Factor analysis and the measurement of economic strength:

——A comparison of Chinese provinces

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Abstract

This paper focuses on measuring the competitive power of each province in China in 2004. The main purpose of the analysis is to apply factor analysis as the key method and attribute 36 indicators into 6 factors which contain sufficient economic meaning. Finally, we get the rank of economic strength of every province and the rank of each factor in these provinces. We find that the unbalance in the development between eastern and the western China.

1. Introduction

Economic factors have become a leading element in competitive strength assessment. Accurate measurement for each province's economic strength helps the central government to know more details about each area's economy and to make decision upon the assessments. The measurements are also useful to each local government to make use of their advantages and to plan to develop their disadvantages. Therefore, this paper will concentrate on how to measure the economic strength of each province.

The first step is to construct the indicator system. The indicators chosen should reflect the whole economic image of each province. One indicator should be comparable between different provinces and the caliber and scope should be consistent. We should give up the indicators which only have good economic meaning rather than reliable data resource. (See Luo, 2001 and Tian, 2000)

With the consideration of the existing indicators assessment system and the researches of Luo and Tian, we select five groups (36 indicators in total) to set up the economic strength assessment for ranking the 30 Chinese provinces. These groups are economic measurement, living measurement, technology level, environment protection and fundamental facilities which include the main aspects of the economic strength either in economics or in people's life.

The second step is to employ the proper method to assess all the indicators. Because there might be some overlapping information between each indicator, it is difficult to explain the complex relationships between numerous economic indicators and to know the role of each factor by using traditional qualitative analysis. Factor analysis can find uncorrelated synthesized factors substituting the huge number of indicators and reflect all the information in the original indicators so that the number of the indicators can be reduced. (See Wen, Li and Mao, 2004)

The whole paper is divided into four parts. Section 2 establishes the indicator system

and describes the data. Section 3 introduces the theory of factor analysis, finishes the application step by step and derives quantity results. Section 4 is the interpretation of the results. Section 5 is the conclusion. The last part we do simple sensitivity analysis.

2. Data description

There are 34 administration provinces in China, shown in Figure 1. We consider 30 provinces except Hong Kong, Macao Taiwan and Tibet to do our analysis. The indicators in Hong Kong, Macao and Taiwan are not consistent to the indicators of main land. The existing differences are due to the historical reasons. We don't consider Tibet because some indicators are missing values.

Figure 1: Map of China and the Location of Provinces

Beijing located in the northeast of China is the capital of China. It is the commercial,

administrative and cultural center. There are lots of famous colleges and universities and also many large corporations either domestic or international.

Shanghai is located at the estuary of Changjiang River. It has become a very important port of China, because of its favorable location, which is the determinant of its development. It is the commercial, financial and industrial center.

Hainan is a solely tropical island province of China. It lies in extreme south of China and has a tropical climate. It is a good place of escaping cold, relieving summer heat, having holidays and traveling.

Shanxi is an inland province between Shaanxi and Hebei. Shanxi has a wealth of coal and bauxite minerals. Agriculture in Shanxi is greatly limited by Shanxi's arid climate and dwindling water resources. Industry in Shanxi is centered on heavy industries such as coal and chemical production, power generation, and metal refining.

Guizhou is located in southwest China. Overall Guizhou is a mountainous province however it is hillier in the west while the eastern and southern portions are relatively flat. Guizhou has a subtropical humid climate. Guizhou is one of the provinces that contain the most minority groups. Its natural industry includes timer and forestry. Other important industries include energy and mining.

According to the geographical positions and the central government’s policy in Western Development, 12 provinces are assigned to West Province. And we name those 11 provinces located along the coastline East Province. The others situated between these two areas are called Middle Province. The classification of provinces is shown in Table 1 and from Figure 2, we can see it clearly.

Table 1: East, Middle and West Provinces Classification

East Province	Beijing, Tianjin, Liaoning, Heibei, Shandong, Shanghai, Jiangsu, Zhejiang, Fujian, Guangdong, Hainan
Middle Province	Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan
West Province	Chongqing, Sichuan, Guizhou, Yunnan, Inner Mongolia, Shaanxi, Guangxi, Gansu, Qinghai, Ningxia, Xinjiang, Tibet

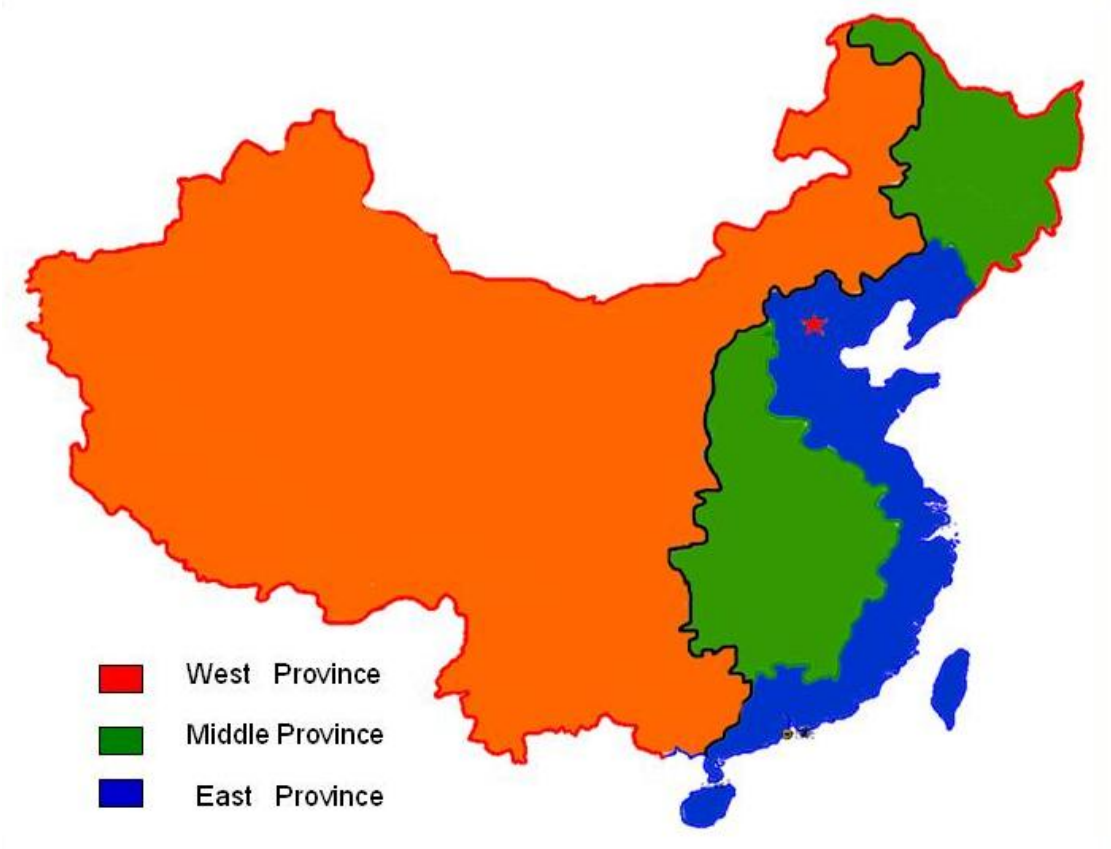

Figure 2: Classification of Chinese Provinces

The essay selects 36 indicators in the China Statistic Yearbook 2005, shown in Appendix, Table A1, to measure the economic strength by using the data of 2004 listed in Appendix, Table A2, from Page 1 to Page 6.

3. Multivariate statistical analysis of economic strength for Chinese provinces

3.1 Introduction of Factor analysis

The purpose of factor analysis lies in describing the connection of many indicators by employing fewer factors, which summarize the observed indicators. It means that in order to eliminate the overlap between the indicators, we can decompose the indicators into different groups and one factor represents one group (every factor is unobservable and is not the real variable, so it is called factor). This method uses less number of factors to represent the most information from the original material. (See Lin and Zhang, 2005)

After collecting the data of the indicator system, we can generate the correlation matrix. And it is easy to see the correlation between every two indicators and the existing overlap provides evidence to the application of factor analysis.

The linear relationship between factors and original indicators are modeled theoretically as followed (suppose there are *p* indicators and *m* factors where $m < p$)

$$\begin{aligned} x_1 &= \mu_1 + \alpha_{11} f_1 + \alpha_{12} f_2 + \cdots + \alpha_{1m} f_m + \varepsilon_1 \\ x_2 &= \mu_2 + \alpha_{21} f_1 + \alpha_{22} f_2 + \cdots + \alpha_{2m} f_m + \varepsilon_2 \\ &\cdots \\ x_p &= \mu_p + \alpha_{p1} f_1 + \alpha_{p2} f_2 + \cdots + \alpha_{pm} f_m + \varepsilon_p \end{aligned} \quad (1)$$

where

x_i is the *i*th indicator, $i = 1,2,\cdots, p$

f_j is the *j*th factor, $j = 1,2,\cdots, m$

α_{ij} is the coefficient of the *i*th indicator and the *j*th factor, and a_{ij} is also called factor loading

μ_i is the intercept for the *i*th indicator, $i = 1,2,\cdots, p$

ε_i is the unobserved error for the *i*th indicator, $i = 1,2,\cdots, p$

We can write equation (1) in matrix form:

$$X = \mu + \alpha f + \varepsilon \quad (2)$$

where

X is a $p \times 1$ vector of observed indicators

f is a $m\times1$ vector of unobserved factors

α is a $p\times m$ matrix of factor loadings, and α is also called factor matrix

μ is a $p\times1$ vector of constant terms

ε is a $p\times1$ vector of unobserved indicators

(See Wu, 2004)

Eigenvalue is the sum of the squared loading for a factor. The eigenvalues measure the amount of variance explained by each factor in relation to total variance. If a factor has a small eigenvalue, then it contributes little to the explanation of variances in all the indicators and may be disregarded as an unnecessary factor. (See Lin and Zhang, 2005)

The most popular technique to determine the number of the factors is Latent Root Criterion. The principle is to select the factors whose eigenvalues are larger than 1. These chosen factors are considered significant. It is reliable to use this criterion when the number of indicators is between 20 and 50. According to this criterion, we would probably retain fewer factors in our analysis. (See Hair, Anderson, Tatham and Black, 1998)

Factor analysis assumes that all the indicators are linear function of few exponential factors. Some of these factors are assumed to be common to two or more indicators and some are unique to only one indicator. The unique factors are orthogonal to each other since they do not contribute to the covariance between indicators. Meanwhile, common factors contribute to the covariance between indicators. (See Kim and Mueller, 1978)

Rotation serves to make the output more understandable and is usually necessary to facilitate the interpretation of factors. The sum of eigenvalues is not affected by

rotation, but rotation will alter the eigenvalues of particular factors and will change the factor loadings. (See Gan, 2002)

Varimax rotation is one of the most common rotation methods. It is an orthogonal rotation of the factor axes to maximize the variance of the squared loadings of a factor on all the indicators in a factor matrix, which has the effect of differentiating the original indicators by extracted factors. Each factor will tend to have either large or small loading of any particular indicator. The Varimax rotation yields results which make it as easy as possible to identify each indicator with a single factor. (See Hair, Anderson, Tatham and Black, 1998)

The factor loadings are the correlation coefficients between the indicators and the factors. The factor loadings for each indicator on each factor are the elements of each column in the factor matrix α , in equation (2).

After linear transformation, we can estimate the actual values of the factors for every observation. These values are called factor scores which are very useful when we want to rank the individual observation. From equation (1) we can generate equation (3) by using regression in order to obtain the factor scores

$$\begin{aligned} f_1 &= \beta_{11}x_1 + \beta_{12}x_2 + \cdots + a_{1p}x_p \\ f_2 &= \beta_{21}x_1 + \beta_{22}x_2 + \cdots + a_{2p}x_p \\ &\cdots \\ f_m &= \beta_{m1}x_1 + \beta_{m2}x_2 + \cdots + a_{mp}x_p \end{aligned} \quad (3)$$

where

β_{ij} are the coefficients of regression

We can write equation (3) in matrix form:

$$f = \beta^T X \quad (4)$$

where

X is a p×1 vector of observed indicators

f is a m×1 vector of unobserved factors

β is a p×m matrix of coefficients of regression, and β is also called factor score coefficient matrix,

β^T is the transpose of β

The integrated scores are the weighted arithmetic mean of each factor with the weight of variance contribution ratio which is the contribution of each factor to the cumulative variance after rotation, shown by equation (5):

$$F = w^T f \quad (5)$$

where

F is the integrated score for each sample point

w is a m×1 vector of the variance contribution ratio, w^T is the transpose of w

f is a m×1 vector of factor scores of sample point

(See Wu, 2004)

3.2 Factor analysis

We have 36 indicators, so we can apply Latent Root Criterion to determine the number of the factors. From Appendix, Table A3, the eigenvalue of the seventh factor is smaller than 1, so it is proper to retain six factors in our analysis. And Table 2 shows the contribution ratio of the first six factors.

Table 2: Total Variance Explained by the 6 Factors

Factor	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	18.087	50.242	50.242
2	6.139	17.053	67.295
3	2.525	7.013	74.308
4	2.009	5.582	79.890
5	1.628	4.523	84.412
6	1.188	3.299	87.712

Then a huge number of indicators influencing the economic strength are simplified into 6 factors.

In order to interpret the factors exactly, we apply Varimax rotation and obtain the new allocation in variance. It is obviously to see the variation in eigenvalues before and after rotation in Table 3.

Table 3: Variation in Eigenvalues before and after Rotation of 6 Factors

Factor	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.087	50.242	50.242	12.489	34.693	34.693
2	6.139	17.053	67.295	9.146	25.406	60.099
3	2.525	7.013	74.308	3.465	9.624	69.723
4	2.009	5.582	79.890	2.734	7.595	77.318
5	1.628	4.523	84.412	2.240	6.222	83.540
6	1.188	3.299	87.712	1.502	4.172	87.712

From Table 3, the first factor depends on the living standard and technology level per capita, which contribution to the economic strength of the province is 34.693%. The second factor depends upon the total product of economic and social development, which has 25.406% of the contribution to economic strength comparison. The growths of environment protection and innovation industry decide the third factor, which contributes with 9.624% to the economic competition. The dedication of the fourth factor which is fixed on fundamental facilities and economic benefit is 7.595%. Lastly, the fifth and sixth factors depend on investment on R&D in companies and the proportion of industrial growth & urban living standard, with 6.222% and 4.172% contribution respectively. These six factors' cumulative contribution ratio reaches

87.712%, which means that they excess 85% of the contribution compared to other factors.

Meanwhile, we can find the factor matrix which illustrates the linear relationship between indicators and factors. Here, we take arbitrary 6 indicators for example: and use the form of equation (2), then we have

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{pmatrix} = \begin{pmatrix} 0.802 & 0.326 & 0.372 & -0.049 & 0.196 & 0.104 \\ 0.334 & 0.892 & 0.025 & -0.078 & 0.085 & -0.224 \\ 0.458 & 0.131 & -0.345 & 0.116 & -0.184 & 0.591 \\ 0.24 & 0.17 & -0.028 & 0.137 & 0.857 & -0.054 \\ 0.349 & 0.079 & 0.777 & 0.206 & -0.02 & -0.263 \\ 0.159 & -0.162 & 0.02 & 0.868 & 0.004 & 0.125 \end{pmatrix} \begin{pmatrix} f_1 \\ f_2 \\ f_3 \\ f_4 \\ f_5 \\ f_6 \end{pmatrix} \quad (6)$$

where

x_1 is Per Capita GDP

x_2 is Total Value of Imports and Exports

x_3 is Engle Coefficient of Urban Households

x_4 is Percentage of Population with Access to Tap Water

x_5 is Ratio of New Industrial Output Value to Total Industrial Output Value in the Industrial Enterprises above Designated Size

x_6 is Percentage of Personnel Engaged in Technology Activities to Total Number of Employees in the Enterprises above Designated Size

f_i is the *i*th factor

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{pmatrix} = \begin{pmatrix} 0.802 & 0.326 & 0.372 & -0.049 & 0.196 & 0.104 \\ 0.334 & 0.892 & 0.025 & -0.078 & 0.085 & -0.224 \\ 0.458 & 0.131 & -0.345 & 0.116 & -0.184 & 0.591 \\ 0.24 & 0.17 & -0.028 & 0.137 & 0.857 & -0.054 \\ 0.349 & 0.079 & 0.777 & 0.206 & -0.02 & -0.263 \\ 0.159 & -0.162 & 0.02 & 0.868 & 0.004 & 0.125 \end{pmatrix} \begin{pmatrix} f_1 \\ f_2 \\ f_3 \\ f_4 \\ f_5 \\ f_6 \end{pmatrix}$$

From equation (6), we find strong positive correlation between Per Capita GDP and factor1, Total Value of Imports & Exports and factor2, Engle Coefficient of Urban Households and factor6, Percentage of Population with Access to Tap Water and factor5, Ratio of New Industrial Output Value to Total Industrial Output Value in the Industrial Enterprises above Designated Size and factor3, Percentage of Personnel Engaged in Technology Activities to Total Number of Employees in the Enterprises above Designated Size and factor4.

The 6×6 matrix in equation (6) is a part of the factor matrix. For further results of the factor matrix after rotation, see Appendix, Table A4.

Furthermore, each factor has different effects on the economic strength, which can be reflected by factor scores. The factor scores are the products of the observed data and the factor score coefficient matrix (negative number implies that the score is under the average). We calculate factor scores using equation (3), take factor1 for example and write equation (7) in a simple way as followed:

$$f_1 = -0.076x_1 + 0.057x_2 - 0.069x_3 + \cdots + 0.126x_{13} + \cdots + 0.104x_{21} + \cdots + 0.084x_{33}$$

where

x_1 is GDP

x_2 is Per Capita GDP

x_3 is Total Investment in Fixed Assets

x_{13} is Percentage of Government Revenue to GDP

x_{21} is Number of Doctors per 10000 Population

x_{33} is Per capita Passenger Traffic of Public Transport

It is clear that Percentage of Government Revenue to GDP, Number of Doctors per 10000 Population and Per capita Passenger Traffic of Public Transport have a strong positive influence on factor1. Factor1 is also determined by Per Capita GDP. GDP and Total Investment in Fixed Assets have a negative linear relation to factor1.

We name the factors after the commonness of the explanatory variables. Therefore factor1 is called living standard and technology level per capita. For further information of factor score coefficient matrix, see Appendix, Table A5.

From equation (5), we can find the integrated scores which measure the economic strength of 30 Chinese provinces objectively and synthetically. The weights of are the ratios of the contribution of each factor (34.693%, 25.406%, 9.624%, 7.595%, 6.222%, and 4.172%) to the cumulative variance (87.712%), which are 0.396, 0.29, 0.11, 0.087, 0.071 and 0.048. The integrated score of Beijing is calculated as followed:

$$\begin{aligned} f &= 0.396 f_1 + 0.29 f_2 + 0.11 f_3 + 0.087 f_4 + 0.071 f_5 + 0.048 f_6 \\ &= 0.396 \times 3.622 - 0.29 \times 0.282 - 0.11 \times 0.375 + 0.087 \times 2.525 + 0.071 \times 0.603 - 0.048 \times 0.415 \\ &= 1.5516 \end{aligned}$$

Similarly, we can generate the other five equations to calculate the scores for factor2 to factor6 and finally get the integrated scores for each province. Chinese provinces are placed in sequence according to integrated scores in Appendix, Table A6, which is also including the factor scores and the rank of 6 factors.

4. Comparison in economic strength based on factor analysis

4.1 Comparison in economic strength between provinces

The most 5 competitive areas is Beijing, Shanghai, Guangdong, Jiangsu and Zhejiang.

In Beijing, the standard of living and technology per capita, company's investment on R&D play an important role, these are competitive advantages. But environment protection and innovation industry are Beijing's weaknesses. Total product of economic and social development, fundamental facilities and economic effectiveness are indistinctive.

In Shanghai, the most eminent factors are the standard of living and technology per capita, total product of economic and social development and environment protection and innovation industry which are Shanghai's competitive advantages. But the company's investment on R&D is Shanghai's disadvantage. Fundamental facilities, economic effectiveness, proportion of industrial growth & urban living standard are in general level.

In Guangdong, the most competitive factors are the standard of living and technology per capita and total product of economic and social development, which are competitive advantages. But environment protection and innovation industry, company's investment on R&D, proportion of industrial growth & urban living standard are all Guangdong's disadvantages. Fundamental facilities play a less important role.

In Jiangsu, total product of economic and social development is Jiangsu's competitive advantages. The standard of living and technology per capita are Jiangsu's weaknesses. Environment protection and innovation industry, fundamental facilities and economic effectiveness, company's investment on R&D, proportion of industrial growth & urban living standard are more competitive than the average level of the whole country.

In Zhejiang, the total product of economic and social development and environment protection and innovation industry are Zhejiang's aggressive factors. Its drawback is

the company's investment on R&D. The standard of living and technology per capita, fundamental facilities and economic effectiveness and proportion of industrial growth & urban living standard are at the average.

4.2 Comparison between factors

According to the result in Appendix, Table A6, we conclude that: in the factors of the standard of living and technology per capita, the first three areas are Beijing, Shanghai and Tianjin; the last three are Anhui Sichuan and Henan, respectively.

In the factors of total product of economic and social development, the first three areas are Guangdong, Jiangsu and Shandong; the last three are Qinghai, Xinjiang and Hainan.

In the factors of environment protection and innovation industry, the first three areas are Tianjin, Chongqing and Fujian; the last three are Guizhou, Xinjiang and Qinghai.

In the factors of fundamental facilities and economic effectiveness, the first three areas are Beijing, Shaanxi and Sichuan; the last three are Yunnan, Hainan and Xinjiang.

In the factors of investment on R&D in companies, the first three areas are Hebei, Hainan and Xinjiang; the last three are Hubei Chongqing and Ningxia.

In the factors of proportion of industrial growth & urban living standard, the first three areas are Shandong, Heilongjiang and Jilin; the last three are Guangxi, Hainan and Guangdong.

5. Conclusion

From Table 4 and Figure 3, eastern China along the sea is the most competitive area where 9 provinces are in the top 10 except Hebei and Hainan. And further, Hainan is the 29th in the 30 provinces. The 10th is Heilongjiang which is the only one middle province in the top ten provinces. The 23rd Anhui and 24th Jiangxi which are located in the middle of China belong to the last 10. Other provinces in middle China are neither prosperous nor backward. The western provinces obviously fall behind. Among them,

7 provinces are at the bottom of the list. The others are in the normal condition. Thus, we have to focus on the development in the western China.

Table 4: Top Ten and Last Ten Provinces

Top10	Rank	Last10	Rank
Beijing	1	Inner Mongolia	21
Shanghai	2	Ningxia	22
Guangdong	3	Anhui	23
Jiangsu	4	Jiangxi	24
Zhejiang	5	Qinghai	25
Tianjin	6	Gansu	26
Shandong	7	Yunnan	27
Liaoning	8	Guangxi	28
Fujian	9	Hainan	29
Heilongjiang	10	Guizhou	30

Figure 3: The Location of the Top Ten and Last Ten Provinces

According to the results, we observe that the standard of living and technology per capita, total product of economic and social development are the most important factors determining the economic strength. There are more than 70% lands but less than 30% population in western China. And the natural resources and environment are their features. Therefore, the backward provinces should concentrate on these characteristics and appeal more investment and human recourses to develop their potential capability to achieve the balance between provinces.

6. Sensitivity analysis

We use the sensitivity analysis to test this model. First, we have to get the greatest coefficient-of-variation. According to the correlation matrix, Total Investment in Fixed Assets and Total Value of Imports and Exports are mostly correlated. Then excluding these two indicators and redoing the factor analysis, we find the top 9 provinces are stay on the list. Hubei becomes the new 10^{th} province and Heilongjiang is the 12^{rd}. Although there are some slight changes in the rank of the last 10 provinces, most provinces at the bottom of the list are still located in the western China. This shows that the model is insensitive to the input data variation. The comparison of the rank of every province is shown in Appendix**,** Table A7.

Appendix

Table A1: Indicator System of Economic Strength for Chinese Provinces

The Economic Strength	1.Economic Measurement	(1) Gross national income (GDP)
		(2) Per Capita GDP
		(3) Production Proceeds of Sale of Three Kinds of Foreign-invested Eterprises or Ventures
		(4) Total Volume of Retail Sales
		(5) Total Investment in Fixed Assets
		(6) Total Value of Imports and Exports
		(7) Foreign Trade Dependence
		(8) Tertiary Industry Product
		(9) Total Investment of Foreign Funded Enterprises
		(10) Overall Labor Productivity
		(11) Ratio of Valued Added of the Industry
	2.Living Measurement	(12) Urban Proportion
		(13) Percentage of Government Revenue to GDP
		(14) Per Capita Floor Space of Residential Building
		(15) Per Capita Premium Income of Insurance Company
		(16) Per Capita Outstanding of Deposits of Financial Institutions
		(17) Per Capita Net Income of Rural Households
		(18) Per Capita Disposable Income of Urban Households
		(19) Engle Coefficient of Urban Households
		(20) Number of Hospital Beds per 10000 Population
		(21) Number of Doctors per 10000 Population
	3.Technology Level	(22) Percentage of Personnel Engaged in Technology Activities to Total Number of Employees in the Enterprises above Designated Size
		(23) Percentage of Expenditures on R&D to Sales Revenue
		(24) Intramural Expenditures on R&D
		(25) Ratio of new industrial output value to total industrial output value in the Industrial Enterprises above Designated Size
		(26) Money amount of technological market negotiated contract
		(27) The number of domestic Patent Applications Examined
		(28) Total Enrollment in Regular Institutions of Higher Education Per 10000 Population
	4.Environment Protection	(29) Per capita Area of Urban Gardens and Green Areas
		(30) Percentage of Industrial Waste Water Meeting Discharge Standards
		(31) Percentage of Industrial Solid Wastes Utilized
	5.Fundamental Facilities	(32) Length of Paved Roads Per 10000 Population
		(33) Per capita Passenger Traffic of Public Transport
		(34) Per capita Business Volume of Telecommunication Services
		(35) Percentage of Population with Access to Tap Water
		(36) Percentage of Urban Population with Access to Gas

Table A2: Data of 36 Indicators for 30 Chinese Provinces in 2004 Page 1

2004	GDP (￥100 million)	Per Capita GDP (￥/person)	Total Investment in Fixed Assets (￥100 million)	Total Volume of Retail Sales (￥100 million)	Proceeds of Sale of Three Kinds of Foreign-Invested Industrial Enterprises or Ventures (￥100 million)	Total Value of Imports and Exports ($10000)	Foreign Trade Dependence ($10000/￥100 million)
Beijing	4283.31	37058	2528.2	2191.80	2135.11	9457573	2208.01
Tianjin	2931.88	31550	1245.7	1052.70	2592.72	4202861	1433.50
Hebei	8768.79	12918	3218.8	2522.90	1029.39	1352585	154.25
Shanxi	3042.41	9150	1443.9	884.80	165.46	538249	176.92
Inner Mongolia	2712.08	11305	1788.0	892.00	188.61	372171	137.23
Liaoning	6872.65	16297	2979.6	2642.80	1737.12	3441086	500.69
Jilin	2958.21	10932	1169.1	1252.60	744.64	679045	229.55
Heilongjiang	5303.00	13897	1430.8	1555.40	204.56	678900	128.02
Shanghai	7450.27	55307	3050.3	2454.61	8790.91	16000992	2147.71
Jiangsu	15403.16	20705	6557.1	4159.70	8842.36	17084901	1109.18
Zhejiang	11243.00	23942	5781.4	3645.40	3680.47	8520488	757.85
Anhui	4812.68	7768	1935.3	1503.10	531.67	721156	149.84
Fujian	6053.14	17218	1829.9	1995.82	3750.53	4752701	785.16
Jiangxi	3495.94	8189	1713.2	1059.90	300.19	352795	100.92
Shandong	15490.73	16925	6970.6	4483.40	3245.77	6065822	391.58
Henan	8815.09	9470	3099.4	2808.20	451.48	661955	75.09
Hubei	6309.92	10500	2264.8	2667.48	939.53	676581	107.22
Hunan	5612.26	9117	2072.6	2069.80	304.36	544352	96.99
Guangdong	16039.46	19707	5870.0	6370.42	16556.27	35713062	2226.58
Guangxi	3320.10	7196	1236.5	973.40	372.66	427722	128.83
Hainan	769.36	9450	317.1	220.20	59.09	340169	442.15
Chongqing	2665.39	9608	1537.1	1061.50	404.03	385715	144.71
Sichuan	6556.01	8113	2818.4	2384.00	360.67	686699	104.74
Guizhou	1591.90	4215	865.2	517.56	41.92	151373	95.09
Yunnan	2959.48	6733	1291.5	884.86	113.46	374117	126.41
Shaanxi	2883.51	7757	1508.9	966.50	161.00	364238	126.32
Gansu	1558.93	5970	733.9	535.80	36.47	176315	113.10
Qinghai	465.73	8606	289.2	115.60	11.76	57552	123.57
Ningxia	460.35	7880	376.2	137.76	51.20	90821	197.29
Xinjiang	2200.15	11199	1147.2	563.65	28.10	563452	256.10

Table A2 (continued) Page 2

2004	Tertiary Industry Product(￥100 million)	Total Investment of Foreign Funded Enterprises($100 million)	Overall Labor Productivity (￥/persons*years)	Ratio of Valued Added of Industry (%)	Urban Proportion (%)	Percentage of Government Revenue to GDP (%)	Per Capita Floor Space of Residential Building(㎡)
Beijing	2570.04	532	126044	29.40	79.52	17.38	25.12
Tianjin	1269.43	470	117482	47.60	54.31	8.40	24.65
Hebei	2763.16	201	90525	28.04	35.83	4.65	24.92
Shanxi	978.96	69	66829	40.85	39.63	8.43	23.58
Inner Mongolia	873.53	108	95551	28.64	45.87	7.25	21.38
Liaoning	2823.87	679	91234	32.82	56.01	7.71	20.99
Jilin	1017.94	194	94321	33.61	88.97	5.62	21.75
Heilongjiang	1559.92	95	122560	30.54	52.78	5.46	21.25
Shanghai	3565.34	1722	147212	46.00	77.16	14.85	32.10
Jiangsu	5371.68	2170	103197	41.86	48.18	6.37	26.90
Zhejiang	4382.00	834	66261	37.12	54.00	7.17	34.02
Anhui	1710.44	129	76503	22.49	32.29	5.71	21.70
Fujian	2324.94	689	70420	30.49	69.06	5.51	31.52
Jiangxi	1188.50	163	61615	17.67	35.58	5.89	24.89
Shandong	4987.91	694	100694	41.95	67.67	5.35	25.72
Henan	2652.26	149	22100	26.46	28.91	4.86	21.62
Hubei	2295.16	227	88259	26.38	43.68	4.92	24.05
Hunan	2242.00	119	75254	21.35	35.50	5.71	25.39
Guangdong	5903.75	2610	87230	44.18	45.74	8.84	26.27
Guangxi	1220.46	127	69592	17.94	31.70	7.16	26.74
Hainan	305.11	86	96979	13.35	25.67	7.41	24.04
Chongqing	1052.83	72	65329	21.75	38.62	7.53	28.25
Sichuan	2471.76	140	76420	23.59	21.94	5.88	26.87
Guizhou	543.13	22	65629	27.54	26.28	9.38	18.26
Yunnan	1040.96	79	134384	29.78	28.10	8.90	26.54
Shaanxi	1071.71	125	64144	30.20	32.98	7.45	22.38
Gansu	519.35	31	66054	32.40	28.60	6.68	21.98
Qinghai	180.86	10	98715	28.43	38.59	5.80	20.98
Ningxia	155.80	41	68697	31.93	40.58	8.14	22.90
Xinjiang	745.38	14	148745	28.04	35.16	7.08	21.32

Table A2 (continued) Page 3

2004	Per Capita Premium Income of Insurance Company(￥)	Per Capita Outstanding of Deposits of Financial Institutions(￥)	Per Capita Net Income of Rural Households(￥)	Per Capita Disposable Income of Urban Households (￥)	Engle Coefficient of Urban Households (%)	Number of Hospital Beds per 10000 Population(Unit)	Number of Doctors per 10000 Population (Person)
Beijing	1868.36	144848.42	6170.33	15637.84	0.0311	66.8	42.5
Tianjin	790.89	46187.60	5019.53	11467.16	0.0269	41.8	27.2
Hebei	301.67	13584.87	3171.06	7951.31	0.0272	23.3	12.3
Shanxi	312.27	17426.25	2589.60	7902.86	0.0295	32.4	17.9
Inner Mongolia	231.63	10806.92	2606.37	8122.99	0.0308	28.0	21.0
Liaoning	487.31	24172.39	3307.14	8007.56	0.0248	42.5	22.1
Jilin	274.27	13597.25	2999.62	7840.61	0.0279	32.5	21.9
Heilongjiang	334.40	13921.58	3005.18	7470.71	0.0282	31.4	14.0
Shanghai	1762.97	104009.99	7066.33	16682.82	0.0275	63.0	32.0
Jiangsu	563.63	24500.23	4753.85	10481.93	0.0250	25.4	14.3
Zhejiang	616.59	36518.26	5944.06	14546.38	0.0276	29.5	18.1
Anhui	189.60	7808.91	2499.33	7511.43	0.0228	19.0	10.0
Fujian	386.31	17068.61	4089.38	11175.37	0.0240	25.0	12.4
Jiangxi	188.35	8772.97	2786.78	7559.64	0.0233	19.6	11.7
Shandong	345.49	15810.76	3507.43	9437.80	0.0289	25.3	15.3
Henan	207.93	8883.18	2553.15	7704.90	0.0286	21.5	11.3
Hubei	203.69	11691.46	2890.01	8022.75	0.0254	22.9	11.2
Hunan	172.76	8212.11	2837.76	8617.48	0.0278	22.1	11.9
Guangdong	525.21	37044.88	4365.87	13627.65	0.0270	25.6	14.5
Guangxi	136.13	7513.17	2305.22	8689.99	0.0227	17.5	11.0
Hainan	175.70	13579.79	2817.62	7735.78	0.0213	22.5	12.3
Chongqing	213.04	12939.17	2510.41	9220.96	0.0265	20.3	11.6
Sichuan	199.07	9698.69	2518.93	7709.87	0.0249	22.1	13.1
Guizhou	155.92	5948.44	1721.55	7322.05	0.0243	14.9	12.2
Yunnan	168.02	9975.90	1864.19	8870.88	0.0236	21.6	12.1
Shaanxi	222.97	14521.68	1866.52	7492.47	0.0279	27.0	16.0
Gansu	169.53	9478.37	1852.22	7376.74	0.0270	23.7	11.3
Qinghai	136.71	11164.16	1957.65	7319.67	0.0280	30.6	14.4
Ningxia	235.02	14305.45	2320.05	7217.87	0.0270	28.8	18.2
Xinjiang	347.07	15077.84	2244.93	7503.42	0.0277	37.7	21.9

Table A2 (continued) Page 4

2004	Percentage of Personnel in technology Activities to Total Employees (%)	Percentage of Expenditures on R&D to Sales Revenue (%)	Intramural Expenditures on R&D (￥10000)	Ratio of new industrial output value to total (%)	Money amount of technological market negotiated contract (￥10000)	The number of domestic Patent Applications Examined (Unit)	Total Enrollment in Institutions of Higher Education Per 10000 Population (Person)
Beijing	4.9	1.0	1551783	18.1	4249975	18402	334.6
Tianjin	3.0	0.5	83674	23.8	450276	8406	279.0
Hebei	2.5	0.3	74229	4.3	72718	5647	102.4
Shanxi	2.9	0.4	31621	5.9	59960	1949	103.5
Inner Mongolia	2.3	0.2	14075	6.5	104085	1457	83.4
Liaoning	3.6	0.9	160363	11.3	752817	14695	138.4
Jilin	2.0	0.4	85079	4.7	107900	3657	133.7
Heilongjiang	3.8	0.5	32780	6.3	125715	4919	122.0
Shanghai	3.0	0.6	432699	19.8	1716963	20471	238.6
Jiangsu	3.2	0.6	319768	11.0	897855	23532	133.8
Zhejiang	2.3	0.5	46193	12.9	581465	25294	121.3
Anhui	3.2	0.6	75896	12.1	90675	2943	77.6
Fujian	1.6	0.6	18197	12.4	141395	7498	92.8
Jiangxi	3.9	0.7	28759	8.7	93661	2685	114.3
Shandong	2.5	0.5	62068	10.1	750850	18388	103.1
Henan	2.8	0.4	99796	6.6	203207	6318	72.3
Hubei	3.8	0.5	151336	11.4	461700	7960	148.3
Hunan	3.5	0.5	37321	13.2	408280	7693	95.4
Guangdong	1.7	0.6	68933	10.9	572651	52201	87.5
Guangxi	2.4	0.4	11259	15.4	90955	2202	57.5
Hainan	1.4	0.3	4990	16.4	1885	375	70.8
Chongqing	3.9	0.7	18902	24.3	596186	5171	91.1
Sichuan	4.3	0.6	329125	10.6	165640	7260	73.0
Guizhou	2.7	0.5	14036	5.6	13533	1486	46.1
Yunnan	2.3	0.2	53028	3.9	215555	2132	49.0
Shaanxi	4.9	1.0	421211	8.6	139129	3217	157.6
Gansu	3.3	0.3	60105	3.2	119608	910	76.5
Qinghai	2.6	0.5	6251	1.6	12793	124	54.7
Ningxia	1.9	0.4	1970	4.6	12827	399	70.5
Xinjiang	2.2	0.2	19687	2.0	133371	1492	83.1

Table A2 (continued) Page 5

2004	Per capita Area of Urban Gardens and Green Areas(㎡)	Percentage of Industrial Waste Water Meeting Discharge Standards (%)	Percentage of Industrial Solid Wastes Utilized (%)	Length of Paved Roads Per 10000 Population(km)
Beijing	10.5	98.61	74.7	5.01
Tianjin	8.1	99.35	103.9	4.14
Hebei	7.3	96.41	44.9	1.17
Shanxi	5.0	89.62	44.3	1.37
Inner Mongolia	7.0	61.13	31.9	1.52
Liaoning	7.1	93.93	40.0	2.47
Jilin	5.8	79.44	52.7	1.68
Heilongjiang	7.0	93.69	76.1	2.38
Shanghai	8.5	96.27	98.2	6.33
Jiangsu	8.9	97.22	98.4	3.58
Zhejiang	8.4	95.94	87.9	2.39
Anhui	5.9	96.91	79.1	1.12
Fujian	8.1	97.19	66.6	1.32
Jiangxi	7.4	88.66	25.6	0.86
Shandong	7.7	97.00	90.7	2.57
Henan	7.1	93.68	69.5	0.67
Hubei	5.9	85.78	72.2	2.40
Hunan	6.5	83.65	67.8	0.83
Guangdong	9.6	83.87	88.6	2.71
Guangxi	6.4	86.60	59.3	0.97
Hainan	10.1	93.76	66.1	1.34
Chongqing	4.1	93.41	73.4	1.10
Sichuan	7.7	86.43	58.3	0.95
Guizhou	5.3	58.15	40.3	0.53
Yunnan	7.4	74.73	40.3	0.57
Shaanxi	4.5	91.59	21.8	0.83
Gansu	6.1	73.20	33.3	1.07
Qinghai	6.7	62.73	20.3	1.00
Ningxia	4.7	80.72	51.9	2.07
Xinjiang	6.8	61.38	49.3	1.89

Table A2 (continued) Page 6

2004	Per capita Passenger Traffic of Public Transport(Times)	Per capita Business Volume of Telecommunication Services(￥)	Percentage of Population with Access to Tap Water (%)	Percentage of Urban Population with Access to Gas (%)
Beijing	344.19	2094.51	100.00	99.75
Tianjin	76.66	1300.68	100.00	98.48
Hebei	12.76	596.68	99.94	93.29
Shanxi	17.97	605.58	85.62	68.63
Inner Mongolia	12.78	620.85	82.21	62.79
Liaoning	81.05	827.60	92.99	87.16
Jilin	36.27	743.30	77.25	71.33
Heilongjiang	31.26	689.08	80.77	68.84
Shanghai	190.47	1796.44	100.00	100.00
Jiangsu	35.39	686.26	94.00	91.98
Zhejiang	45.38	1373.14	98.86	98.22
Anhui	17.98	315.29	89.95	69.18
Fujian	40.06	1161.61	95.90	93.18
Jiangxi	17.08	435.25	92.24	80.15
Shandong	20.82	543.74	75.46	74.29
Henan	13.61	417.07	92.14	66.17
Hubei	34.05	448.82	73.75	64.35
Hunan	26.15	397.49	87.61	68.71
Guangdong	38.07	2084.44	95.14	92.99
Guangxi	21.13	515.44	78.74	67.39
Hainan	15.69	716.75	89.64	88.24
Chongqing	30.49	510.06	76.81	63.52
Sichuan	19.89	362.19	97.49	81.75
Guizhou	20.32	320.47	88.60	59.54
Yunnan	13.21	448.74	81.50	61.85
Shaanxi	25.26	618.65	94.43	76.73
Gansu	17.54	388.81	85.15	65.20
Qinghai	48.80	454.92	99.94	69.95
Ningxia	18.29	609.86	61.10	49.39
Xinjiang	43.15	736.27	98.12	87.25

Table A3: Total Variance Explained by Factors before and after Rotation

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.087	50.242	50.242	18.087	50.242	50.242	12.489	34.693	34.693
2	6.139	17.053	67.295	6.139	17.053	67.295	9.146	25.406	60.099
3	2.525	7.013	74.308	2.525	7.013	74.308	3.465	9.624	69.723
4	2.009	5.582	79.890	2.009	5.582	79.890	2.734	7.595	77.318
5	1.628	4.523	84.412	1.628	4.523	84.412	2.240	6.222	83.540
6	1.188	3.299	87.712	1.188	3.299	87.712	1.502	4.172	87.712
7	.910	2.528	90.240						
8	.812	2.255	92.495						
9	.604	1.679	94.174						
10	.511	1.419	95.593						
11	.338	.938	96.531						
12	.247	.685	97.217						
13	.186	.517	97.734						
14	.169	.469	98.203						
15	.157	.437	98.640						
16	.110	.307	98.947						
17	.099	.276	99.223						
18	.079	.218	99.441						
19	.056	.157	99.598						
20	.043	.118	99.716						
21	.035	.097	99.813						
22	.023	.064	99.877						
23	.012	.034	99.911						
24	.011	.032	99.943						
25	.008	.022	99.965						
26	.006	.018	99.983						
27	.003	.007	99.990						
28	.002	.006	99.996						
29	.001	.004	100.000						
30	4.989E-16	1.386E-15	100.000						
31	2.293E-16	6.370E-16	100.000						
32	1.644E-16	4.567E-16	100.000						
33	-1.381E-17	-3.835E-17	100.000						
34	-1.095E-16	-3.041E-16	100.000						

35	-4.407E-16	-1.224E-15	100.000						
36	-6.337E-16	-1.760E-15	100.000						

Table A4: Rotated Factor Matrix

Indicator	Factor					
	1	2	3	4	5	6
GDP (￥100 million)	-0.098	0.908	0.204	0.085	0.137	0.252
Per Capita GDP (￥/person)	0.802	0.326	0.372	-0.049	0.196	0.104
Total Investment in Fixed Assets (￥100 million)	-0.033	0.872	0.196	0.129	0.129	0.277
Total Volume of Retail Sales (￥100 million)	-0.007	0.934	0.165	0.144	0.104	0.15
Production Proceeds of Sale of Three Kinds of Foreign-invested Enterprises or	0.269	0.896	0.093	-0.148	0.074	-0.195
Total Value of Imports and Exports ($10000)	0.334	0.892	0.025	-0.078	0.085	-0.224
Foreign Trade Dependence ($10000/￥100 million)	0.747	0.55	0.192	-0.018	0.183	-0.193
Tertiary Industry Product (￥100 million)	0.064	0.911	0.245	0.126	0.165	0.175
Total Investment of Foreign Funded Enterprises ($100 million)	0.282	0.887	0.141	-0.089	0.111	-0.127
Overall Labor Productivity (￥/person*year)	0.612	-0.016	-0.036	-0.361	0.245	0.132
Ratio of Valued Added of the Industry (%)	0.441	0.565	0.001	-0.247	-0.103	0.399
Urban Proportion (%)	0.647	0.244	0.245	-0.068	-0.092	0.391
Percentage of Government Revenue to GDP (%)	0.89	0.041	-0.022	0.135	-0.024	-0.321
Per Capita Floor Space of Residential Building (m^2)	0.162	0.37	0.658	-0.1	0.149	-0.124
Per Capita Premium Income of Insurance Company (￥)	0.908	0.223	0.217	0.139	0.172	0.023
Per Capita Outstanding of Deposits of Financial Institutions (￥)	0.92	0.178	0.156	0.213	0.152	-0.053
Per Capita Net Income of Rural Households (￥)	0.671	0.463	0.469	-0.013	0.241	0.101
Per Capita Disposable Income of Urban Households (￥)	0.698	0.507	0.358	-0.013	0.152	-0.122

Engle Coefficient of Urban Households (%)	0.458	0.131	-0.345	0.116	-0.184	0.591
Number of Hospital Beds per 10000 Population (unit)	0.935	0.015	0.037	0.065	0.155	0.196
Number of Doctors per 10000 Population (person)	0.947	-0.014	-0.009	0.074	0.096	0.175
Percentage of Personnel Engaged in Technology Activities to Total Number of Employees in the Enterprises above Designated Size (%)	0.159	-0.162	0.02	0.868	0.004	0.125
Percentage of Expenditures on R&D to Sales Revenue (%)	0.287	0.186	0.169	0.795	0.037	-0.107
Intramural Expenditures on R&D (¥ 10000)	0.71	0.057	-0.018	0.586	0.17	-0.028
Ratio of new industrial output value to total industrial output value in the Industrial Enterprises above Designated Size (%)	0.349	0.079	0.777	0.206	-0.02	-0.263
Money Amount of Technological Market Negotiated Contract (¥ 10000)	0.801	0.194	0.117	0.426	0.085	-0.021
The number of domestic Patent Applications Examined (case)	0.267	0.928	0.101	0.051	0.088	-0.091
Total Enrollment in Regular Institutions of Higher Education Per 10000 Population (person)	0.8	0.042	0.303	0.306	0.136	0.22
Per capita Area of Urban Gardens and Green Areas (m^2)	0.38	0.417	0.194	-0.117	0.616	-0.138
Percentage of Industrial Waste Water Meeting Discharge Standards (%)	0.091	0.245	0.771	0.351	0.138	0.167
Percentage of Industrial Solid Wastes Utilized (%)	0.269	0.508	0.668	-0.11	-0.039	0.092
Length of Paved Roads Per 10000 Population (km)	0.821	0.34	0.299	-0.039	0.05	0.156
Per capita Passenger Traffic of Public Transport (time)	0.905	0.037	0.081	0.318	0.154	-0.049
Per capita Business Volume of Telecommunication Services (¥)	0.756	0.483	0.158	-0.053	0.186	-0.146
Percentage of Population with Access to Tap Water (%)	0.24	0.17	-0.028	0.137	0.857	-0.054
Percentage of Urban Population with Access to Gas (%)	0.427	0.368	0.33	0.009	0.712	0.031

Table A5: Factor Score Coefficient Matrix

Indicator	Factor					
	1	2	3	4	5	6
GDP (￥100 million)	-0.076	0.123	-0.005	0.061	0.042	0.162
Per Capita GDP (￥/person)	0.057	-0.03	0.09	-0.077	0.021	0.066
Total Investment in Fixed Assets (￥100 million)	-0.069	0.116	-0.009	0.074	0.037	0.176
Total Volume of Retail Sales (￥100 million)	-0.059	0.14	-0.038	0.086	-0.001	0.076
Production Proceeds of Sale of Three Kinds of Foreign-invested Enterprises or	0.017	0.142	-0.081	-0.041	-0.079	-0.18
Total Value of Imports and Exports ($10000)	0.025	0.152	-0.123	-0.012	-0.078	-0.207
Foreign Trade Dependence($10000/￥100 million)	0.066	0.052	-0.034	-0.036	-0.028	-0.166
Tertiary Industry Product (￥100 million)	-0.059	0.118	-0.003	0.068	0.033	0.104
Total Investment of Foreign Funded Enterprises ($100 million)	0.006	0.131	-0.061	-0.022	-0.05	-0.126
Overall Labor Productivity (￥/person*year)	0.075	-0.058	-0.034	-0.188	0.131	0.103
Ratio of Valued Added of the Industry (%)	0.048	0.068	-0.049	-0.109	-0.104	0.226
Urban Proportion (%)	0.06	-0.017	0.081	-0.074	-0.105	0.239
Percentage of Government Revenue to GDP (%)	0.126	0.011	-0.086	0.015	-0.142	-0.276
Per Capita Floor Space of Residential Building (m^2)	-0.026	-0.024	0.247	-0.072	0.001	-0.06
Per Capita Premium Income of Insurance Company (￥)	0.077	-0.019	0.01	0.001	0.001	-0.005
Per Capita Outstanding of Deposits of Financial Institutions (￥)	0.084	-0.011	-0.021	0.034	-0.016	-0.065
Per Capita Net Income of Rural Households (￥)	0.025	-0.015	0.122	-0.055	0.045	0.072
Per Capita Disposable Income of Urban Households (￥)	0.051	0.025	0.057	-0.043	-0.042	-0.106

Engle Coefficient of Urban Households (%)	0.059	0.041	-0.167	0.038	-0.083	0.349
Number of Hospital Beds per 10000 Population (unit)	0.094	-0.047	-0.037	-0.032	0.038	0.117
Number of Doctors per 10000 Population (person)	0.104	-0.041	-0.054	-0.027	0	0.093
Percentage of Personnel Engaged in Technology Activities to Total Number of Employees in the Enterprises above Designated Size (%)	-0.03	-0.006	-0.024	0.339	0.006	0.075
Percentage of Expenditures on R&D to Sales Revenue (%)	-0.02	0.042	-0.012	0.312	-0.049	-0.1
Intramural Expenditures on R&D (￥10000)	0.045	0.005	-0.098	0.204	0.034	-0.045
Ratio of new industrial output value to total industrial output value in the Industrial Enterprises above Designated Size (%)	0.004	-0.062	0.312	0.029	-0.132	-0.173
Money Amount of Technological Market Negotiated Contract (￥10000)	0.063	0.012	-0.041	0.132	-0.048	-0.052
The number of domestic Patent Applications Examined (case)	-0.002	0.149	-0.088	0.04	-0.062	-0.109
Total Enrollment in Regular Institutions of Higher Education Per 10000 Population (person)	0.048	-0.059	0.08	0.06	0.02	0.145
Per capita Area of Urban Gardens and Green Areas (m^2)	-0.015	-0.007	-0.014	-0.068	0.312	-0.047
Percentage of Industrial Waste Water Meeting Discharge Standards (%)	-0.075	-0.054	0.308	0.101	0.035	0.152
Percentage of Industrial Solid Wastes Utilized (%)	-0.008	0.001	0.252	-0.079	-0.119	0.059
Length of Paved Roads Per 10000 Population (km)	0.073	-0.009	0.064	-0.069	-0.068	0.079
Per capita Passenger Traffic of Public Transport (time)	0.084	-0.024	-0.044	0.077	0.002	-0.059
Per capita Business Volume of Telecommunication Services (￥)	0.07	0.039	-0.038	-0.052	-0.013	-0.13
Percentage of Population with Access to Tap Water (%)	-0.055	-0.036	-0.106	0.043	0.527	0.045
Percentage of Urban Population with Access to Gas (%)	-0.038	-0.044	0.049	-0.032	0.388	0.09

Table A6: Factor Scores and Rank of Chinese Provinces

2004	Integrated	R	1st factor	R	2nd factor	R	3rd factor	R	4th factor	R	5th factor	R	6th factor	R
Beijing	1.5516	1	3.622	1	-0.282	13	-0.375	21	2.525	1	0.603	9	-0.415	21
Shanghai	1.3073	2	2.774	2	0.602	5	1.225	5	-1.019	27	0.041	14	-0.284	19
Guangdong	0.8795	3	0.134	8	3.884	1	-1.242	26	-0.604	21	-0.216	18	-1.987	30
Jiangsu	0.5746	4	-0.369	19	2.067	2	0.399	11	0.252	11	0.531	11	0.395	12
Zhejiang	0.4689	5	-0.133	13	1.122	4	1.302	4	-0.414	19	0.854	7	0.606	9
Tianjin	0.4584	6	1.206	3	-0.700	27	1.733	1	-0.980	25	0.590	10	0.772	6
Shandong	0.3279	7	-0.496	23	1.451	3	0.584	9	-0.050	13	-0.909	26	2.280	1
Liaoning	0.2214	8	0.126	9	0.195	7	-0.300	19	1.092	4	0.497	12	0.381	13
Fujian	0.0075	9	-0.332	18	0.068	8	1.371	3	-0.796	22	0.828	8	-0.440	22
Heilongjiang	-0.0811	10	-0.040	12	-0.393	18	0.126	13	-0.061	14	-0.364	21	1.383	2
Jilin	-0.0925	11	0.407	5	-0.434	20	-0.342	20	-0.962	24	-1.007	27	1.357	3
Hubei	-0.1235	12	-0.420	21	-0.013	10	0.572	10	0.542	10	-1.161	28	0.399	11
Shaanxi	-0.1291	13	-0.324	17	-0.407	19	-0.792	24	2.275	2	0.000	15	0.143	14
Shanxi	-0.1627	14	0.082	10	-0.371	16	-0.520	22	-0.147	16	-0.827	25	0.851	5
Hebei	-0.1651	15	-0.817	26	0.006	9	-0.103	16	-0.199	17	1.787	1	1.227	4
Sichuan	-0.2136	16	-0.950	29	-0.085	11	0.070	15	1.190	3	1.202	4	-0.192	18
Hunan	-0.2190	17	-0.626	25	-0.140	12	0.297	12	0.555	9	-0.228	19	0.099	15
Henan	-0.2265	18	-1.024	30	0.327	6	-0.200	17	0.740	7	0.080	13	0.757	7
Chongqing	-0.2267	19	-0.378	20	-0.527	23	1.572	2	0.987	6	-1.936	29	-0.946	26
Xinjiang	-0.2381	20	0.413	4	-0.782	29	-1.543	29	-1.502	30	1.384	3	0.553	10
Inner Mongolia	-0.2390	21	0.312	7	-0.374	17	-1.438	27	-1.014	26	-0.527	22	0.607	8
Ningxia	-0.3391	22	0.329	6	-0.553	25	-0.297	18	-0.826	23	-2.654	30	-0.355	20
Anhui	-0.3454	23	-0.871	28	-0.369	15	0.754	8	0.584	8	-0.052	17	-0.500	23
Jiangxi	-0.3575	24	-0.827	27	-0.546	24	0.103	14	1.006	5	0.916	5	-0.744	24
Qinghai	-0.3932	25	-0.020	11	-0.711	28	-1.848	30	-0.431	20	0.866	6	-0.011	16
Gansu	-0.4094	26	-0.273	15	-0.474	21	-1.121	25	-0.104	15	-0.347	20	-0.156	17
Yunnan	-0.4183	27	-0.162	14	-0.489	22	-0.569	23	-1.190	28	-0.050	16	-0.918	25
Guangxi	-0.4409	28	-0.611	24	-0.553	26	0.949	7	-0.256	18	-0.675	24	-1.535	28
Hainan	-0.4803	29	-0.441	22	-1.166	30	1.157	6	-1.222	29	1.420	2	-1.889	29
Guizhou	-0.4963	30	-0.292	16	-0.352	14	-1.525	28	0.030	12	-0.646	23	-1.438	27

Table A7: Comparison in Integrated Scores and Rank

R	Before	Integrated score	After	Integrated score
1	Beijing	1.6749	Beijing	1.5516
2	Shanghai	1.2523	Shanghai	1.3073
3	Guangdong	0.7850	Guangdong	0.8795
4	Jiangsu	0.4992	Jiangsu	0.5746
5	Zhejiang	0.4629	Zhejiang	0.4689
6	Tianjin	0.3722	Tianjin	0.4584
7	Shandong	0.2474	Shandong	0.3279
8	Liaoning	0.2069	Liaoning	0.2214
9	Fujian	0.0113	Fujian	0.0075
10	Hubei	-0.1201	Heilongjiang	-0.0811
11	Shaanxi	-0.1378	Jilin	-0.0925
12	Heilongjiang	-0.1423	Hubei	-0.1235
13	Sichuan	-0.1544	Shaanxi	-0.1291
14	Chongqing	-0.1702	Shanxi	-0.1627
15	Jilin	-0.1745	Hebei	-0.1651
16	Hunan	-0.1885	Sichuan	-0.2136
17	Hebei	-0.1966	Hunan	-0.2190
18	Shanxi	-0.2163	Henan	-0.2265
19	Henan	-0.2181	Chongqing	-0.2267
20	Inner Mongolia	-0.2617	Xinjiang	-0.2381
21	Xinjiang	-0.2686	Inner Mongolia	-0.2390
22	Jiangxi	-0.3019	Ningxia	-0.3391
23	Anhui	-0.3106	Anhui	-0.3454
24	Ningxia	-0.3393	Jiangxi	-0.3575
25	Guangxi	-0.3469	Qinghai	-0.3932
26	Yunnan	-0.3536	Gansu	-0.4094
27	Hainan	-0.3682	Yunnan	-0.4183
28	Qinghai	-0.4046	Guangxi	-0.4409
29	Gansu	-0.4051	Hainan	-0.4803
30	Guizhou	-0.4329	Guizhou	-0.4963

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