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Basic Public Services (BPS) and Regional Development ——Evidence for China, 2010

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Abstract
This paper attempts to specify a public economic theory to explain the differences and the institutional or political causations of across-regional BPS non-equalization. *Factor Analysis* method is introduced to make clear some of the intricate relationship between these factors, as listed in the paper as basic education, public health, etc., which exert an influence on the non-equalization of BPS. In this way, a comparison can be made between the developments of different regions, and thus factors that cause the differences can be analyzed. For our empirical application, we focus on China's transition economy, which can offer a broad range of institutional environments to examine the relationship between the supply of BPSs and regional development.
Keywords: regional development, BPSs, Factor Analysis

1. Introduction

There is little debate in the literature about whether there is government involvement in regional development. Generally, the regional development apparatus is so entrenched in worldwide, especially after WWⅡ and recently the sub-prime crisis, that it is hard to imagine regions without government involvement. Several OECD countries and regions are experiencing gaps between the poor and the wealthy, meanwhile a part of them are plagued with great economic stroke due to the sub-prime crisis, which would consequently result in political issues if not well- treated. Regarding this regional economic and political development, government involving may be an evitable work-out. BPS, possessing intrinsic characteristics of public properties-non-exclusive and non-competitive, is of great importance in attracting FDI (Foreign Direct Investment) (TIMOTHY GOODSPEED, JORGE MARTINEZVAZQUEZ AND LI ZHANG [2008]) and in ensuring the welfare of regional citizens, thus a great deal attention should be attached.

Two directions of literature on BPS equalization may be broadly identified:

The first one is the analysis of BPS equalization indicator system, as well as the overall trend during certain period. Tifu Ann, Qiang Ren discussed the construction of the BPS equalization indicator system based on regional differences (TIFU ANN AND QIANG REN [2008]). Chengkui Liu, Chaocai Wang studied in the equalization indicator system from the perspective of urban and rural differences and concluded that China's current BPS are unequal, especially in the terms of consumption level (CHENGKUI LIU AND CHAOCAI WANG [2011]). Xuebing Tang built the evaluation system of BPS equalization and found that the overall level showed a declining trend during 1996 to 2006 (XUEBING TANG [2009]). Mingming Zhang, Jiechang Xia found that the East-West equalization of public services had been gradually achieved and the regional differences had been generally shorted (MINGMING ZHANG AND JIECHANG XIA [2009]).

The second is about an explanation to the factors for a specific level of public services. Min Su, Minjun Liu, Xiaojun Jia discussed BPS equalization based on the theory of Poverty Reduction, they found out that there are obvious regional differences of BPS capacity (MIN SU, MINJUN LIU AND XIAOJUN JIA [2011]). Weitong Wang analyzed the urbanization influences on the performance of BPS from the view of fiscal responsibility and Countermeasures (WEITONG WANG [2007a], [2009b]). Jiayong Wang explored the path to achieve BPS equalization and considered that public transfers have a part in it (JIAYONG WANG [2008]). Yihong Zhao, Feng Li make an empirical analysis to factor which impacts the gap across and in the regions (YIHONG ZHAO AND FENG LI [2009]). It is generally believed that BPS is non-equilibrium. However, that how to measure the differences had rarely been discussed.

Both the analysis of the BPS overall level and the research on the causes of a certain BPS level have not given a clear view about how these BPSs rank between regions and what main factors, or we say in this paper the common factors, cause this gaps. Thus the aim of this paper is to shed light on BPS equalization between different regions based on the case study of China. In order to do it, a number of issues both political and economic should be discussed. While our interests are concentrating on the equalization of metropolitan cities[note1] in China, it is likely in our view that this will hold in other regions and countries, as we can draw from literatures that it is the case with United States' public education (MCDONALD [2008] AND WRIGHT [2010]) and Australian transfer system (JOHN CREEDY AND JUSTIN VAN DE VEN [2001]). Inequality in BPS may also hold in urban and rural areas. Moreover, we accord that it is relative equalization that would contribute to our regional development not the absolute one, which would otherwise remove the incentives and hamper government to seek efficiency. The organization of the paper is as follows. Section2 builds BPS structure and the

scoring model. Section3 makes a *Factor Analysis* and does a research on causes of inequality. Secton4 concludes.

2. BPS Structure and Scoring Model

2.1 BPS Structure

A common way to achieve the object of the BPS equalization is to decide what public services should be included in. Although the vast majority of scholars agree that BPS should be given priority when discussing the notion of equalization, they are not exactly make clear what the BPS encompasses. The connotation of BPS is widespread in daily life such as education, employment, insurance, etc. It is truly in such a wide range and such a broad category that always makes scholars miss the corresponding understanding of BPS boundaries both theoretically and practically. While BPS depends on the demands of society members, we should pay attention to the fact that the social and public needs changes as the socio-economic does. The difference in the aware of public services has led to the various viewpoint of BPS.

There is definition in the literature about government role, say planning, financing, regulating and managing, which becomes a core when these scholars tend to figure out what in deed the BPS consists of. On such basis, many researchers have been able to aware of BPS structure especially when combined with different theory. Here's the review.

Yingfa Song, Xingrong Bao has classified BPS into three categories: (1) the systematic one (including general administration, law, justice and defense), (2) the economic one (mainly encompassing productive infrastructure), (3) the social one (including public education, public health and public security, etc.) based on the powerful function of reallocation in terms of government role in regional development (YINGFA SONG AND XINGRONG BAO [2007]). The definition of "policy" may have changed over time, but the focus of attention in "equality" never has. When determining which should be included in BPS if we intend to attach the goal of equal distribution, Changsheng Chen considers the concept "basic capabilities equality" advanced by Amarya Sen should be preferred and then the "resources equality" by Rawls and David Miller followed closely. With the philosophy of "equal", he reasons nine categories of BPS should be given priority in the following order: national defense, basic education, public health, social security, public safety, environment protection, infrastructure, science and technology and general public services (CHANGSHENG CHEN [2007]).

Rather than classifying BPS in a more economic way, the scholars may adopt survival-development rule [note2] (FULIN CHI [2000]) to unveil the BPS structure from the viewpoint of social development. Thus a social-regard view illustrates what the BPS should contain is presented by Xiuzhe Chang, who figures that there are four parts consisting BPS (XIUZHE CHANG [2007]): (1) the basic livelihood services, such as employment and social security; (2) the public unity services, such as compulsory education, public health and medicine care; (3) the nonprofit public services, such as basic infrastructure, ecologically environmental protection; (4) the public safety services, such as production and consumer security, national defense, etc. They consider BPS to be characterized sociality and thus it is sensible for BPS to meet the basic line of survival. The same benchmark goes with Xinjian Liu and Qi Guo's. They focus on the basic civil rights, which in their opinions should be included in when we measure BPS equalization and not be deprived of no matter how different the whole context may vary (XINJIAN LIU AND QI GUO [2007]). The three categories are as follows: the survival—basic medicine security, water supply, heating, housing, etc.; the development—compulsory education, job training, public museums, libraries, cultural centers, etc.; the enjoyment after the achievement of the survival and development—parks, public cinemas, etc.

Although the scholars' concerns differ in the understanding of what could be included in while measuring the BPS equalization, most scholars consider that it is the basic education, public health and the basic livelihood insurance of the disadvantage groups that should be put into a priority list and also the public safety and environment protection be in the measuring scope.

From the literature reviewed above, we can draw the conclusion that the indicators measuring BPS are in a wide range, and each type of service may also include many different specific services or the 2nd level appraising criteria we named in this paper, thus the metrics of the basic public services is not all the same in empirical research. On the conduct of BPS definition and selection principles, as well as taking into consideration categories defined by XINMING WANG AND RUI NAN [2011], and other authors as noted before (CHANGSHENG CHEN AND YUEZHOU CAI [2007], TIFU ANN AND QIANG REN [2008]), the measuring system of this research can be divided into 7 appraising dimensions and 14 appraising criteria for probing into the issue regarding how the BPS equalization be measured and what connection with regional development it may be. It is fairly clear presented in *Table 1*. In this complex system, a wide variety of the 1st level appraising dimension, with the 7 main BPS being: Basic Education Index, Social Security Index, Public Health Index, Public Safety Index, Environmental Protection Index, Public Employment Index and Science and Technology Index. The general structure of such system is shown in *Table 1*.

All data used are taken from the 2011 Chinese Statistics Annual of 31 municipalities related to public services. The 14 appraising criteria in the measuring system for BPS equalizaion is not consistent, for some indicators (e.g. the number of medical treatment beds per million, etc.) are positive, and some of them (e.g. population accident rates) are invers. Different types of individual indicators need different dimensionless handling[note3]. We use the formula standardization method to eliminate the effects of magnitude differences caused by dimensional inconsistency between the indicators. For type of positive indicators, the equation used in this paper would be:

$$y_i = \frac{x_i - \min x_i}{\max x_i - \min x_i}, \quad yi \in [0, 1] \tag{1}$$

Type of inverse indicators, the equation used should be written as:

$$y_i = \frac{\max x_i - x_i}{\max x_i - \min x_i}, \quad yi \in [0, 1] \tag{2}$$

Among them, the y*i* is on behalf of the individual evaluation value, which range between 0 and 1; xi represents the actual value of the individual indicators, the max xi and min xi are chosen to be the actual value of the 31 provinces/cities in different regions, which means maximum and minimum respectively.

2.2 Scoring Model

The wide scope of BPS is a multi-dimensional variable, to which the scientific and objective evaluation is more difficult. This paper applies *Factor Analysis* to a comprehensive evaluation of the basic level of public services in provinces and autonomous regions. The *Factor Analysis* is based on the Principle Component Analysis (PCA). PCA, put forward by Hotelling in 1933, can transform some indexes into several common factors with more meanings, making numerous and hard-compared indexes more likely to be dimensionless. Therefore, *Factor Analysis* can fulfill all its tasks by evaluating those common factors. We present the steps to show how *Factor Analysis* may work in evaluating the BPS equalization. The first is to extract the common factor which contains most of the information an original index could possess. Calculating the comprehensive scores of these few factors based on dimensionless of the multi-index system would be the second one. After these two steps, the consequence can be comparatively high-qualified. To replace the majority of economic indicators with few common factors not only reflects the vast majority of the original indicators information, but also contains a specific meaning. The last step is to use the factor scores to evaluate the relative level of BPS in provinces/cities. *Factor Analysis* can take full advantage of all the data and automatically generate the index weight based on the degree of correlation between the index weights. It do not need expert advice, thus avoid the subjectivity of human to determine the weight, which posses a strong characteristic of objectivity.

Inter-provincial equalization of BPS has a total of 14 indicators, which can be de-dimensionalized with the equation below:

$$S_i = \sum_{i=1, j=1}^{i=31, j=14} y_{ij} F_j, \quad i \in [1, 31], j \in [1, 14] \tag{3}$$

Where

i=metropolitans, j=BPS;

S_i stands for the scoring of 31 metropolitans. As the last result we intend to get.

y_{ij} is the standardization result of each BPS for an metropolitan i.

F_j is a measure of common factor and when applied to this model we choose the fitter one.

3. Factor Analysis

3.1 Factor Loadings

The *Factor Analysis* method is adopted to evaluate the regional levels of BPS. We set a sample with the data of the 31 metropolitans in 2010. *Table 2* shows the result of de-dimensionalization method and some important feature of the main common factors. The key are as follows: “Variance” and “Cumulative value” explain how each factor matters; “Difference” indicate how far between the value and the behinds; “Proportion” and “Cumulative Proportion” have a close connection, which describe what contribution each of the factor makes. We can draw from the *table 2* that the first three of the four common factors in the original variable variance has a cumulative rate of 85.23% to the contribution of the original variable variance. 14 variables using *Factor Analysis* model can get a good dimensionality reduction straightly to four common factors, which will benefit the further analysis, discussion of BPS and the change of the inter-provincial equalization.

3.2 Rotation

In order to assure the authenticity and reliability that could be achieved, an orthogonal rotation and an oblique rotation have been implemented. Those rotations have been used to generate a more effective result. The

big difference is that the factor result after the implement of the orthogonal rotation is still independent with each other, which is more suitable to our expectation. Therefore, we use the maximum variance rotation, one of the orthogonal methods, to make the unit value of factor loading matrix as polarizable as possible. Model greatly committed to this methodology will be more prone to get the result (unit value) distant apart, leaving some of them closely to zero and the remains larger as it can achieve. We set a *two common factors model* to simplify the complex rotation process (TIEMAI GAO, JINMING WANG, YUNFANG LIANG AND YUHONG LIU [2009]).

Firstly, we set the Factor Loading Matrix as follows:

$$L=\begin{pmatrix} l_{11} & l_{12} \\ l_{21} & l_{22} \\ \vdots & \vdots \\ l_{p1} & l_{p2} \end{pmatrix} \tag{4}$$

the orthogonal matrix could be:

$$T=\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix} \tag{5}$$

Where θ accounts for the angles being rotated.

When we multiplied these two matrixes, a new one can be achieved, we name it "L^*":

$$L^*=LT=\begin{pmatrix} l_{11}\cos\theta+l_{12}\sin\theta & -l_{11}\sin\theta+l_{12}\cos\theta \\ \vdots & \vdots \\ l_{p1}\cos\theta+l_{p2}\sin\theta & -l_{p1}\sin\theta+l_{p2}\cos\theta \end{pmatrix}=\begin{pmatrix} l_{11}^* & l_{12}^* \\ \vdots & \vdots \\ l_{p1}^* & l_{p2}^* \end{pmatrix} \tag{6}$$

We are expecting the "new" factors have a more scattered contribution, in other word, some of the variable *p* could be connected to one factors while the remains to another. In the consequence, we introduce the V variable.

$$V_j=\frac{1}{p}\sum_{i=1}^{p}(d_{ij}^2)^2-\bar{d}_j^2, \qquad \text{j=1, 2} \tag{7}$$

Those two variables mentioned are in the meaning of:

$$d_{ij}=l_{ij}^*/h_i, \qquad \text{i=1, 2,…, p; j=1, 2} \tag{8}$$

$$\bar{d}_j=\frac{1}{p}\sum_{i=1}^{p}d_{ij}^2, \qquad \text{j=1, 2} \tag{9}$$

That d_{ij}-squared in (8) is to eliminate the positive or negative symbol influence of different factor loadings, while divided by h_i is to the influence of different common degree. Constrains could be:

$$\max G=V_1+V_2 \tag{10}$$

According to the *Extreme Conditions* (11) and some variables we defined (12) to make the process more transpicuous (RAOTING ZHANG AND KAITAI FANG [1982]), we can get the results (13):

$$dG/d\theta=0 \tag{11}$$

$$u_i=(\frac{l_{i1}}{h_i})^2-(\frac{l_{i2}}{h_i})^2, \qquad v_i=2\frac{l_{i1}l_{i2}}{h_i^2}, \qquad tg4\theta=\frac{c_1-2c_2c_3/p}{c_4-(c_2^2-c_3^2)/p} \tag{12}$$

$$c_1=2\sum_{i=1}^{p}u_iv_i, \quad c_2=\sum_{i=1}^{p}u_i, \quad c_3=\sum_{i=1}^{p}v_i, \quad c_4=\sum_{i=1}^{p}(u_i^2-v_i^2) \tag{13}$$

Furthermore, if the common factors are more than two, we can also gain our expectation gradually, say, if the common factor number is *m*, we would need C_m^2 transformation to finish one rotation. Taking more times of rotation can be a evitable way to receive a better and meaningful consequence until we get a more or less constant total variance. In particular, rather than getting the common factors, *Factor Analysis* intends to well

elaborate the true meanings of each common factor represented to further discussion. The results combined with original data can be showed in *figure 1*.

3.3 Score

One issue addressed by previous experiment is the potential disparities of the aggregate BPS. BPS equilibrium would not stand in a line for 31 metropolitans in China. This in our opinion is likely to happen since public education, public employment, etc. are obviously different in each metropolitan. However, when putting gross regional product (GRP) into these model, one should aim for a close correlation between GRP and common factors as well as the across-region fluctuation in selected group since valuable characters will be present. We use regression method to calculate four common factors' score. The result has been displayed in *figure 1*.

One interesting finding from comparing the results for the four common factors regression is that F1 seems to highly match the trend of GRP when the rest three limit oneself to the reverse opposition of different degrees. Nevertheless, we are not searching for the perfect matching since the BPS score value of 31 metropolitans, after a series of *Factor Analysis* and regression methods, should be understood to be closely connected but not accurately positioned. We focus on the identification of how far each metropolitan would be apart along the achievement of BPS equalization.

According *to figure 1(a)*, F1 and GRP match most. That say, F1 representing the Social Security, Public Employment and Science & Technology factor play an important role in explaining the correlation between regional development and BPS supply. Take Public Employment for example, eastern area like Beijing, Jiangsu, etc. who claims to be the most employ-attracting place has legged behind. It is rightly the most employ-attracting areas that lead to a low sharing of job opportunity since scarce resources have to be allocated to a crowed of people. Exaggerated perceptions of a strong unbalanced implement of employment policy are frequently nourished by the advocacy of identical pace of regional development. The regional economic development and the awareness of employment for government are crucial to the implement and regulatory of employment policy. There's much room for government to make things right. Policy designer and maker should balance the implement of employment policy according to the various regional economic developments, as to the maximum to decrease the welfare gap between participants and non-participants of a certain employment policy, and encourage more groups to enter the scope of such project.

Focus on *figure 1 (b)*: the correlation between Environmental Protection factor and GRP. Most west-northern area gets a low score due to inadequate work of environmental protection, as we can list Qinghai, Shanxi, etc. It also provides some evidence that densely populated metropolitans, such as Beijing, Tianjin, Shanghai, Guangdong, etc. is indeed scoring low. That is to say, if we consider making regional policies, the environmental protection factors should not be neglected. In general, however, one can observe the environment standards tend to become more stringent as regional economic grows and that large scale environment program are also connected with a regional GRP level, while individual awareness and involvement in environmental protection may manifest themselves somewhat independently of the level of regional economic growth.

Figure 1 (c) illustrates the basic problem associated with regional development, the education. It shows that when comparing F3 and GRP, an observed curves can be a combination of two separate trends, one being relatively high and the others positioning lowly, list Beijing and western areas like Sichuan, Yunnan, respectively. As we know, human capital has a positive externality. Thus, when promoting the regional development, improving the quality of regional labor force would be a necessity. In conjunction with these externalities, one must note the importance of the effect associated with all kinds of education degrees. It no longer suffices for a region to have a university educated labor force; one needs a well-educated university labor force with advanced degrees and thus specialized training to compete. As a crucial part of BPS, regional government should invest in generating, attracting and preserving high levels of human capital in the same way of physical infrastructure.

Rather than other figures, *figure 1 (d)* may be the least related to the trend of GRP, leaving itself much lower to the GRP, which indicates that the public health factor and public safety factor may not be as good performing in reality as that of other common factors. We also notice that economic developed regions as Beijing, Tianjin, Shanghai has a relatively higher score of Public Health and Public Safety factor as well as some developing areas but sharing the support of central government, like Tibet, Qinghai, Ningxia. As always, opportunities are not equally distributed among regions due to a monopoly power gained from an incentive of additional equipment and services. Public hospitals, with larger per capital budget, have more possibilities than private hospitals in price setting, size expanding, technical advancing and structural optimizing, which result in the low market vitality of medical services and the low efficiency collocation of health care resources. This would also imply that, if the regional government really intends on maximizing their citizens' welfare, the emphasis of Public Health could be a proper way. Coming to our region, the low score of F4 shows that the impact of differentials in health care is expected to be large.

In order to get a full view of regional provision of BPS, we use the regression method to synthesize four common factors and make a final score showed in *figure 2*.

To make it easy understanding we divide those 31 metropolitans into 3 categories. The first category includes Beijing and Shanghai, both achieving a higher level of equalization. Beijing and Shanghai, as the Chinese capital and the largest economic center, separately, have better economic base, therefore they can enjoy a comprehensive regional development, and consequently the corresponding high level of equalization. To some extent we can conclude the level of regional equalization has a great connection with and economic foundation and development capacity. However, the scores of central and western provinces such as Jilin, Gansu, Hunan, etc. is in contract with conclusion above: although the economic base and the general regional development capacity are relatively weak, the equalization of the levels are relatively high. That is to say, the provision of BPS is also associated with other factors such as government transfer payments and the policy orientation. The third category is the Shaanxi, Henan, Sichuan with a lower level of equalization. Policy makers should take into account the varieties of each region and treat differently.

It is important to remark that the analysis applied not only to Chinese BPS supply, also potentially to a broader range of regional development concerning BPS equalization. Although the inter-district public service gap is a combined result of many factors, the fiscal capacity between inter-districts as well as government supply preference are undoubtedly the most direct causations. That is, the central government, as the provider of BPS supply system, should balance the financial capacities each states possesses through the innovation of institutional system and mechanism to change the incentive structure of regional government and optimize their behavior. Specifically, the central government should give full play to the redistribution functions of public finance, increasing financial transfer payments to economic-underdeveloped areas (as we can see from China's example: the central and western regions). Decentralization may work as a laboratory for new policies, which can be transferred from the leading region to the other (the poorer). However, the establishment of more efficient transfer payments system access to roughly equal public services for all the residents is not enough. At the same time, building a public finance system to make regional government get access to scarce resources and speed up the local government's transition from an economic growth-based one to a public service-based one is necessary. When implement this strategy, the scope should be narrow, limited to the activities for which the regional authorities can take responsibility. Consequently, we could achieve the goal of efficient allocation of financial capital for BPS. The core lies in the current financial system to change the incentive structure of local government.

4. Concluding Remarks

Applying empirical method to analyse the economic problems is currently under development. For a detailed description of this method, see (TIEMAI GAO, JINMIN WANG, YUNFANG LIANG AND YUHONG LIU, "The model and method of empirical analysis," [2009]). The method would be used during the econometric research phrase, in order to supply the explanations of economic phenomenon and the analysis of economic theory as well as the forecasts of future development with validity. In their writing, Tifu An, Qiang Ren, etc, clearly brought to light several features of BPS and the index design method (TIFU AN AND QIANG REN [2007]). We focus on the relative level of the supply of regional government and those four common factors affecting them. Such a analysis is likely to clarify the construct of BPS and therefore makes the evaluation more effective than initial expected.

Our quantitative institutional analysis yields results in line with TIMOTHY GOODSPEED's [2008] contention that "the adequate provision of public services in a broad sense […] would seem to be an important policy principle for regional and central government. These government need to offer a package of public services that generate benefits that are commensurate with the taxes that the beneficiaries will pay." The crucial role of the regional economy as an institutional system driving the provision of BPS seems close to the BIRD [1994] notion of "the equalization process is always and inevitably political."

The research result indicates that it is the equal provision of BPS that matters much in regional development. In order to gain a better performance, much work hereby can be done to achieve higher level of public services institutionally and politically. The next stage of the research will focus on the measures that could reduce these gaps, say, how much to equalize. The economic bases, transfer payments and comprehensively regional development could be seriously analysed. This will allow more complex method in respond to the provision of BPS and regional development.

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Note:

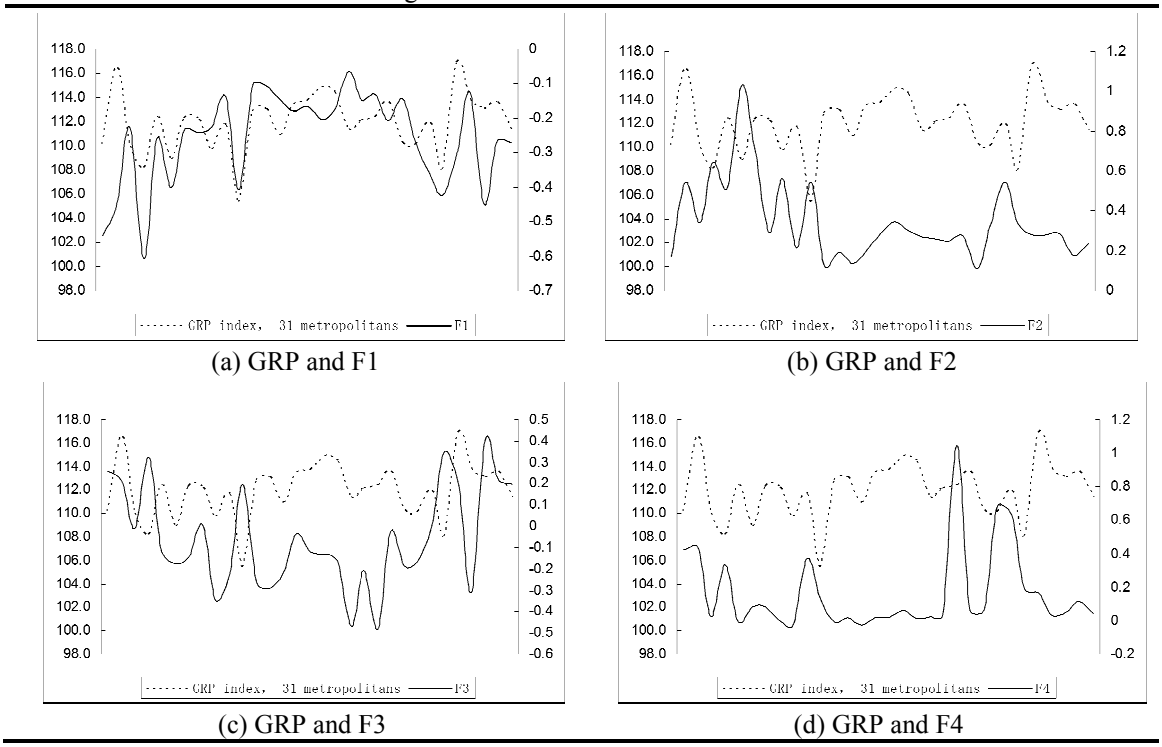
Note1: Since 2005, four economic regions of the statistics on the mainland of China, namely the eastern, central, western and northeastern region, were formed as follows: Eastern regions, including 10 provinces/cities like

Beijing, Tianjin, etc.; Central regions, including 6 province as to Shanxi, Hunan etc.; Western regions, including 12 provinces, that is Chongqing, Sichuan, etc.; Northeast region includes Liaoning, Jilin, Heilongjiang.

Note2：Fulin Chi put forward that economic and society developed versus the public governance structure lagged behind is one of the three major contradictions exiting in China. As early as 2000, Fulin Chi strongly discussed the most outstanding achievements of the reform is that we made a historic change in social stages. In his view, China has been starting the pace in the translation of "survival stage to development stage".

Note3：Indicators dimensionless: due to the different dimension of each index, the indexes themselves can not be compared and computed with each other, thus the indexes need to be dimensionless before the comprehensive analysis. The so-called dimensionless is to remove the impact of the dimension and magnitude, putting the actual value of the indicators transform into the integrated evaluation value, so as to solve the comprehensive evaluation of the all-sided indexes.

Figure 1 Common factors and GRP



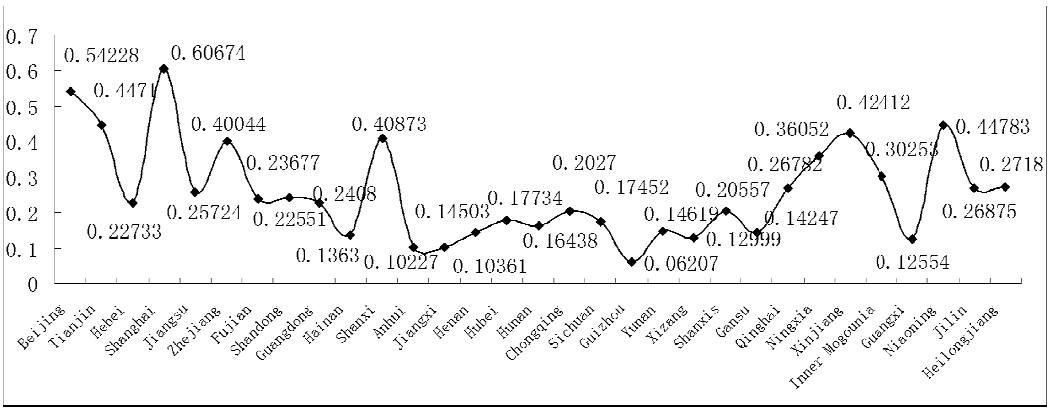
(a) GRP and F1 (b) GRP and F2

(c) GRP and F3 (d) GRP and F4

Source: author using the 2011 Chinese Statistics Annual micro data. (http://www.stats.gov.cn/tjsj/ndsj/2011/indexch.htm)

Notes: work out through original data and *Table 2* to get the score, using a regression method. X-axis is for 31 metropolitans; Y-axis-left for Gross Regional Products (GRP), while Y-axis-right for the scores of each common factor.

Figure 2 The score of 31 metropolitans



Notes: the comprehensive value of provision of BPS, 31metropolitans. X-axis explains for the 31 metropolitans and Y-axis for the scores.

Table 1 BPS index system

Classify index	*Individual index*
Basic Education	Junior high school student-teacher ratio (SER02)
	Pupil-teacher ratio (SER02)
Social Security	The proportion of pension insurance people to the total population (%)(SER03)
	The proportion of unemployment insurance people to the total population (%)(SER04)
Public Health	One medical treatment bed per 10,000 people could have (bed / million) (SER05)
	One doctor per 10,000 people could have (doctor/million)(SER06)
Public Safety	Traffic incidence (happening / million) (SER07)
	Fire incidence (happening / million) (SER08)
Environmental Protection	One set of wastewater treatment facilities per 10,000 people could have (sets/million) (SER09)
	One set of air control facilities per 10,000 people could have (sets/million) (SER10)
Public Employment	Ratio of unemployment (%)(SER11)
	Average wages (RMB）(SER12)
Science &Technology	Number of the licenses of domestic invention patent per 10,000 people could have (license/million)(SER13)
	Technical market turnover per 10 000 people could have (RMB/million)(SER14)

Note: the Classify index and the Individual index is too much to list all of them, so we just select some typical index according to definition of BPS and selection principles of evaluation index system. The selection of these indexes is based on numeral and previous research of BPS mentioned above. In such a system, we choose 7 main classifications covering the scope of BPS more accurately.

Table 2 Factor analysis of BPS before rotation

14 indexes and 4 common factors

	F1	*F2*	*F3*	*F4*	*Communality*	*Uniqueness*
SER01	-0.401002	-0.412216	-0.041450	0.521203	0.604095	0.395905
SER02	-0.097625	-0.424228	-0.025427	0.450073	0.392712	0.607288
SER03	0.739163	0.551363	0.202112	-0.162029	0.917466	0.082534
SER04	0.675648	0.697156	0.239735	-4.88E-16	1.000000	0.000000
SER05	0.326112	0.623002	0.123387	-0.545320	0.807078	0.192922
SER06	-0.298197	0.387001	0.872530	1.30E-16	1.000000	0.000000
SER07	-0.476529	0.267449	-0.571616	0.109234	0.637285	0.362715
SER08	0.025362	-0.295018	-0.390620	0.394121	0.395594	0.604406
SER09	0.843422	-0.506786	0.178345	-5.53E-16	1.000000	0.000000
SER10	0.592838	-0.090833	0.260390	-0.566887	0.748872	0.251128
SER11	0.377304	0.453841	0.088924	0.467603	0.574890	0.425110
SER12	0.416805	0.518520	0.614921	0.109426	0.832691	0.167309
SER13	0.824244	0.221160	0.329843	0.120182	0.851531	0.148469
SER14	0.377463	0.800817	0.198541	0.194991	0.861226	0.138774

Factor	*Variance*	*Cumulative value*	*Difference*	*Proportion*	*Cumulative proportion*
F1	3.796948	3.796948	0.530427	0.357412	0.357412
F2	3.266521	7.063469	1.276111	0.307482	0.664895
F3	1.990409	9.053879	0.420847	0.187360	0.852255
F4	1.569562	10.62344	---	0.147745	1.000000
Total	10.62344	30.53774		1.000000	

	Model	*Independence*	*Saturated*
Discrepancy	3.476130	16.92612	0.000000
Chi-square statistic	104.2839	507.7837	---
Chi-square prob.	0.0000	0.0000	---
Bartlett chi-square	75.89551	414.6900	---
Bartlett probability	0.0007	0.0000	---
Parameters	64	14	105
Degrees of Freedom	41	91	---