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ADB Institute Discussion Paper No. 66

Who's in First? A Regional Development Index for the People's Republic of China's Provinces

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I. INTRODUCTION

During the past nearly three decades, the People's Republic of China (PRC) has experienced tremendous economic growth, at an average rate close to 10 percent. Real GDP expanded by 11 times from 1978 to 2005. The size of the PRC's economy surpassed both the UK and France in 2005, becoming the fourth largest economy in the world.

Although the PRC's general economic performance is strong, economic development among its regions has diverged. Growth has been faster in the more developed east coast provinces than in the less developed inland provinces, and has been particularly slow in the least developed western provinces during the past two decades. Regional disparities are large and growing. Per capita GDP (now renamed Gross Regional Product, or DRP, for provinces in Chinese statistics) in Shanghai, the most developed city at the provincial level, was 51,474 Yuan (about 6,434 US dollars) in 2005, whereas in the least developed province, Guizhou, it was only 5,052 Yuan, (or 631 dollars), less than 1/10 of that in Shanghai (NBS, 2006).

In earlier studies, Cai and Du (2000) found an economic divergence between the eastern, central and western regions but a convergence within these regions in the 1990s. Wang and Fan found that per capita GDP in the western provinces, as a percentage of that in the east coast provinces, decreased from 53% to 39% during the period of 1980-2002. They also found that the flow of capital and human capital from the central and western regions to the eastern region contributed to the regional divergence, but that the flow of labor in the same direction moderated this tendency (Wang and Fan, 2003, 2004).

Other studies found that regional disparities in the PRC were the result of a combination of geographic location, economic policy, and other factors such as infrastructural conditions (e.g., Demurger et al., 2002). One study also confirmed that market-oriented institutional change in the PRC had made a positive contribution to the PRC's total factor productivity growth at the provincial level (Chen and Fan, 2004), although TFP growth in the less developed central and western regions was lower than in the eastern region. In recent years, economic growth and total factor productivity growth were found to have accelerated in some central and western provinces, although there has been no clear evidence for regional convergence (Jefferson, Rawski and Zhang, 2007).

Partially as a result of regional disparities, income inequality in the PRC increased rapidly after the middle of the 1980s. The Gini coefficient of income increased from 0.26 in 1984 to 0.45 in 2001 (WIDER, 2000; World Bank, 2005). In addition to inequality among regions, the increasing rural-urban income gap and inequality among different resident groups were also responsible for the high Gini coefficient.

In the 1980s and 1990s, the central government focused mostly on economic development, and especially on growth. The economic growth rates in provinces, municipalities, and even counties and towns were used as important references for assessing the administration performance of local governments and major local officials. However, this did not change the diverging trend in regional development, but resulted in negative effects, i.e., the fabrication and exaggeration of local growth performance, ignoring social needs, heavier environment pollution, massive government investment at low efficiency, and unnecessary government intervention.

There have been changes during the past few years in the new century, as the central government has come to realize that high income inequality, poor public services in health care and education, heavy environment pollution, and the low efficiency of investment and energy consumption, etc., have become major constraints to economic development, as well as causes of social instability. The government is now making greater efforts to resolve these urgent problems.

However, incentive mechanisms have not been changed, and the central effort has received a limited response from local governments. While the central government has increased expenditures on education, health care and pollution control, some provincial and municipal governments still put most of their available resources into investment projects. Industrial pollution in some counties and towns is tacitly permitted by the local governments and their departments. Cultivated land is being rapidly reduced and converted into commercial sites, despite a major effort by the central government to protect land. The economic growth rate remains high, but it has been described as unsustainable growth or “extensive growth patterns” (meaning growth driven by massive inputs with pollution and high energy consumption and little productivity growth), not only by economists, but also by government leaders (see Premier Wen Jiabao, 2006).

In addition, institutional development towards a market oriented and law-based society has been slow. Corruption, low transparency and inefficiencies characterize the government sector, undermining economic development and social justice in the future.

All these problems need to be solved. However, the current incentive systems for government at various administrative levels still strongly encourage economic growth, not only because growth performance is valued by higher authorities, but also because of the existence of tax revenues and other benefits. While more complete institutional and legal frameworks are required, there is also a need for an assessment system for the achievements of administrative regions (e.g., provinces) from an overall economic and social development perspective. Unlike measures to promote economic growth, this assessment system should provide a correct incentive mechanism for a balanced pattern of regional development.

Some assessment systems for the PRC’s regional development have been in the literature, but they mainly focus on one particular aspect of development. The World Bank recently published a report assessing the competitiveness of 120 of the PRC’s cities based on survey data (World Bank, 2006). This study mainly emphasizes the investment climate, but also contains useful information on other issues, including government effectiveness and “social harmony.” Nevertheless, more issues should be covered in an overall assessment system on development.

The United Nations (2003) lists Millennium Development Goals (MDG) indicators for countries including the PRC. It lists a number of basic variables on human development, including poverty reduction, education, gender equity, health, and environment protection. However, the MDG do not assess economic development and institutional changes, and do not contain country information at the provincial level.

UNDP and CDRF jointly published *China Human Development Report* (2005). They constructed a Human Development Index at the provincial level, which provides some useful information on life expectation and education.

The National Economic Research Institute in Beijing regularly publishes a Marketization Index for China's Provinces, which gauges the achievements of provinces in marketization (Fan, Wang and Zhu, various years). This is also an important part of the context of development. However, assessing overall development is not the target of this study.

There is also a Regional Analysis & Planning System (CD-ROM) for the PRC's regional development (Heilig, G., 2004). It measures development in the PRC at the provincial level using a large number of statistical indicators, covering six areas: human development, natural resources, economic development, infrastructure, research and technology, and administrative efficiencies. It is a quite comprehensive study on the PRC's regional development, although a few important fields are not covered, e.g., social equity, public services, and institutional development. There are also some serious shortcomings.¹

In light of these existing studies, the author aims to establish a regional development index for the PRC's provinces that can function as an assessment system for overall achievement in regional development. It is expected that a balanced assessment will be able to provide correct incentives to local governments, in order to extricate them from the purely growth-oriented incentive mechanism. This index system is also expected to provide useful information for researchers, investors, and others interested in regional development in the PRC.

In Section II of this paper, the framework of the index system is established. In Section III, the methodologies used to construct the index are described. Section IV presents the overall index and field indices for the development of each province, with scores and ranks, using the most recent available statistical data. Section V is a short summary of some interesting points from the outcome of the study.

II. AN INDEX SYSTEM FOR REGIONAL DEVELOPMENT IN THE PRC

The Regional Development Index for China (RDIC) consists of 10 field indices (and one reference index) to measure regional development in different fields. They are:

- 1) Level of economic development;
- 2) Productivity and R&D;
- 3) Human development;
- 4) Education;
- 5) Social equity;
- 6) Public services;
- 7) Social security;

¹ The uses of some indicators in this system are questionable. For instance, some indices mix the level of development and growth rate together: a "non-agricultural population" variable is used to indicate "human development" instead of industrialization; "administrative efficiency" is measured with some irrelevant variables, e.g., "number of layoff workers," "number of members in the National Peoples Congress," and "geographic background of newly appointed provincial leaders." These problems seem to have resulted in unreliable assessments on regional development.

- 8) Infrastructure;
- 9) Environment protection;
- 10) Institutional development; and
- 11) Natural resources and geographic location (reference index)

Each of the ten field indices directly presents a certain field of development, and together they constitute the overall index. Each field index consists of a few sub-indices, which are based on one or more basic indicators. In total, 70 basic indicators are used. The eleventh field index presents the natural endowments of a province, which act as conditions for development, not as achievements of development. Therefore it is used as a reference but not a component of the overall index.

In the following, the structure of the index is specified. Indicators with “(MDG)” are those used by UN (2003) as the MDG indicators, though there may be slight differences in data definitions. Indicators in *italic* are currently unavailable at the provincial level.

1. Economic Development

1.1 GDP per capita (yuan/person)

1.2 Income per capita

1.21 Urban income per capita (yuan/person)

1.22 Rural income per capita (yuan/person)

1.3 Urbanization and industrialization

1.31 Urbanization ratio (% of urban residents in population)

1.32 Non-agricultural employment ratio (% of non-agricultural employment in total employment)

2. Productivity and R&D

2.1 Productivity

2.11 Productivity of capital (ratio of value-added to total assets in industry)

2.12 Capital contribution (ratio of the sum of profit, taxes and interests paid to total assets in industry)

2.13 Labor productivity (value-added /total employment)

2.2 R&D

2.21 Number of technological personnel as a proportion to population (%)

2.22 R&D expenditure of the government (% of GDP)

2.23 Patent applied (case/per 10000 technical personnel)

2.24 Transaction value in technical market (% of GDP)

3. Human Development

3.1 Population development

3.11 Life expectation: male & female

- 3.12 Natural population growth rate (non-negative lower rates are preferable)
- 3.13 Aging ratio of the population
- 3.14 Sex ratio of the population ($\left| \frac{\text{male}}{\text{female}} - 1 \right| \times 100\%$, lower ratio is preferred)
 - Under five mortality rate (MDG)*
 - Infant mortality rate (MDG)*
- 3.2 Demographic mobility (immigrants to cities/population)
- 3.3 Human safety
 - 3.31 Death rate by traffic accident (per 10,000 persons of population)
 - 3.32 Fire accident (per 10,000 persons of population)
- 4. Education
 - 4.1 Literate rate of the population ≥ 6 (MDG)
 - 4.2 Average year of schooling of the population ≥ 6
 - 4.3 Students in tertiary & vocational secondary education (% of population)
- 5. Social Equity
 - 5.1 Income disparity
 - 5.11 Urban Gini coefficients (MDG)
 - 5.12 Rural Gini coefficients (MDG)
 - 5.13 Urban-rural income gap (MDG)
 - Population below national poverty line (%)*
 - 5.2 Employment opportunity
 - 5.21 Unemployment rate (MDG)
 - Layoff worker rate*
 - 5.3 Sex equality
 - 5.31 School girl to boy ratio – primary
 - 5.32 School girl to boy ratio – junior high
 - 5.33 School girl to boy ratio – senior high
 - 5.34 School girl to boy ratio – university
- 6. Public Services
 - 6.1 School completion
 - 6.11 Primary school completion ratio (graduation/6 year lag enrolment, 2-year moving average) (MDG)
 - 6.12 Junior high enrolment ratio
 - 6.13 Junior high school completion ratio (graduation/3 year lag enrolment, 2-year moving average)
 - 6.14 Children in-school ratio (7-16 years old)

- 6.2 Resources for education
 - 6.21 Fiscal expenses in education (% of GDP)
 - 6.22 Teachers as a ratio of population
- 6.3 Resources for public health
 - 6.31 Fiscal expenses in public health
 - 6.32 Medical doctors as a ratio of population
- 7. Social Security
 - 7.1 Coverage of urban basic pension insurance
 - 7.2 Coverage of urban employment insurance
 - 7.3 Coverage of urban basic medical insurance
 - Coverage of rural cooperative medical system*
 - Coverage of rural retirement insurance*
- 8. Infrastructure
 - 8.1 Highway
 - 8.11 Standard highway density (km/kkm²)
 - 8.12 Standard highway-population ratio (km/10k population)
 - 8.2 Railway
 - 8.21 Standard railway density (km/kkm²)
 - 8.22 Standard railway population ratio (km/10k population)
 - 8.3 Port
 - 8.31 Port density (quay length/area, m/100km²)
 - 8.32 Port population ratio (quay length/population, m/10k population)
 - 8.4 Local transport (% of villages connected by highways)
 - 8.5 Telecommunication
 - 8.51 Mobile phone coverage (subscriber/population, %) (MDG)
 - 8.52 Telephone coverage (subscriber/population, %) (MDG)
 - 8.6 Computer hold (personal computers/population, %) (MDG)
 - Airports (/population, /land area)*
 - Urban public vehicle (/urban population)*
 - Urban road (length/per capita)*
 - Tap water users (% of urban population) (MDG)*
 - Percentage villages have electricity supply*
- 9. Environment Protection
 - 9.1 Ecological environment
 - 9.11 Area covered by forests (%) (MDG)

- 9.12 Area protected for biologic diversification (%) (MDG)
- 9.2 Energy consumption ratio (to GDP, tons of standard coal/10,000 yuan) (MDG)
- 9.3 Air pollution
 - 9.31 Industrial waste gas emission per capita (standard m³/person of population) (MDG)
 - 9.32 Urban air quality (% of days meeting air quality grade II in provincial capital)
- 9.4 Treatment of waste water and solid waste
 - 9.41 Industrial waste water treated (%)
 - 9.42 Industrial solid waste treated (%)
 - 9.43 Living solid waste treated (%)
- 10. Institutional Development
 - 10.1 Marketization (marketization index)
 - 10.2 Legal environment
 - 10.3 Government
 - 10.31 Government intervention on enterprise (Entrepreneurs' time proportion dealing with government)
 - 10.32 Farmers' financial burden (% of income)
 - 10.33 Enterprises' non-tax burden (% of total sales)
 - 10.34 Government efficiency (ratio of government/party employment to population)
- 11. Natural Resources and Geographic Location (reference)
 - 11.1 Water resources (surface and ground water resource per capita, 100 m²/person)
 - 11.2 Agricultural land (cultivated land per capita, hectare/person)
 - 11.3 Forest (forest per capita, hectare/person)
 - 11.4 Mineral energy resource reserves (oil, coal, natural gas) per capita (ton/person)
 - 11.5 Geographic location (railway distance from provincial capital city to a main coastal port (km))

Grass land per capita

Overall, the index system consists of one overall index, ten field indices and two reference indices, constituted from 70 basic indicators.

The author should also point out that the current structure of the index is not complete, due to data shortages in some fields, although a large number of statistic indicators have been included. For example, some productivity variables are available only for the industrial sector. When considering human safety, crime statistics are important, but detailed data for provinces are not available. For natural resources, the current field index only includes water, land forest, and mineral energy resources. Other mineral resources are also important, but data are incomplete. Therefore the index system will require further improvement in the future.

III. METHODOLOGY AND DATA

Calculating the index

This index system measures levels of development in different dimensions. It focuses on the relative position of each province. To derive aggregated field indices and the overall index, data need to be normalized, so all the basic indicators are transformed into a 0-10 score system before aggregation. The scores 0 and 10 indicate the positions of the relevant provinces at the lowest and highest levels of development in certain fields among the 31 provinces (including five ethnic autonomous regions and four municipalities administratively at the provincial level; same below). For positive indicators (greater numbers reflect higher level of development), the scores are calculated using the following equation:

$$i^{th} \text{ province} = \frac{V_i - V_{\min}}{V_{\max} - V_{\min}} \times 10$$

For negative indicators (smaller numbers reflect a higher level of development), the following equation is used:

$$i^{th} \text{ province} = \frac{V_{\max} - V_i}{V_{\max} - V_{\min}} \times 10$$

The transformed indicator forms a sub-index or a second grade sub-index. Aggregation of a few sub-indices forms a field index. The total of 10 field indices form the overall index.

Weights of field indices and sub-indices

An important issue is how to determine the weight of each field index in order to construct the overall index, or weights of each sub-index for a field index. There are alternative ways to determine the weights:

1. Weighting based on the judgment of analysts or experts;
2. A Principle Component Analysis Method may be used for weight determination; or,
3. Simple average.

Method 1 is not adopted in this study because it is more or less arbitrary. Previous experiences show that, when the number of indicators included is relatively large, methods 2 and 3 usually lead to very similar results. An additional consideration is that when the indices are updated, the Principle Component Analysis Method leads to changes of the weights. This has the side effect that indices become incomparable over years. However, maintaining comparability is very important when an index is regularly updated. Meanwhile, the simple average method can give consistent measures from

year to year, so that changes in the level of development in each province can be correctly traced. For this reason, a simple average method is adopted. This means that all field indices are equally weighted in constructing the overall index; and all sub-indices in one field are equally weighted to form a field index.

In general, the indices show the relative position of development of each province, in particular relate to the provinces with the best or least performance overall and in different fields. This is measured with scores and ranks.

The relative performance of each province is also indicated by its rank among all 31 provinces. Finally, their performance in different fields can be traced by the basic indicators, which provide the original information on the absolute achievements of each province without comparison.

The index can be updated regularly when new information is available. Thus changes in the development of the provinces over years can be traced.

Data for RDIC are mainly cited or calculated from the latest available statistics, mostly from the National Bureau of Statistics of China (NBS, various years, 2005b). A few indicators are provided by related government departments or from sample surveys (Fan, Wang and Zhu, various years). Statistical data are mainly for 2005; where they are unavailable, earlier data are used.

IV. RESULTS

Table 1 shows the overall results of the Regional Development Index. It indicates that the three large cities, Shanghai, Beijing, and Tianjin, ranked at the top among the 31 provinces. This is partly due to the fact that they have only limited rural areas, whereas all other provinces have broad rural areas that are normally less developed. Amongst these three cities, Shanghai is more advanced than Beijing and Tianjin.

Table 1. Overall Regional Development: Ranks and Scores (2005)

Rank	Province	Score	Rank	Province	Score
1	Shanghai	6.64	17	Hainan	4.11
2	Beijing	6.27	18	Hunan	4.10
3	Tianjin	5.96	19	Hubei	4.09
4	Guangdong	5.23	20	Xinjiang	4.05
5	Zhejiang	5.16	21	Chongqing	3.98
6	Jiangsu	5.04	22	Jiangxi	3.93
7	Liaoning	4.76	23	Anhui	3.90
8	Shandong	4.71	24	Sichuan	3.79
9	Fujian	4.66	25	Guangxi	3.77
10	Hebei	4.46	26	Yunnan	3.66
11	Jilin	4.42	27	Ningxia	3.28
12	Heilongjiang	4.42	28	Gansu	3.23
13	Inner Mongolia	4.32	29	Qinghai	3.20
14	Shaanxi	4.20	30	Guizhou	2.97
15	Henan	4.18	31	Tibet	2.79
16	Shanxi	4.16			

Fourth place belongs to Guangdong province, which experienced more rapid economic development than other provinces during the 1980s and 1990s, being a pioneer province in the early stage of economic reform. It also benefited from its geographic proximity to Hong Kong. Zhejiang and Jiangsu, two southeast coast provinces in the Yangzi River delta region, both with good economic performance, ranked at fifth and sixth places. Liaoning, Shandong, Fujian and Hebei (seventh to tenth place) are also coast provinces of the PRC.

At the low level of development are Tibet, Guizhou, Qinghai, Gansu and Ningxia (31st - 27th), etc. They are either southwestern or northwestern provinces. In the middle, there are a number of northeast, central and western provinces.

Figure A1 (see Appendix) more clearly illustrates the relative position of provinces in overall development. In general, there is a clear link between the level of development and geographic location. Ten of the 11 east coast provinces (except Hainan) ranked in the top ten places. Ten of the 12 western province plus two central provinces ranked in the lowest twelve places.

The ten field indices and one reference index are illustrated in Figures A2 – A12 in the Appendix. For Economic Development (Field 1), the ranks are close to those of the overall index (Figure A2). The two series of scores have a high correlation coefficient, equal to 0.917 (see Table 2 for the correlation coefficient matrix), although all ten field indices are equally weighted for overall development. This indicates that economic development grasps a large part of the common features of other development indicators. Nevertheless, we can also see that economic development does not cover everything.

Table 2. Correlation Coefficients of the Overall Index and Field Indices

	OVR	EDV	PRD	HD	EDU	SE	PBS	SS	IFR	EVP	IDV	NRG
OVR	1.000											
EDV	0.917	1.000										
PRD	0.733	0.613	1.000									
HD	0.671	0.507	0.407	1.000								
EDU	0.852	0.670	0.552	0.638	1.000							
SE	0.667	0.538	0.361	0.510	0.798	1.000						
PBS	0.424	0.496	0.356	-0.078	0.465	0.439	1.000					
SS	0.674	0.446	0.540	0.542	0.659	0.388	-0.056	1.000				
IFR	0.868	0.912	0.592	0.395	0.706	0.531	0.594	0.485	1.000			
EVP	0.322	0.287	0.213	0.350	0.086	0.041	-0.267	0.035	0.073	1.000		
IDV	0.787	0.706	0.506	0.741	0.575	0.368	-0.031	0.631	0.602	0.494	1.000	
NRG	-0.198	-0.162	-0.149	-0.334	-0.218	-0.216	0.145	-0.200	-0.149	-0.364	-0.483	1.000

Notes:

OVR=overall development
 PRD=Productivity and R&D
 EDU=Education
 PBS=Public Services
 IFR=Infrastructure
 IDV=Institutional Development

EDV=Economic Development
 HD=Human Development
 SE=Social Equity
 SS=Social Security
 EVP=Environment Protection
 NRG=Natural Resources and Geographic Location

Again, in economic development, Shanghai, Beijing Tianjin, Zhejiang, Jiangsu and Guangdong held the top six places, although their ranks are slightly different from the overall index. It is somewhat surprising that Guangdong has been surpassed by both Zhejiang and Jiangsu, considering that previously it was the leading province in economic development outside of the three large cities. In terms of GDP per capita, urbanization and industrialization, Zhejiang and Jiangsu now have higher indicators than Guangdong. Their rural income per capita is also higher than the latter.

Five western provinces—Yunnan, Guizhou, Gansu, Ningxia and Sichuan—ranked low in economic development. Guizhou had the lowest levels of GDP per capita and income per capita, and Yunnan had the lowest level of development in terms of urbanization and industrialization. Tibet ranked much higher than them, in 18th place. This is mainly due to its relatively high urban income and urbanization rate, perhaps partially as a result of subsidies from the central government and financial aid from other provinces. Nevertheless, it is notable for its low rural income and level of industrialization.

For Productivity and R&D (Figure A3), Tianjin, the third largest city in the eastern PRC, had the highest score, possibly thanks to the foreign-funded enterprises that have located there in recent years. Surprisingly, Yunnan, a less developed southwest province, is ranked second, holding a place among economically far more developed cities and provinces. This is largely due to its profitable tobacco industry. Xinjiang, an autonomous region in the far west, and Heilongjiang, a northeastern province, also ranked relatively high (sixth and eighth places, respectively). These two provinces have a very high proportion of crude oil production in their industrial value-added, and their capital productivity and capital contribution figures are much higher than many other provinces because of the high oil prices. This does not reflect their real productivity, however. Thus the figures for the two provinces have been replaced with the provincial averages.

For Human Development (Figure A4), Fujian, another coastal province, ranked first, above Beijing and Shanghai. Its scores in all the three sub-indices are not the highest, but are all above average. By contrast, Beijing received the highest score for population mobility, but the lowest for human safety, due to its high rate of fires. Hubei and Sichuan, two less developed central and western provinces, ranked fourth and sixth places, above Guangdong and a number of other more developed provinces. This is mainly because of their low natural population growth rates and more balanced sex ratios, along with lower traffic and fire accident ratios.

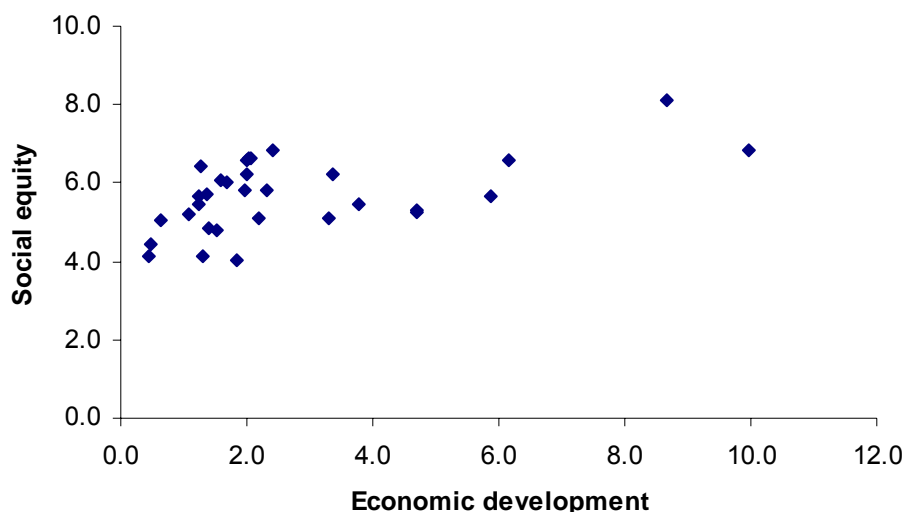
For Education (Figure A5), Liaoning, Jilin (both northeastern provinces), Shaanxi and Shanxi (central and western) have relatively high ranks (fourth to seventh), following Beijing, Tianjin and Shanghai. This was mainly driven by their relatively high literacy rates and years of schooling. Economically more developed Guangdong, Fujian and Shandong ranked relatively low, due to either lower years of schooling or lower rates of tertiary and vocational secondary school students in the population.

For Social Equity (Figure A6), Beijing, Shanghai, Jilin, Chongqing and Hebei hold the top five ranks. Beijing's score for income disparity is only average in level, but it has a low unemployment rate and relatively high sex equality ratio. Shanghai has low income disparities and a high sex equality ratio, but its unemployment rate is relatively high. Jilin,

Chongqing and Hebei all benefited from their low income disparities and high sex equality, although their unemployment rates were below average.

Does social equity relate to the level of economic development? Figure 1 indicates that there is a positive relationship between the two, although not necessarily, as Kuznets suggested, in an inverted U shape curve (between income and income inequality).

Figure 1. Is There a Correlation between Social Equity & Economic Development?



For Public Services (Figure A7), Beijing, Xinjiang, Tianjin, Shanxi and Shaanxi ranked high. They all have relatively high school completion ratios for primary and junior secondary students. Their public expenditures on education and public health, as ratios to GDP, were also relatively high. Ningxia and Tibet also hold good positions (seventh and eighth). Tibet's school completion ratio is still low, but it has a high proportion of government spending on education and public health. Guangxi, Sichuan, Chongqing (all in the southwest) and Anhui ranked low, because of their low government spending on public services.

For Social Security (Figure A8), Shanghai, Tianjin, Jiangsu, Guangdong and Liaoning are the top five. Beijing, although being the capital city, ranked very low (30th), only above Tibet. Its coverage rates of basic pension insurance and unemployment insurance are very low, and its basic medical insurance is below average.

For Infrastructure (Figure A9), not surprisingly, the three large cities of Shanghai, Beijing and Tianjin have the highest ranks. Following them are Guangdong, Liaoning, Jiangsu and Shandong, all east coast provinces. There is a high correlation between infrastructure and economic development (corr=0.912, see Table 2). Quizhou and Tibet have the lowest scores, due not only to their low achievements in economic development (thus lower demand for infrastructure and lower financial capability), but also their unfavorable geographic situations, which make highway and railway construction difficult. Heilongjiang ranked also low, partially because of its low rate for villages connected with highways.

Environment Protection (Figure A10) has no significant correlation with economic development ($\text{corr}=0.287$). The top six are Fujian, Hainan, Jiangxi, Zhejiang, Guangdong and Tibet. Beijing and Shanghai ranked in the middle tier, at 12th and 20th. High-ranked provinces are of two different types: some more economically developed provinces with a high proportion of treatment of waste water and solid wastes, and some less developed provinces with a good environment and little pollution. However, low ranking provinces are mostly in the western region, and have low levels of economic development. The bottom six are Ningxia, Shanxi, Inner Mongolia, Xinjiang, Gansu and Guizhou. Their rankings are heavily affected by the low forest coverage rate. Inefficient consumption of energy and little treatment of wastewater and solid wastes also contributed to some of their low rankings.

For Institutional Development (Figure A11), the top six provinces are Shanghai, Zhejiang, Guangdong, Fujian, Jiangsu and Beijing. They are economically developed. Quzhou, Shanxi and a few northwestern provinces with a low level of economic development ranked low. These provinces have low scores for both marketization and legal environment. Some also have low efficiency of government, high intervention by the government in enterprises, or a high financial burden on farmers and enterprises. This implies that there is a correlation between economic development and institutional development. However, further research is needed on the causalities between these two variables: is the low achievement in economic development the reason for the low achievement of institutional development, or is it rather the result of the latter?

For Natural Resources and Geographic Allocation (Figure A12), the ranks are significantly different from most of the other field indices. The correlation coefficients of its scores with most of other field indices are insignificant and have negative signs (see Table 2). This indicates that natural endowment is not a major determinant for development, although it can be an important contributor. In addition, it does not indicate the level of development. This is why it is considered only as a reference index and excluded from the overall index in this study. Some central and west provinces, i.e., Inner Mongolia, Tibet, Shanxi, and Heilongjiang ranked at the top, but for different reasons. Inner Mongolia benefited from its high per capita area of cultivated land and energy resources. Tibet benefited from its large per capita water and forest resources, although it has a disadvantage in terms of distance to the coast. Shanxi is rich in coal reserves, and Heilongjiang's cultivated land area per capita is high.

Some structural characters of the regions are also excluded from this index system, although they may be important for development. For instance, foreign trade has played an important role in the development of many provinces, and the ownership structure and industrial structure may be also important characteristics for certain provinces. However, these structural characters themselves do not indicate the level of development, and neither are they targets of development. In Tables A1-A3 in the Appendix, some structural indicators for all the provinces are listed as references.

V. SUMMARY, FINDINGS AND IMPLICATIONS

In this paper, I constructed a regional development index for the People's Republic of China (PRC). The index aims to assess overall economic and social development of the PRC's provinces. It assesses achievements related to development in the provinces using ten field indices: economic development, productivity and R&D, human

development, education, social equity, public services, social security, infrastructure, environment protection, and institutional development. These ten field indices constitute an overall regional development index. Natural resources and geographic location, and structural characters are also referenced.

The result demonstrates an interesting link between overall development and geographic location of the 31 provinces. Most of the east coast provinces ranked high, and most western provinces ranked relatively low. Six of the eight central and inland northeastern provinces, plus two western and one eastern provinces, ranked in between. This result shows a clear regional disparity in development.

The index also provides some evidence of possible changes. The two inland northeast provinces and two western provinces (Jilin, Heilongjiang, Inner Mongolia and Shaanxi), have relatively high positions (11th – 14th), which may imply some effectiveness of the central policies for western development and for revitalizing the northeast PRC that were launched in the late 1990s and recent years.

In terms of economic development, the provinces ranked quite similarly with their ranks on the overall index. Compared with the other field indices, economic development has a highest correlation coefficient with the overall index, although all ten field indices are equally weighted in the overall index. This implies that economic development catches most of the common features of the other field indices. This is also reflected in the relatively high correlation coefficients between the economic development index and most other indices. The correlation coefficients are especially high between economic development and infrastructure.

In spite of this, economic development is not the sole determinant for development in various other fields. This is shown by the ranks in a number of field indices, i.e., human development, education, social equity, public services, social security, environment protection, and to some extent, institutional development. In these fields, some economically less developed provinces performed well, and this may provide better conditions for their economic development in the future.

For example, although Shaanxi ranked low (23rd) in economic development among the 31 provinces, its overall rank was much higher (14th). This is because it achieved relatively good scores in education (6th) and public services (5th). These achievements place it in a good position in human capital formation, and therefore may contribute to its long-run economic development. Therefore, its overall rank is a more reliable indicator of its general position than its ranks in economic development or simple growth statistics.

As another example, Beijing ranked high in both the overall index (second) and a few field indices including economic development; however, its ranking in social security systems was very low (30th), due to the low coverage rates of these systems. This is a warning to the Beijing municipal government to make further efforts to develop its social security systems; otherwise the city may lose its competitiveness in recruiting workers or suffer from social instability in the long-term.

As a third example, the index system shows that Heilongjiang ranked at the middle tier in most fields, but its infrastructure is underdeveloped, ranking 29th among the 31 provinces. This information can certainly help the provincial government to discover the province's bottleneck and to solve the problem.

In general, this index system provides clear information on the relative position of each province in different fields of development. Therefore, it can be a useful tool for provincial governments in identifying their urgent problems and determining their policy emphasis, and to formulate a balanced development strategy. It can also be a useful tool for the central government in assessing provincial development performance in general and in different fields, especially when a time series data set of the index system is established.

In addition, the system also gives economic researchers a convenient instrument for analyzing patterns of regional development in the PRC, and to find how different fields of development are related. Investors and other business people may also benefit from it, if they need to find an investment destination or trade partner region in the PRC based on their regional comparative advantages.

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APPENDICES

Figure A1. Regional Development: Overall Index

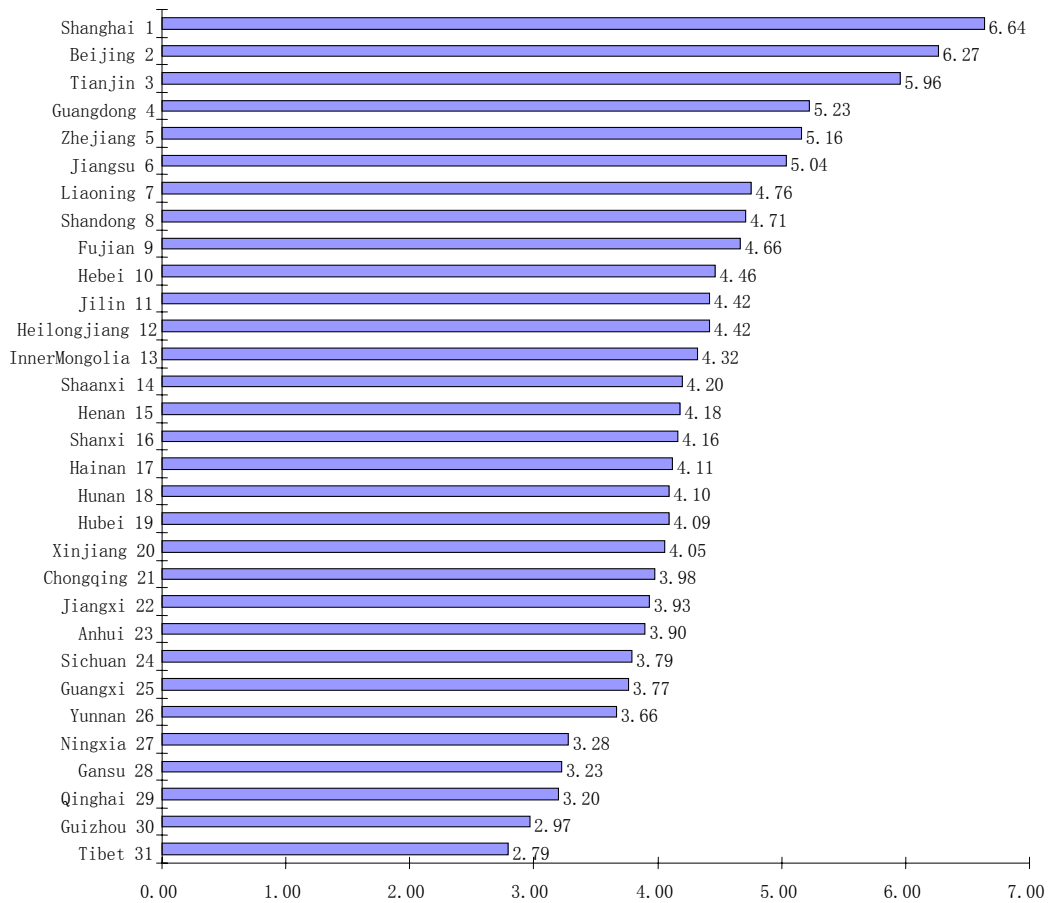


Figure A2. Economic Development

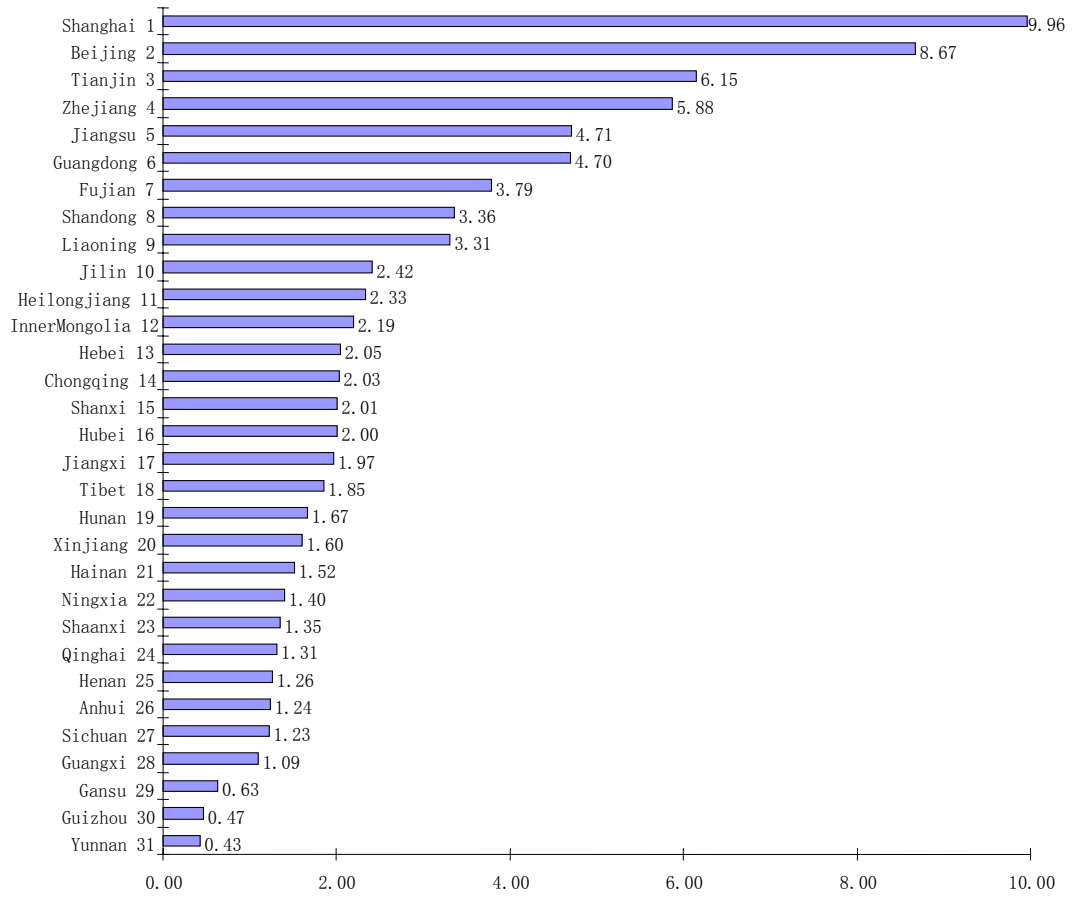


Figure A3. Productivity and R&D

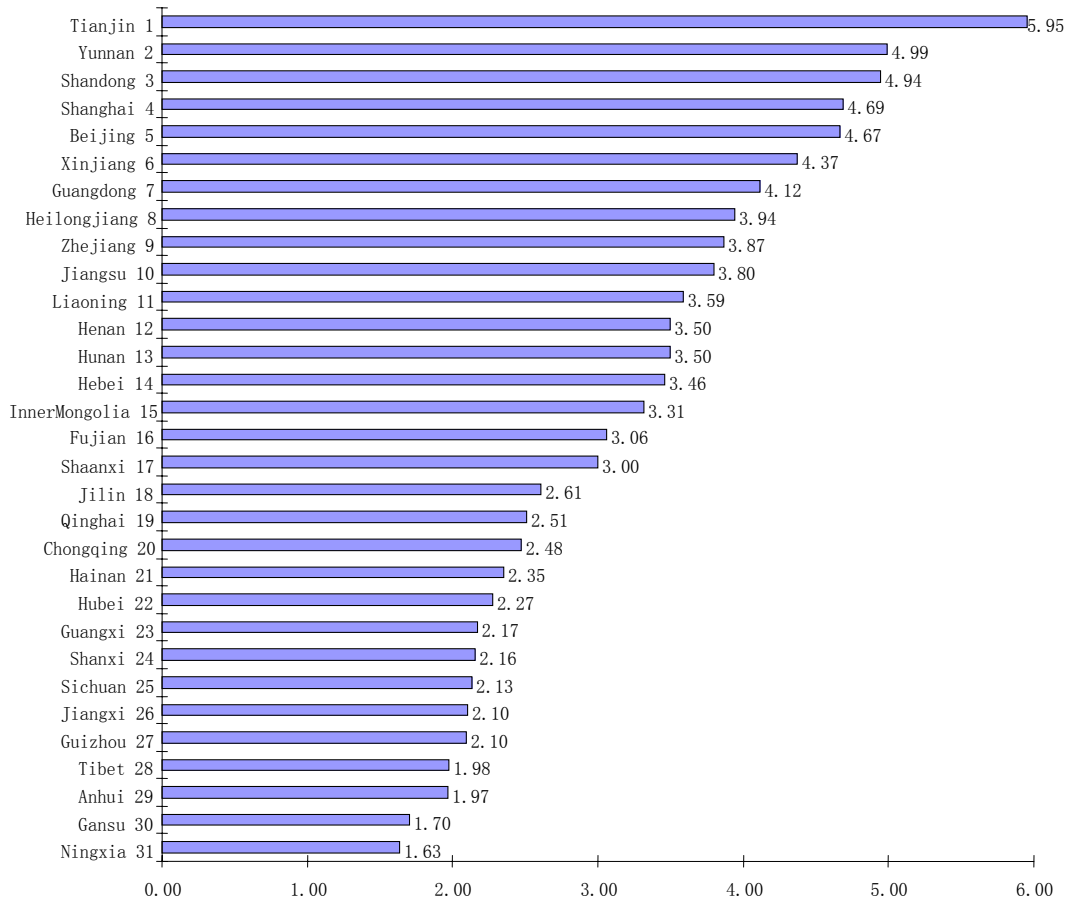


Figure A4. Human Development

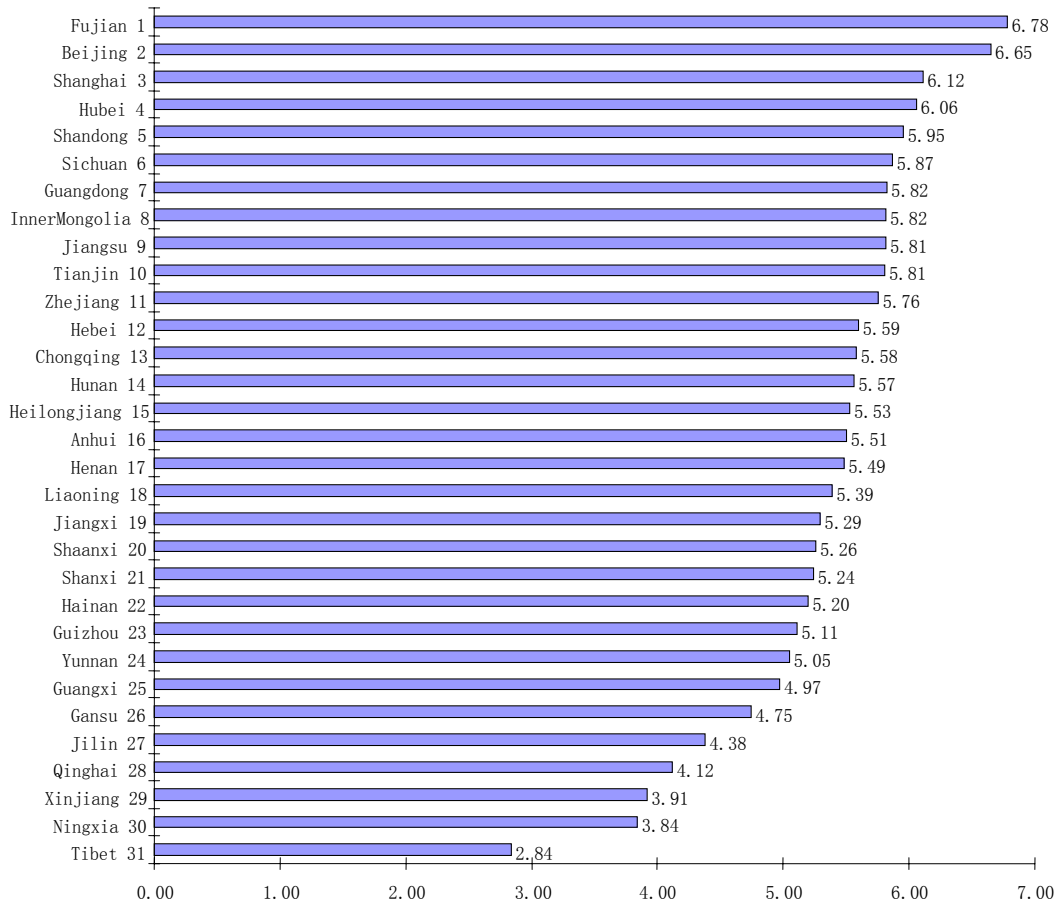


Figure A5. Education

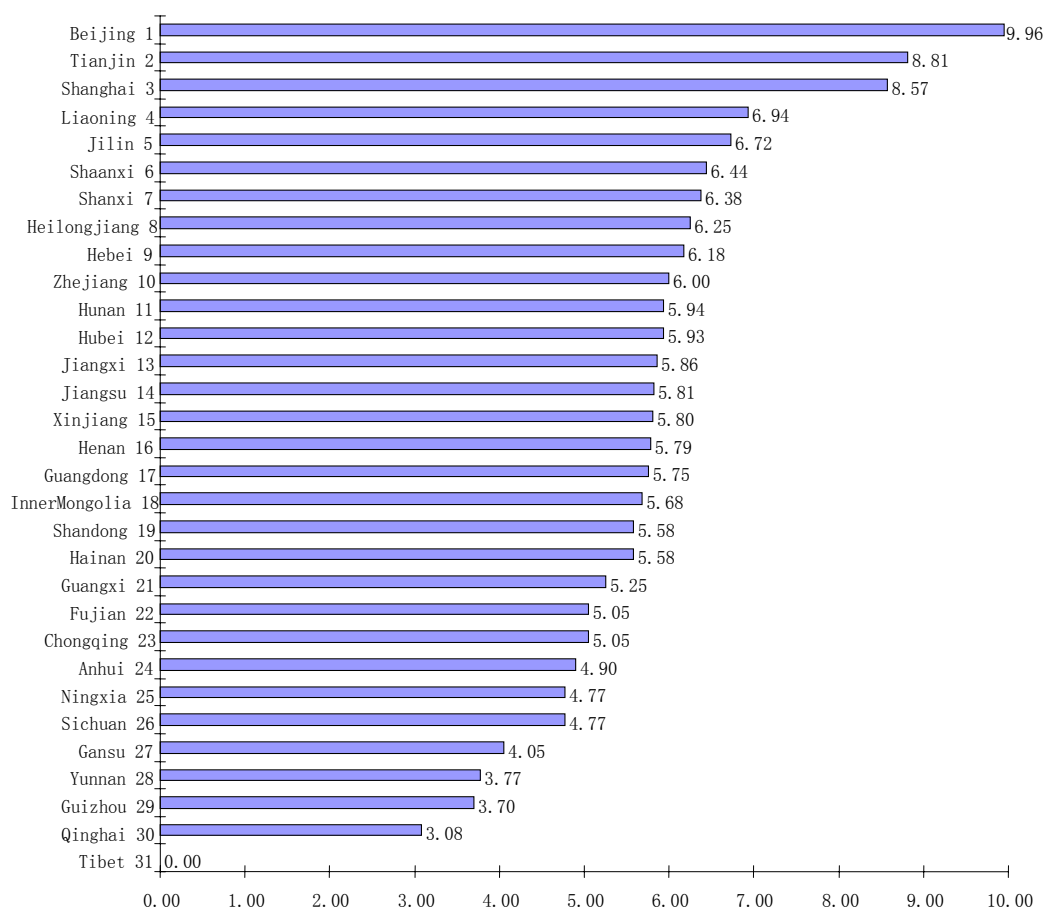


Figure A6. Social Equity

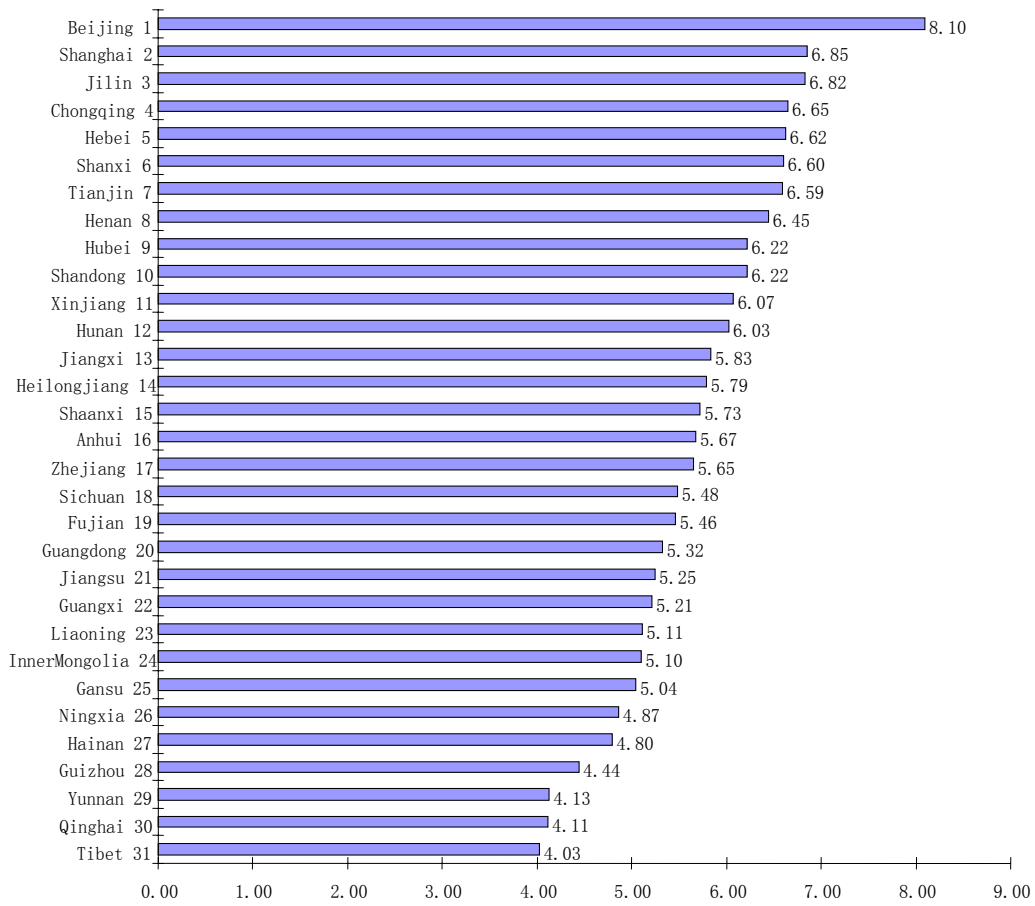


Figure A7. Public Services

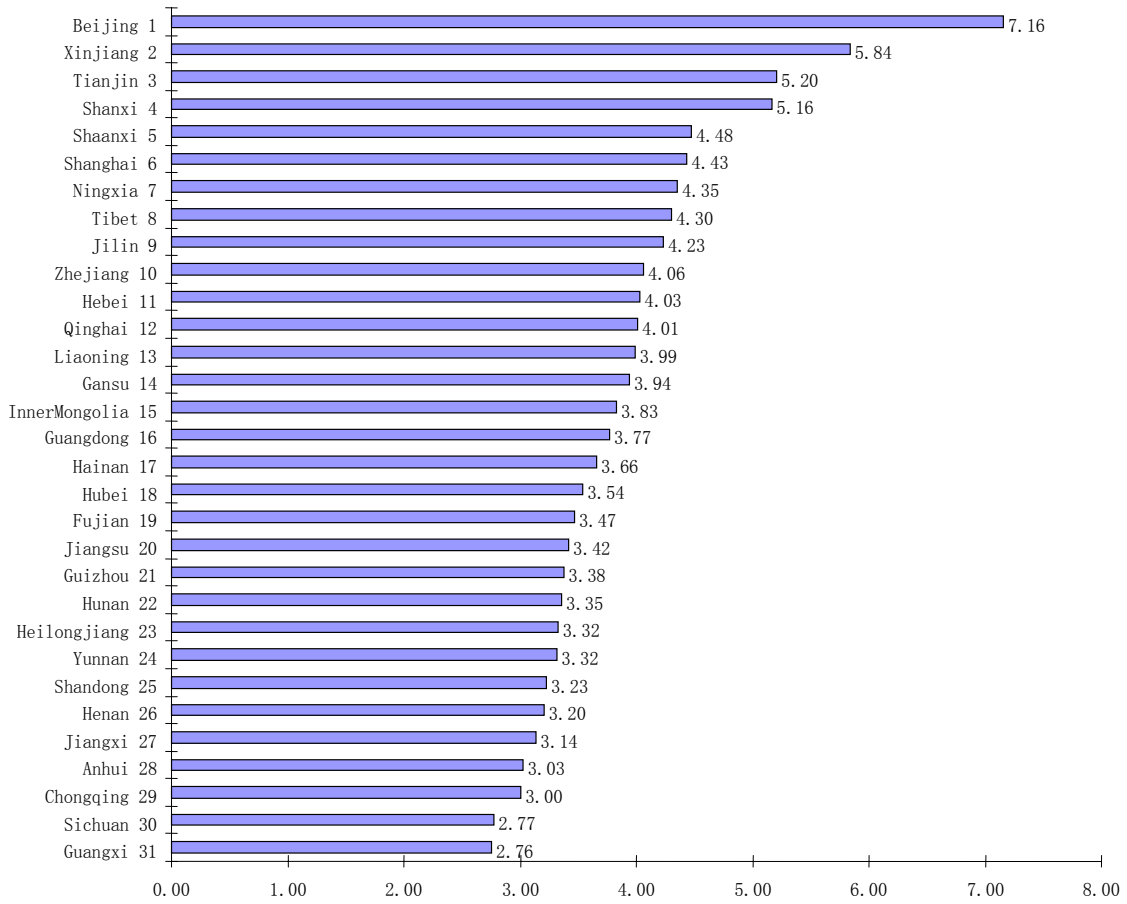


Figure A8. Social Security

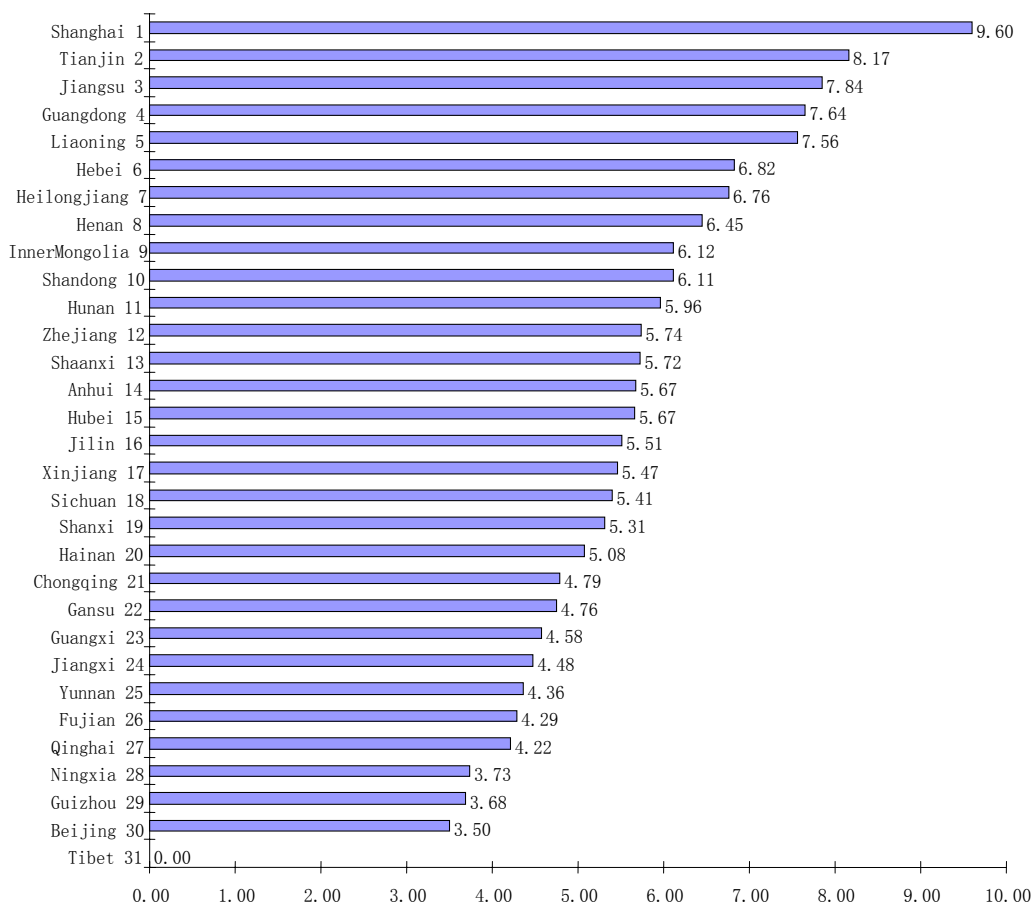


Figure A9. Infrastructure

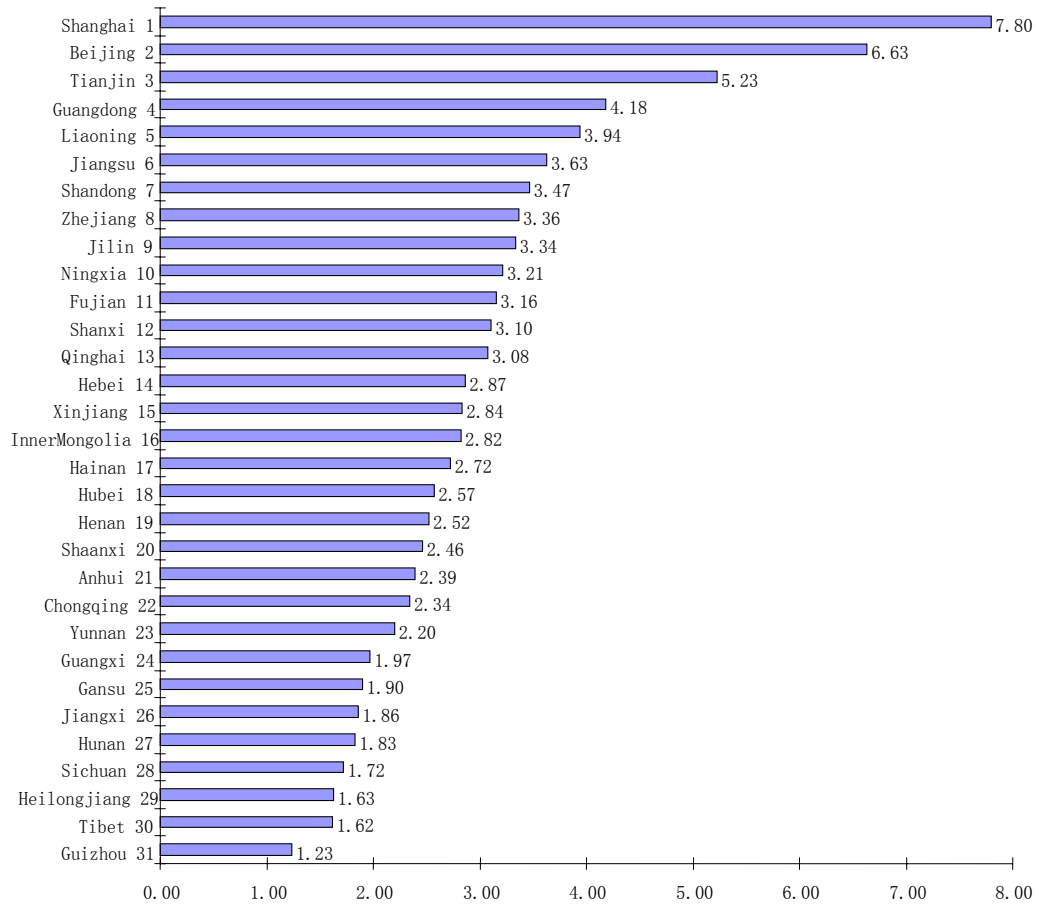


Figure A10. Environment Protection

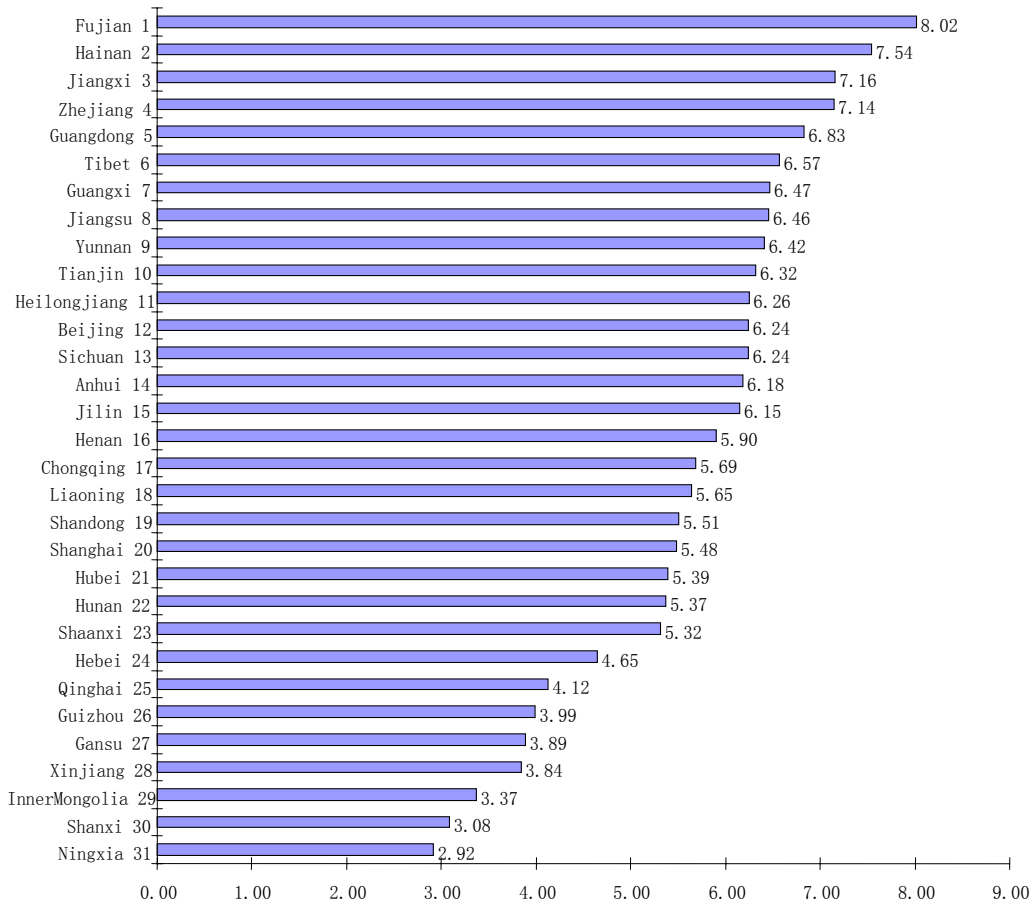


Figure A11. Institutional Development

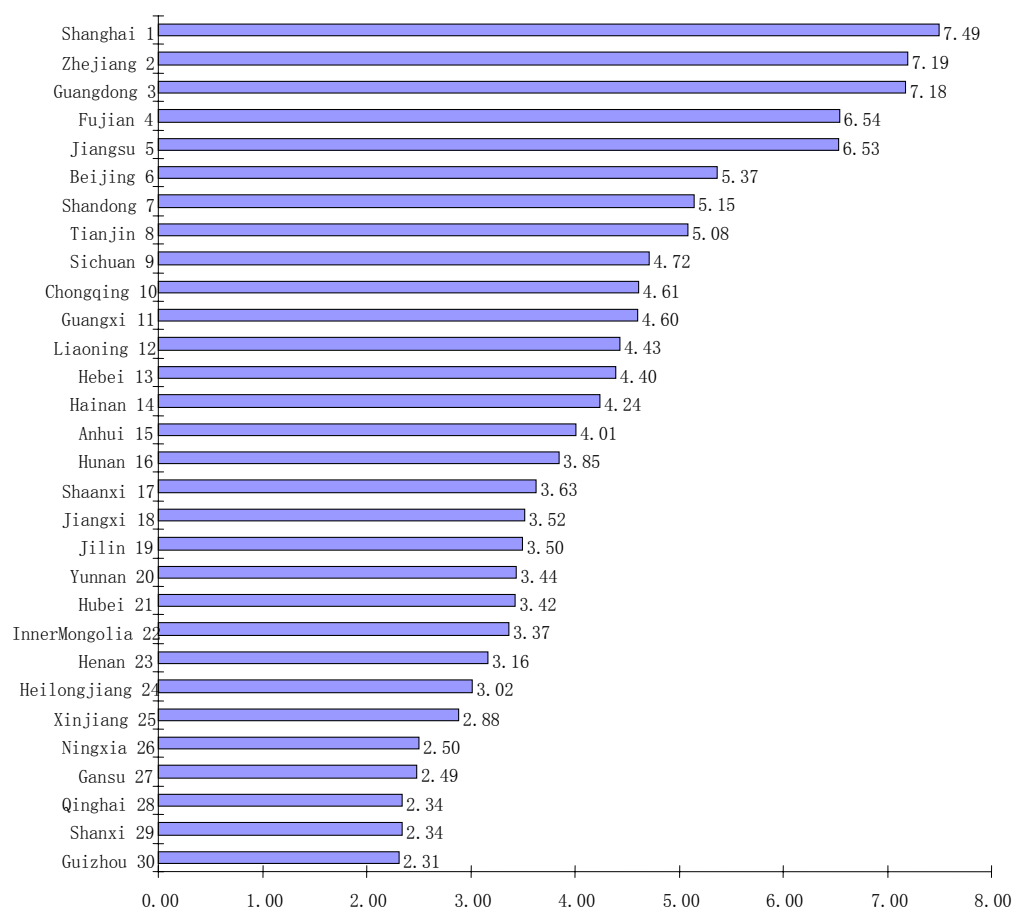


Figure A12. Natural Resources and Geographic Location

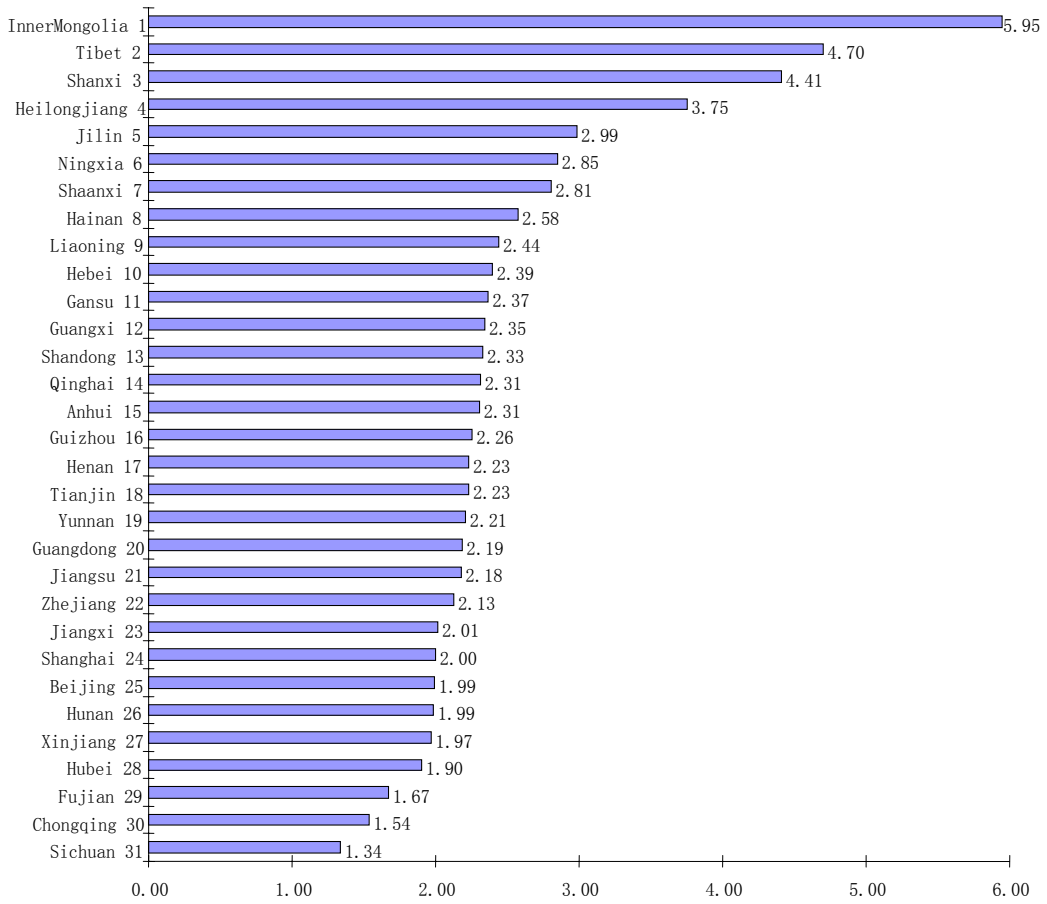


Table A1. Sectoral Structure of GDP (2004)

	Primary industry		Secondary industry		Tertiary industry	
	%	Rank	%	Rank	%	Rank
Beijing	2.4	30	37.6	29	60.0	1
Tianjin	3.5	29	53.2	7	43.3	4
Hebei	15.6	17	52.9	8	31.5	29
Shanxi	8.3	26	59.5	2	32.2	28
Inner Mongolia	18.7	13	49.1	13	32.2	26
Liaoning	11.2	23	47.7	17	41.1	5
Jilin	19.0	11	46.6	19	34.4	20
Heilongjiang	11.1	24	59.5	1	29.4	31
Shanghai	1.3	31	50.8	11	47.9	3
Jiangsu	8.5	25	56.6	3	34.9	19
Zhejiang	7.3	28	53.8	6	39.0	9
Anhui	19.4	10	45.1	22	35.5	17
Fujian	12.9	20	48.7	15	38.4	11
Jiangxi	20.4	8	45.6	21	34.0	22
Shandong	11.5	22	56.3	4	32.2	27
Henan	18.7	12	51.2	10	30.1	30
Hubei	16.2	16	47.5	18	36.4	16
Hunan	20.6	5	39.5	27	39.9	6
Guangdong	7.8	27	55.4	5	36.8	14
Guangxi	24.4	2	38.8	28	36.8	15
Hainan	36.9	1	23.4	31	39.7	7
Chongqing	16.2	15	44.3	25	39.5	8
Sichuan	21.3	3	41.0	26	37.7	12
Guizhou	21.0	4	44.9	23	34.1	21
Yunnan	20.4	7	44.4	24	35.2	18
Tibet	20.5	6	27.2	30	52.3	2
Shaanxi	13.7	19	49.1	12	37.2	13
Gansu	18.1	14	48.6	16	33.3	25
Qinghai	12.4	21	48.8	14	38.8	10
Ningxia	14.2	18	52.0	9	33.8	24
Xinjiang	20.2	9	45.9	20	33.9	23

Table A2. Ownership Structure and Trade Dependence

Province	Non-state share in industrial output		Non-state share in investment		Proportion of international trade value to GDP	
	2003		2004		2004	
	%	Rank	%	Rank	%	Rank
Beijing	46.2	13	71.0	3	82.7	5
Tianjin	64.0	6	61.1	16	122.0	3
Hebei	58.7	7	68.0	10	14.4	15
Shanxi	43.4	16	61.4	15	24.7	11
Inner Mongolia	41.1	19	51.3	26	13.3	16
Liaoning	41.9	18	68.8	8	48.1	8
Jilin	24.2	26	61.0	17	20.9	13
Heilongjiang	20.6	30	55.1	23	11.2	24
Shanghai	56.8	8	70.2	5	174.2	2
Jiangsu	81.0	3	69.4	7	96.5	4
Zhejiang	86.9	1	73.8	2	69.7	6
Anhui	44.9	14	63.0	14	12.0	20
Fujian	77.3	4	69.8	6	68.2	7
Jiangxi	35.7	22	57.7	21	11.4	23
Shandong	66.5	5	74.9	1	37.1	9
Henan	49.3	10	64.7	11	6.9	30
Hubei	43.2	17	59.0	20	9.9	27
Hunan	46.7	11	59.7	19	9.0	28
Guangdong	81.6	2	70.7	4	187.5	1
Guangxi	44.4	15	56.7	22	12.0	19
Hainan	36.0	21	68.3	9	31.2	10
Chongqing	46.3	12	59.8	18	11.6	21
Sichuan	52.5	9	64.4	12	8.5	29
Guizhou	31.7	23	41.7	29	12.3	18
Yunnan	26.4	24	53.0	25	10.4	25
Tibet	21.6	28	15.6	31	6.5	31
Shaanxi	25.9	25	46.3	28	13.1	17
Gansu	23.2	27	39.1	30	10.4	26
Qinghai	21.3	29	48.5	27	11.5	22
Ningxia	40.0	20	63.3	13	20.3	14
Xinjiang	18.3	31	54.7	24	22.7	12

Table A3. Consumption Ratio, Capital-Labor Ratio and Value-Added Ratio

Province	Share of private consumption in GDP		Capital-labor ratio in industry (10000 yuan/person)		Value-added ratio in industry	
	2004		2004		2003	
	%	Rank	Value	Rank	%	Rank
Beijing	8.3	31	60.9	2	26.6	28
Tianjin	14.4	29	43.3	8	26.5	29
Hebei	36.3	10	28.6	23	31.6	16
Shanxi	22.7	21	28.6	24	37.3	7
Inner Mongolia	20.6	22	38.6	12	38.1	6
Liaoning	15.7	28	41.0	9	28.1	25
Jilin	16.9	25	39.7	10	30.6	19
Heilongjiang	16.5	26	35.3	14	46.8	3
Shanghai	9.0	30	57.3	4	27.4	26
Jiangsu	26.3	18	32.5	16	25.9	30
Zhejiang	37.1	8	27.0	26	24.1	31
Anhui	43.1	2	28.8	22	33.8	14
Fujian	44.2	1	23.7	30	29.2	22
Jiangxi	41.5	4	25.3	29	30.4	21
Shandong	32.4	15	27.2	25	30.6	20
Henan	32.7	13	22.7	31	32.4	15
Hubei	30.5	16	39.4	11	33.9	12
Hunan	37.0	9	26.3	28	34.0	11
Guangdong	18.7	24	26.8	27	26.6	27
Guangxi	35.8	11	29.2	21	31.1	17
Hainan	39.8	7	49.6	6	28.9	23
Chongqing	26.9	17	30.6	19	28.2	24
Sichuan	41.3	5	32.4	17	34.4	10
Guizhou	41.2	6	30.5	20	35.4	9
Yunnan	41.6	3	50.6	5	47.9	2
Tibet	16.3	27	44.0	7	57.9	1
Shaanxi	32.8	12	36.1	13	35.9	8
Gansu	32.6	14	31.0	18	33.8	13
Qinghai	22.9	20	69.6	1	38.4	5
Ningxia	24.0	19	33.3	15	31.0	18
Xinjiang	19.5	23	59.6	3	41.6	4