The Analysis of Basic Public Service Supply Regional Equalization in China's Provinces——Based on the Theil Index Evaluation

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Abstract. Accomplishing the regional equalization of basic public service supply among the provinces in China is an important objective that can promote the people's livelihood construction. In order to measure the problem which is about the non-equalization of basic public service supply, this paper takes these aspects as the first index, such as the infrastructure construction, basic education services, public employment services, public health service and social security service. At the same time, it cooperates with 16 index as the second index to construct the performance evaluation systems, and then use the Theil index to evaluate the performance in provinces that using the panel data from the year 2000 to 2012.

1. Introduction
Recently, the equalization of basic public services has become an important strategic goal of the national macroeconomic regulation in China. The spatial allocation of basic public services, should give full consideration to the efficiency and justice problems, coordinating quality and level of basic public service among the different provinces, and ensuring the equalization of basic public services in space allocation. But it is undeniable that there are still some problems such as imbalance in the structure of supply among the provinces in the field of education, employment, medical care, health and other public services in China at present, which leads to unfair treatment situation in the construction of basic public service [1]. Therefore, determining scientifically the supply of basic public service and analyzing its spatial pattern the spatial variation mechanism can provide scientific and necessary decision for China to formulate and implement the policy on regional equalization of basic public services.

For the problems about regional equalization of basic public services supply, many scholars have conducted beneficial exploration. Grand [2] and World Bank [3] pointed out the regional non-equalization of basic public services is the universal problem. Because of development and income gap in urban and rural areas, regions, groups and personal aspects at the present stage in China, Liu S X [4] said that it was mainly caused by the system reason, which was unable to eliminate to rely on a single region, groups and individuals. Pan X G [5] thought that the problem about the non-equalization of basic public service supply was mainly originated from local government insufficient supply capacity, the single supply object, the lack of unified clear supply standards. Xiang J Q [6] gives a general induction to the reason of non-equalization of basic public services among regions in China: the unequal possession of resources; the service consumption inequality; the dualization and legal rights imbalanced in service system.

How to measure the non-equalization of basic public service supply, Powell & Boyne [7] argued that it was about equal that the ratio of the expenditure of public services and local demand were equal in
different areas. Combined with the per capita tax contribution index, Boyle & Jacobs [8] measured the equalization of public service distribution from tax contribution in different regions. Zang N K [9] analyzed the equalization of basic public service from the aspects of the government performance obstacle. He thought that it was the cause of equalization process of appraisal obstacle that fair value lost, the frame system of general index failed to meet the requirements of basic public service, and a single governance structure was formed. However, the key to eliminate obstacle is to clarify the value of equalization performance evaluation, construct the index system, and promote the diversification of main performance evaluation.

In conclusion, the problem of non-equalization supply of inter-provincial basic public services in China is very prominent. But the existing research on the ideas behind the phenomena of non-equalization and empirical analysis on the non-equalization of difference measure is still not thorough. Furthermore, the existing research results on the spatial scale and scope of provincial differences in basic public services also has limitations. The selection of evaluation index is not reasonable and the calculation method also exists problems and is not standard. Based on these, this paper will construct an evaluation index system of the equalization of basic public service supply. By using the Theil index to measure the quality and level of inter-provincial supply of basic public services in China.

2. Index system, evaluation methods and data description

2.1. The content equalization of basic public services and structure of index evaluation system

In general, equalization is a reflection of the fairness, which means the non-discriminatory basic public services for different provinces. Thus, this paper evaluates the equalization of basic public services supply from the level of investment performance.

Based on the previous researches, the paper designs Indicator system, like Table 1 that contains 5 primary indicators and 16 secondary indicators that can measure and evaluate the basic public services supplies situation of Chinese provinces' equalization, according to the connotation of basic public services, systematizes, integrity, selection of cross data, statistics data availability, and index system reliability into account.

| Primary Indicators | Secondary Indicators |
|--------------------|----------------------|
| Infrastructure     | Railway mileage per capita (Km/ten thousand people) |
|                     | Highway mileage per capita (Km/ten thousand people) |
|                     | Ordinary primary school student-teacher ratio |
|                     | Ordinary junior middle school student-teacher ratio |
| Basic education services | Total education funds input per ordinary primary school student (Ten thousand yuan/per capita) |
|                     | Total education funds input per junior middle school student (Ten thousand yuan/per capita) |
| Public employment services | Registered urban unemployment rate (%) |
|                     | Employment agencies (Unit/hundred thousand people) |
| Public health service | Possess number of health institutions (Unit/thousand people) |
|                     | Possess number of hygienic personnel (Person/thousand people) |
|                     | Possess number of health institutions bed (Unit/thousand people) |
| Social security services | Urban and rural residents social insurance joining rate (%) |
|                     | New rural cooperative medical insurance joining rate (%) |
|                     | Urban basic medical insurance joining rate (%) |
|                     | Urban minimum living allowance level (Yuan/per capita) |
|                     | Rural minimum living allowance level (Yuan/per capita) |

2.2. Theil Index
Theil index is an analysis method that commonly measures the income disparities of inter-individual or inter-regional, or that the degree of inequality analysis method. Because evaluating the regional equalization of basic public services supplies contains with no significant values, but equally regard basic public service provision levels of regions or provinces as a unified index [10]. So, this paper gives the same weight to the different provinces, choosing Theil index to evaluate the regional equalization of basic public services supplies levels.

In general, the Theil index is calculated as

$$E(y) = \frac{1}{n} \sum_{i=1}^{n} \frac{y_i}{\mu} \ln \frac{y_i}{\mu}$$

Where represents the number of samples, which means the number of provinces; represents income of the province that ranged from low to high. the range of Theil index is, 0 means complete equality, and the higher the value, the greater the degree becomes inequality. The most important feature of Theil index is that can measure the contribution of internal group gaps and gap between groups to total gaps.

2.3. Data Sources
The data are from the authoritative materials of National Bureau of Statistics and other departments, which include China Statistical Yearbook, China Population and Employment Statistics Yearbook, Educational Statistics Yearbook of China, China Affairs' Statistics Yearbook, China Health Statistical Yearbook, and National Economic and Social Development Statistics Bulletin of nation and provinces.

3. Inter-provincial equalization performance evaluation results
According to the performance evaluation system that constructed above, this paper calculate Theil index using panel data from 2000 to 2012 years, and evaluating the equalization performance of primary levels of infrastructure construction, basic education, public employment services, public health services and social security respectively.

3.1. Infrastructure supply equalization performance evaluation
From Fig. 1 we can see that the tendency of infrastructure supply differences of Chinese provinces appears increasing first and then decreasing since 2000. Theil index shows significant upward trend from year 2000 to 2003, Theil index of railway mileage per capita and highway mileage per capita reaches 0.2780 and 0.1710, respectively in 2003. But then gradually reduce after 2003, especially after 2005, Theil index of railway mileage per capita and highway mileage per capita reaches 0.0710 and 0.0540, respectively in 2012. The data suggests that the gap of infrastructure equalization of basic public services supply in China is shrinking in recent years, but the reductions of extent are inconsistent in different years.

Figure 1. Theil index tendency of inter-provincial infrastructure construction.
Analyzing the reasons for this trend, it probably applied to the implementation of a series of regional development strategies since 2003, such as the developed of the western, central northeast region in China. The country constructs infrastructure, especially increases inputs of railway and highway construction in the less developed central and western provinces, which narrowed the gap between them and the developed eastern provinces. Meanwhile, the nation has implemented "village road", the benefits of agricultural policies, increasing supply services of infrastructure construction in rural areas since 2005, which also plays an important role to narrow the gap between developed provinces and backward provinces.

3.2. Basic education services supply equalization performance evaluation
Fig. 2 is the Theil index trend of basic education services from year 2004 to 2012, which reflects the degree of equalization changes that primary education supply of Chinese provinces. Four evaluation indicators selected from this point of view since 2004, the inequalities of ordinary primary school student-teacher ratio and Ordinary junior middle school students-teacher ratio have gradually improved. Theil index showed a slight downward trend especially since 2006, which shows the differences between provinces gradually reduced from the school size of ordinary primary schools and ordinary junior middle school, but the absolute values are still great different, it still needs to be worked that narrow differences in resource allocation of ordinary junior middle school conditions.

However, Theil index of basic education funds input has kept rising since 2004, suggesting that exacerbate unequal degree of inter-provincial investment in basic education. For the reason, developed provinces increase investment of basic education services caused by the demand of talents and development of basic education, but relatively speaking, because of insufficient financial resources or not enough attention of less developed provinces, funds for basic education in terms of the total the amount or in the growth rate, are not as much as developed provinces, resulting in the gap continues widening.

![Figure 2. Theil index tendency of inter-provincial basic education services.](image)

3.3. Public employment service supply equalization performance evaluation
Employment problem is serious issue that government efforts to solve, and the realization of public employment services can play an important role in guaranteeing employment of residents. In view of the data are not available, the article selects two indicators that are the registered urban unemployment rate and the number of employment agencies per hundred thousand people to measure the Theil index during the equalization performance evaluation process of inter-provincial public employment service. From Fig. 3, the difference between the registered urban unemployment rate is very small. Probably due to the characteristics of the statistical aspects of employment in China, the registered urban unemployment rates of provinces are very low, remained at 4% or less, and thus the Theil index of urban registered unemployment rate is small.
But investigating the number of employment agencies per hundred thousand people, Theil index slightly fluctuated in these 11 years, substantially widening, this inequality was the most evident especially since 2008. Theil index was 0.2647 in 2008, but the Theil index rose to 0.4220 in 2010, it remained at 0.4005 in 2012, which reflects the basic public service provisions in the aspect of employment agencies are great different. This condition may be related to the financial crisis in 2008, the serious problem of unemployment caused by the economic downturn, such as the severe unemployment of economically developed coastal provinces, employment demand increases, prompting the government is committed to put in the public employment service protection, but because the employment situation is different among provinces, this situation exists inequality gap.

![Figure 3. Theil index tendency of inter-provincial public employment services.](image)

### 3.4. Public Health Services Equalization Performance Evaluation

Used the data in the year 2000-2012, and selected the number of health institutions per thousand people. The number of health workers per thousand people and the number of beds per thousand people health institutions as the measure indicators to calculate Theil index of inter-provincial equalization of public health services, the calculation results are shown in Table 2.

| Year | Number of health institutions per thousand people | Number of hygienic personnel per thousand people | Number of health institutions bed per thousand people |
|------|-------------------------------------------------|-----------------------------------------------|-----------------------------------------------------|
| 2000 | 0.0163                                          | 0.2536                                        | 0.1271                                              |
| 2001 | 0.0177                                          | 0.2548                                        | 0.2090                                              |
| 2002 | 0.0215                                          | 0.1429                                        | 0.2128                                              |
| 2003 | 0.0172                                          | 0.1455                                        | 0.1328                                              |
| 2004 | 0.0168                                          | 0.1406                                        | 0.1293                                              |
| 2005 | 0.0157                                          | 0.1248                                        | 0.1170                                              |
| 2006 | 0.0154                                          | 0.1200                                        | 0.1031                                              |
| 2007 | 0.0187                                          | 0.1245                                        | 0.0847                                              |
| 2008 | 0.0181                                          | 0.2544                                        | 0.0612                                              |
| 2009 | 0.0234                                          | 0.0919                                        | 0.0484                                              |
| 2010 | 0.0230                                          | 0.0768                                        | 0.0391                                              |
| 2011 | 0.0290                                          | 0.0684                                        | 0.0325                                              |
| 2012 | 0.0288                                          | 0.0677                                        | 0.0317                                              |

The inter-provincial gap for public health services is small, provincial public health service equalization performance is better. This fully shows that public finances construction has been
continuous improved and central government increase the control efforts of the public service investment, including medical. Under such background, the equalization effect of public health services in China achieves good success, public health service gaps between provinces gradually narrowing. On specific indicators, the gaps between the health sectors were narrow from year 2003 to 2008, but inequality trend exacerbated since 2009. Based on the perspective of number of health technology ownership, although the Theil index fluctuated, but oh the whole the trend showed a narrow, the gap narrowed significantly especially in recent years. The number of beds from health institutions Theil index, declining inequality in provinces, suggesting that the gap is shrinking each year, Theil index reduced to less than 0.0500 especially since 2009.

The reason may be closely related to Chinese medical system, optimize the allocation of resources for health care and investment increasing in public health services. In 2009, the implementation of the national "new medical reform" policy to open a new round of health care reformed, the introduction of a series of policies to increased the healthcare investment of backward areas and less developed provinces, effectively promoted the construction and development of public health services. All of these make the inter-provincial public health resources optimize configuration and constitute a reasonable medical regional development planning, which contribute to vertical and horizontal equalization produced remarkable results among public health services of rural, provincial, eastern and western areas, large hospitals and primary hospitals. So, after development of years, the gap among the provincial public health services are narrowing, equalization performed better overall.

3.5. Social security services supply equalization performance evaluation

From index Theil index of Table 3, urban and rural social endowment insurance and basic medical insurance for urban social security system are both the largest non-equalization degree among the provinces. At present, social security system is still in the pilot and the process of constantly improvement, for example, the national implementation of the new rural social pension insurance system piloted in 2009 and the national implementation of social pension insurance system for urban residents piloted in 2011, and the country to achieve to merger urban and rural social endowment insurance system in 2014. In order to achieve the equalization in the future, development of urban and rural residents' social pension insurance system should focus on the "pavement" and narrow "treatment gap".

Theil index of urban basic medical insurance rate fluctuate frequently, but rise significantly, especially since 2008, this difference significantly expanded. However, it should be seen, whether it is a single system, or merge system, its Theil index is above 0.1600, which indicates that the construction of medical insurance system for urban has large disparities and high levels of inequality among provinces, it is a heavy task to narrow provincial urban basic medical insurance system construction.

Look at NCMS, urban and rural subsistence allowances Theil index, the inter-provincial gap is not large and keep downhill trend, which has relationship with achieving a full coverage in the country since 2010. NCMS implement system characteristics, such as voluntary insurance, government subsidies, high reimbursement and so on, accessing the trust of rural residential. The system is running effective, which has achieved an equalization result. Meanwhile, after 10-year development of urban and rural subsistence allowances system, the gap between the provinces in terms of benefit levels are reduced, the equalization performance is also good.

| Year | Urban and rural residents social insurance joining rate | New rural cooperative medical insurance joining rate | Urban rasic medical insurance joining rate | Urban minimum living allowance level | Rural minimum living allowance level |
|------|-------------------------------------------------------|--------------------------------------------------|----------------------------------------|---------------------------------|-----------------------------------|
| 2006 | 0.5939                                                | 0.0721                                            | 0.1703                                 | 0.1023                          | -                                 |
| 2007 | 0.6221                                                | 0.0649                                            | 0.1783                                 | 0.1070                          | -                                 |
4. Conclusions and suggestions

4.1. Conclusions
Based on the regional equalization performance of basic public services supply in China measured by Theil index, the results show that the provincial unequal phenomenon in the supply of basic public services is obvious, and there are significant differences in status and trend of non-equalization of basic public services in different supply.

4.2. Suggestions
Firstly, strengthen the government's equalization functions of basic public service delivery. We should adjust the structure of revenue and expenditure. At the same time, we can expand the coverage of basic public services, including more groups into the scope of services. Revenue resolves the imbalances of income among fiscal, corporate and resident. Expenditure solves imbalances that between different projects and between the central and local governments. Maintain public services prices relatively stable. Standardize financial transfer payment, optimize the financial transfer payment system, increase the size and proportion of general transfer payments, enlarge spending on public services, and improve balanced transfer payment.

Secondly, building diversified regional equalization standards of basic public services supplies. Fully consider the characteristics of each public services and contents, and combined with a specific level of social-economic development to ensure equalization of public services supply that associated with the most basic livelihood. The form of standard setting can be diversified, establishing the standard system, which combine monetary standard, physical standards and time standard that depend on the characteristics and differences of different service projects.

Thirdly, building a dynamic monitoring system of basic public service provision. Improve government performance evaluation mechanism, increase the supply of basic public services and the weight of equalization effect. Establish monitoring and evaluation system of basic public services. Under the guidance of the central government, according to the basic public service provision related to the equalization standard, requiring local governments to set up monitoring and evaluation organization, assess with a certain authority, and publish the result as bulletin annually for basic public services supply situation in their areas of jurisdiction.

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References
[1] Liu S L and Hu AG 2010 Inspection of infrastructure externality in China:1988-2007 Economic Research Journal vol 3 p 4-15.
[2] Grand J L 1982 The Strategy of Equality: Redistribution and the Social Services (London: Allen and Unwin) p 156.
[3] World Bank 2004 World Development Report 2004: Making Services Work for Poor (Beijing: Chinese Financial & Economic Publishing House) p 29.
[4] Liu S X 2007 Equalization of basic public services: The practical requirements and policy path. *Zhejiang Economy Journal* vol 13 p 24-27.

[5] Pan X G and Zhang X 2014 Realization path of contemporary Chinese equalization of basic public services. *Journal of Jianghan University (Social Sciences)* vol 2 p 29-34.

[6] Xiang J Q 2008 Equalization of basic public services: Policy objectives and system security. *Journal of Huazhong Normal University (Humanities and Social Sciences)* vol 1 p 78-94.

[7] Powerll Martin and Boyne George 2011 The spatial strategy of equality and the spatial division of welfare. *Social Policy & Administration* vol 2 p 181-194.

[8] Boyle and Jacobs 2009 Social economy involvement in public service delivery: Community engagement and accountability. *Regional Studies* vol 7 p 981-992.

[9] Zang N K 2009 Government performance assess and digestion disorders of equalization of basic public services. *Jiangsu Social Sciences* vol 3 p 115-120.

[10] Lei X, Han B.T and Shang Y 2011 The spillover of knowledge level in Yangtze River Delta: Based on Theil Index. *Science of Science and Management of S.& T.* vol 6 p 81-85.