we note the coefficient of the SOE share in industrial production is -0.11433. The average change in this share in our sample is a drop of 2.23 percentage points per year. So, by comparison, the average impact of this measure on GDP growth is to raise it by 0.255% per year. The average difference in this measure between 1997 (the last year for which data on all provinces not missing) and 1978 is a drop of 40.9 percentage points, meaning that the average growth rate in 1997 was 4.68% higher than it would have been had the share remained at 1978 levels.

**5. Conclusions**

Our investigation of SOE size on growth rates in China yields some surprising results. The negative correlation between SOE size and growth that we found for when we use industrial production share is not unexpected. We also document a similar effect for small provinces if we use employment shares as our measure of SOE size. There are standard explanations for this phenomenon, including the notion that SOEs do not respond to market forces the same way that privately owned firms do, and hence retard growth. Our evidence is consistent with this story, though we have not directly tested any formal model.

For large provinces, however, our finding that drops in the SOE share of employment cause significant drops in growth is harder to explain. We have not examined interactive effects with unemployed or underemployed workers. Perhaps drops in SOE employment not only lower SOE share, but also idle workers and hence reduce total output. Perhaps there are other explanations. The fact that SOE employment shares have not fallen very much, while the SOE share in industrial production has fallen dramatically could be related to the explanation of this phenomenon.

We note that our results are robust to the inclusion of a wide variety of different variables that also potentially impact on growth. Hence the effects we uncover are those that cannot be explained by these other variables. In particular, our regressions include fixed effects for each province and time period. The difference between large and small provinces is therefore driven by variations of growth rates and SOE employment around provincial average levels and cannot be attributed solely to size differences.

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**Table 1**

Per Capita GDP by Province for 1998 (measured in 1995 RMB)

| | | |
|---|---|---|
| Shanghai | 上海 | 23,884 |
| Beijing | 北京 | 15,266 |
| Tianjin | 天津 | 13,163 |
| Zhejiang | 浙江 | 10,541 |
| Guangdong | 广东 | 10,518 |
| Fujian | 福建 | 9506 |
| Jiangsu | 江苏 | 9448 |
| Liaoning | 辽宁 | 8795 |
| Shandong | 山东 | 7637 |
| Heilongjiang | 黑龙江 | 7068 |
| Hebei | 河北 | 6102 |
| Xinjiang | 新疆 | 6044 |
| Hubei | 湖北 | 5906 |
| Jilin | 吉林 | 5549 |
| Hainan | 海南 | 5493 |
| Inner Mongolia | 内蒙古 | 4788 |
| Shanxi | 山西 | 4754 |
| Hunan | 湖南 | 4654 |
| Henan | 河南 | 4405 |
| Anhui | 安徽 | 4273 |
| Jiangxi | 江西 | 4162 |
| Qinghai | 青海 | 4121 |
| Sichuan | 四川 | 4081 |
| Yunnan | 云南 | 4078 |
| Ningxia | 宁夏 | 3990 |
| Guangxi | 广西 | 3834 |
| Shaanxi | 陕西 | 3619 |
| Tibet | 西藏 | 3409 |
| Gansu | 甘肃 | 3252 |
| Guizhou | 贵州 | 2168 |

**Table 2**

Data collected from Various Sources, 30 provinces, 1978 - 1999

| | | |
|---|---|---|
| GDP | Gross Domestic Product | 100 million current RMB |
| INV | Gross Investment | 100 million current RMB |
| POP | Population | 1000 people |
| EMP | Employment | 1000 people |
| SW | Staff & Workers | 1000 people |
| STSW | Staff & Workers at SOEs | 1000 people |
| GX | Total Government Expenditures | 100 million current RMB |
| LGX | Local Government Expenditures | 100 million current RMB |
| LGR | Local Government Revenue | 100 million current RMB |
| TIP | Value of Total Industrial Production | 100 million current RMB |
| SIP | Value of SOE Industrial Production | 100 million current RMB |
| NX | Net Exports | 100 million current RMB |
| PSE | Primary School Enrollment | 10,000 students |
| SSE | Secondary School Enrollment | 10,000 students |
| HEE | Higher Education Enrollment | 10,000 students |
| DOC | Number of Doctors | per 10,000 people |
| RPOP | Rural Population | 10,000 people |
| MPOP | Male Population | 10,000 people |
| RRD | Railroads | km |
| HWY | Highways | km |
| TEL | Telephones | number |
| BD | Bank Deposits | 100 million current RMB |

**Table 3**

Adjusted Data used in Regressions, 30 provinces, 1978 - 1999

| | | |
|---|---|---|
| GRGDPPC | Growth Rate of Real GDP per capita | % |
| GTFP | Growth Rate of Total Factor Productivity | % |
| RGDPPC | Real GDP per capita | RMB per person |
| RINVPC | Real Investment per capita | RMB per person |
| GPOP | Growth rate of the population | % |
| SOEEMP | % of Staff & Workers in SOEs | % |
| SOEIP | % of IP Value from SOEs | % |
| LGOVEXP | Local Gov't as % of Total Gov't expenditures | % |
| GEXPGDP | Gov't expenditures as % of GDP | % |
| GREVGDP | Gov't revenues as % of GDP | % |
| NEXGDP | Net Exports as % of GDP | % |
| PSEPC | Primary Enrollment per capita | % |
| SSEPC | Secondary Enrollment per capita | % |
| HEEPC | Higher Ed Enrollment per capita | % |
| DOCPC | Doctors per capita | % |
| RPOPPER | % of Population that is Rural | % |
| MPOPPER | % of Population that is Male | % |
| POPDEN | Population Density | people per sq km |
| RAILDEN | Railroad Density | km per sq km |
| HWYDEN | Highway Density | km per sq km |
| TELPC | Telephones per capita | telephones per person |
| BDGDP | Bank Deposits as % of GDP | % |

Table 4

Results of OLS regressions with missing observations omitted

| SOE measure | SOEEMP | SOEIP | SOEEMP | SOEIP |
|---|---|---|---|---|
| dependent variable | GRGDPPC | GRGDPPC | GTFP | GTFP |
| number of observations | 429 | 429 | 429 | 429 |
| average coefficient value | 0.148056 | -0.11433 | 0.239192 | -0.03381 |
| average standard error | 0.130131 | 0.043536 | 0.134765 | 0.046195 |
| % regressions significant | | | | |
| at 90% | 0.00% | 99.73% | 73.08% | 0.82% |
| at 95% | 0.00% | 89.01% | 22.80% | 0.00% |
| at 99% | 0.00% | 64.84% | 0.00% | 0.00% |
| uniformly-weighted t-stat | 1.13775 | -2.62611 | 1.774885 | -0.73190 |
| p-value | 0.25594 | 0.00899 | 0.07672 | 0.46470 |
| Likelihood-weighted t-stat | 1.13322 | -2.58793 | 1.78671 | -0.73909 |
| p-value | 0.25784 | 0.01003 | 0.07478 | 0.46031 |

Table 5

Results of OLS regressions with missing observations proxied

| SOE measure | SOEEMP | SOEIP | SOEEMP | SOEIP |
|---|---|---|---|---|
| dependent variable | GRGDPPC | GRGDPPC | GTFP | GTFP |
| number of observations | 626 | 626 | 626 | 626 |
| average coefficient value | 0.044208 | -0.01783 | 0.176311 | 0.03146 |
| average standard error | 0.114267 | 0.035706 | 0.125257 | 0.036277 |
| % regressions significant | | | | |
| at 90% | 0.00% | 0.00% | 12.64% | 6.87% |
| at 95% | 0.00% | 0.00% | 0.55% | 3.30% |
| at 99% | 0.00% | 0.00% | 0.00% | 0.00% |
| uniformly-weighted t-stat | 0.38688 | -0.49949 | 1.40759 | 0.86721 |
| p-value | 0.69899 | 0.61763 | 0.15980 | 0.38619 |
| Likelihood-weighted t-stat | 0.37857 | -0.41502 | 1.41441 | 0.92702 |
| p-value | 0.70515 | 0.67828 | 0.15779 | 0.35431 |

Table 6

Results of WLS regressions with missing observations omitted

| SOE measure | SOEEMP | SOEIP | SOEEMP | SOEIP |
|---|---|---|---|---|
| dependent variable | GRGDPPC | GRGDPPC | GTFP | GTFP |
| number of observations | 429 | 429 | 429 | 429 |
| average coefficient value | 0.21220 | -0.10247 | 0.30980 | -0.02727 |
| average standard error | 0.00884 | 0.00310 | 0.00924 | 0.00329 |
| % regressions significant | | | | |
| at 90% | 100.00% | 100.00% | 100.00% | 91.76% |
| at 95% | 100.00% | 100.00% | 100.00% | 91.21% |
| at 99% | 100.00% | 100.00% | 100.00% | 89.29% |
| uniformly-weighted t-stat | 24.01136 | -33.09102 | 33.53997 | -8.28494 |
| p-value | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| Likelihood-weighted t-stat | 23.94416 | -33.18475 | 33.59069 | -8.85646 |
| p-value | 0.00000 | 0.00000 | 0.00000 | 0.00000 |

Table 7

Results of WLS regressions with missing observations proxied

| SOE measure | SOEEMP | SOEIP | SOEEMP | SOEIP |
|---|---|---|---|---|
| dependent variable | GRGDPPC | GRGDPPC | GTFP | GTFP |
| number of observations | 626 | 626 | 626 | 626 |
| average coefficient value | 0.12127 | -0.04018 | 0.26702 | 0.01454 |
| average standard error | 0.00782 | 0.00255 | 0.00875 | 0.00267 |
| % regressions significant | | | | |
| at 90% | 100.00% | 100.00% | 100.00% | 78.30% |
| at 95% | 100.00% | 100.00% | 100.00% | 75.82% |
| at 99% | 100.00% | 100.00% | 100.00% | 67.86% |
| uniformly-weighted t-stat | 15.51042 | -15.76698 | 30.52234 | 5.45262 |
| p-value | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| Likelihood-weighted t-stat | 15.58820 | -15.30589 | 30.61322 | 5.41919 |
| p-value | 0.00000 | 0.00000 | 0.00000 | 0.00000 |

Table 8

Provinces Sorted by Size of Population

| Largest 15 | average | 1999 | Smallest 15 | average | 1999 |
|---|---|---|---|---|---|
| Sichuan/Chongqing | 106156.4 | 116337.0 | Shaanxi | 31899.5 | 36174.9 |
| Henan | 82436.4 | 93870.1 | Guizhou | 31691.9 | 37095.0 |
| Shandong | 80824.2 | 88754.5 | Fujian | 28918.3 | 33166.8 |
| Jiangsu | 65242.5 | 72030.7 | Shanxi | 27937.1 | 32034.4 |
| Guangdong | 60660.0 | 71618.1 | Jilin | 24070.8 | 26577.3 |
| Hunan | 58962.1 | 65285.8 | Gansu | 21808.3 | 25421.4 |
| Hebei | 58656.8 | 66137.8 | Inner Mongolia | 21019.7 | 23621.2 |
| Anhui | 54717.5 | 62365.5 | Xinjiang | 14729.1 | 17605.4 |
| Hubei | 52467.9 | 59382.5 | Shanghai | 12751.9 | 14527.8 |
| Zhejiang | 41249.8 | 44754.9 | Beijing | 10274.2 | 12419.8 |
| Guangxi | 40952.1 | 47122.8 | Tianjin | 8450.3 | 9590.6 |
| Liaoning | 38281.8 | 41707.9 | Hainan | 6397.5 | 7616.5 |
| Jiangxi | 36823.0 | 42304.4 | Ningxia | 4485.8 | 5435.5 |
| Yunnan | 36209.4 | 41918.5 | Qinghai | 4355.0 | 5101.8 |
| Heilongjiang | 34614.7 | 37939.6 | Tibet | 2146.0 | 2559.2 |

Table 9

Results of OLS regressions with missing observations omitted

| sample | Biggest 15 | Smallest 15 | Pooled | Biggest 15 | Smallest 15 | Pooled |
|---|---|---|---|---|---|---|
| dependent variable | GRGDPPC | GRGDPPC | GRGDPPC | GTFP | GTFP | GTFP |
| number of observations | 256 | 173 | 429 | 256 | 173 | 429 |
| average coefficient value | 0.52819 | -0.28432 | 0.148056 | 0.59532 | -0.08843 | 0.239192 |
| average standard error | 0.17254 | 0.21848 | 0.130131 | 0.16780 | 0.21430 | 0.134765 |
| % regressions significant | | | | | | |
| at 90% | 100.00% | 26.10% | 0.00% | 100.00% | 0.00% | 73.08% |
| at 95% | 100.00% | 5.77% | 0.00% | 100.00% | 0.00% | 22.80% |
| at 99% | 92.31% | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% |
| uniformly-weighted t-stat | 3.05478 | -1.31447 | 1.13775 | 3.54123 | -0.41469 | 1.774885 |
| p-value | 0.00127 | 0.09543 | 0.25594 | 0.00024 | 0.33950 | 0.07672 |
| Likelihood-weighted t-stat | 3.05588 | -1.37546 | 1.13322 | 3.53938 | -0.40920 | 1.78671 |
| p-value | 0.00126 | 0.08561 | 0.25784 | 0.00025 | 0.34151 | 0.07478 |

Table 10

Results of OLS regressions with missing observations proxied

| sample | Biggest 15 | Smallest 15 | Pooled | Biggest 15 | Smallest 15 | Pooled |
|---|---|---|---|---|---|---|
| dependent variable | GRGDPPC | GRGDPPC | GRGDPPC | GTFP | GTFP | GTFP |
| number of observations | 315 | 311 | 626 | 315 | 311 | 626 |
| average coefficient value | 0.36069 | -0.25794 | 0.044208 | 0.42371 | -0.05533 | 0.176311 |
| average standard error | 0.15276 | 0.17729 | 0.114267 | 0.16471 | 0.19182 | 0.125257 |
| % regressions significant | | | | | | |
| at 90% | 94.51% | 32.97% | 0.00% | 100.00% | 0.00% | 12.64% |
| at 95% | 84.07% | 8.52% | 0.00% | 96.43% | 0.00% | 0.55% |
| at 99% | 28.30% | 0.00% | 0.00% | 48.35% | 0.00% | 0.00% |
| uniformly-weighted t-stat | 2.36399 | -1.46327 | 0.38688 | 2.57258 | -0.29643 | 1.40759 |
| p-value | 0.00939 | 0.07229 | 0.69899 | 0.00531 | 0.38356 | 0.15980 |
| Likelihood-weighted t-stat | 2.38421 | -1.49053 | 0.37857 | 2.58232 | -0.29781 | 1.41441 |
| p-value | 0.00890 | 0.06863 | 0.70515 | 0.00517 | 0.38304 | 0.15779 |

**Figure 1**

Growth Rates of GDP, GDP per capita and TFP for China, 1978 – 1999


**Figure 2**

Time path of GDP, Labor, Capital and TFP for China, 1978 – 1999

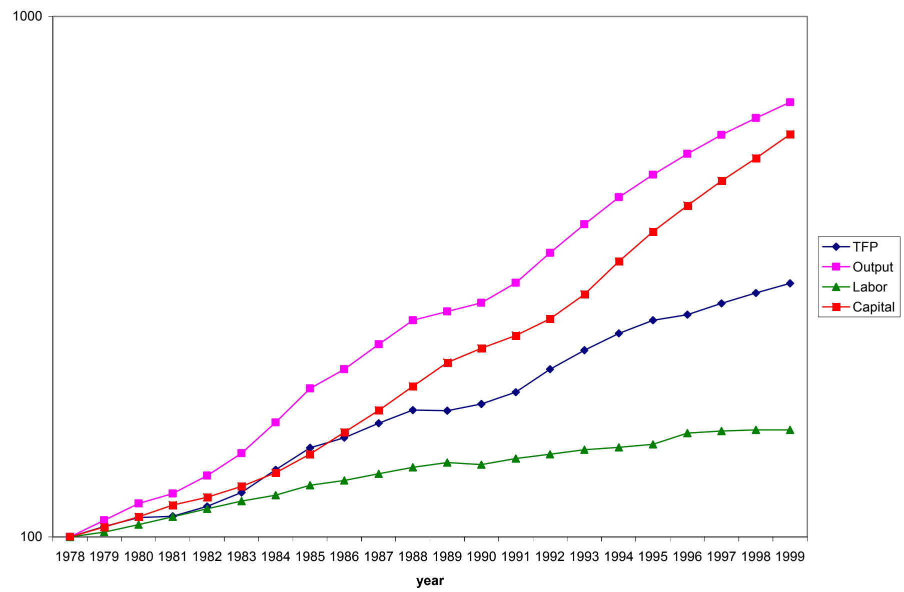

**Figure 3**

Inter-Provincial Gini Coefficients, 1978 - 1998

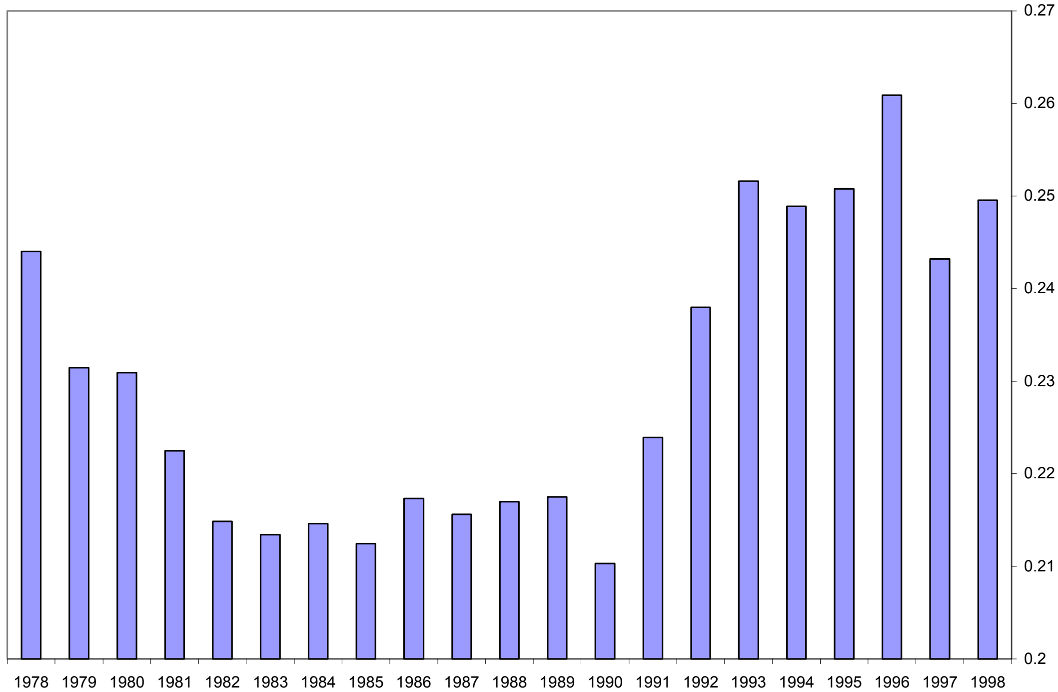


**Figure 4**

Inter-Provincial Lorenz Curve, 1998

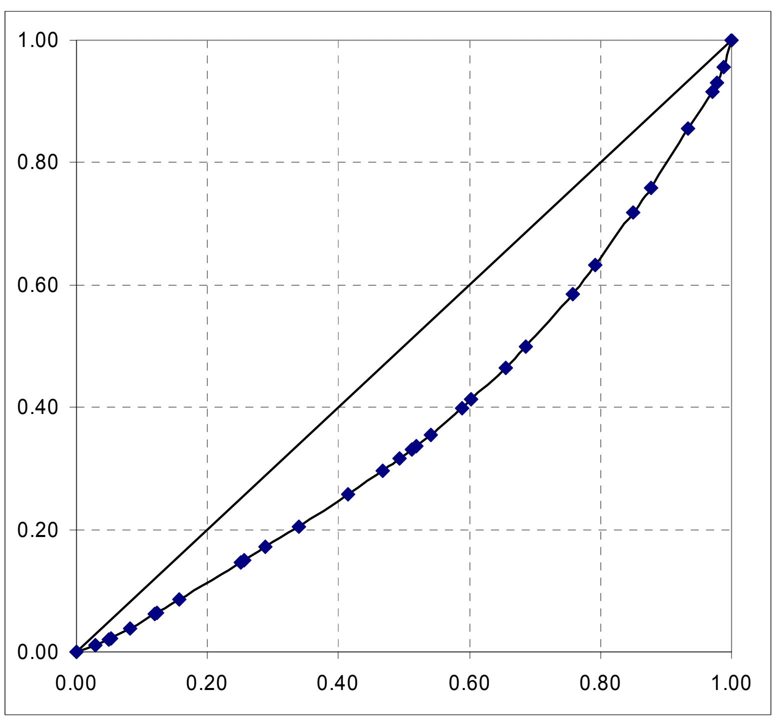

**Figure 5**

Regional Output, 1978 – 1998
(logarithmic scale)