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Differential Evaluation of Urbanization Development Based on Super-Efficiency DEA Method

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Abstract: The super data DEA method is used to establish the super data model for the experimental analysis, which can effectively analyze the differences in the urbanization construction of each city in the country. Based on the differences of urbanization in major cities across the country, this paper uses DEA model to conduct experimental modeling and analysis of data, and carries out a comprehensive evaluation of the differences in urbanization development based on the obtained chart information. Through the experimental demonstration, it is concluded that the super efficiency data envelopment analysis model is more scientific and reasonable than the ordinary method, and can effectively evaluate and sort the urbanization construction efficiency of several different cities.

Keywords: Urbanization; DEA model; Data analysis

1. Introduction

According to the current basic situation of China, some areas cannot achieve the best in the utilization of resources and the benefits of various industrial in the process of urbanization development, and there are some deficiencies corresponding to them[1].The super data DEA is also called data envelopment analysis. And the super data DEA model is a new pioneering work in the research field of operational research, which is used to study the relative effectiveness of the components belonging to the same category. At present, the application rate of the super data DEA model is growing strongly. Some literature at home and abroad began to use DEA model to explore the trend of economic growth and the development of national modernization. The Super data DEA model is based on linear programming and is a model method based on functions. If the socio-economic development of the country is to be coordinated with the progress of urbanization, it is mainly to increase the utilization of resources and to highlight the robustness of urbanization development.

2.Establishing a Differential Evaluation Model of Urbanization Development Based on Super-efficiency DEA

The development of a city can be reflected in many aspects of data research. It is generally reflected in per capita GDP, newborn infant mortality, per capita energy consumption, and people's cultural literacy. Using the super data to model the GDP can effectively analyze the differences in urbanization development of each city[2].The super efficiency DEA includes several data models such as CCR, BCC, SBM and so on. The DEA model is a hypothesis method, assuming that the number of objects studied in a group is n, and the objects in the study include m output variables and s input variables. The 'j' represents the output variable, which belongs to the k-th studied object. The 'x' represents the i-th input variable, which belongs to the k-th studied object. Then the problem of calculating the total efficiency of the k-th research object can be transformed into a simple formula. The number of study objects in a group is n, and the study object has m output variables and s input variables, and the j-th output variable is one of the k-th studied objects. The Ikx refers to the i-th input variable belonging to the k-th studied object. Based on the interrelationships among these variables, the functional model can be used to compile the formula for calculating the total efficiency of these research objects.

$$(CCR) s.t. \sum_{j-1}^{n} Xj\, l\, j \le q\, Xk$$

$$\sum_{j-1}^{n} Xj\, l\, j \ge Yk$$

$$l \quad j \ge 0, \quad j = 1, \ldots\ldots, n$$

In the formula, Xk (X1k, X2k...Xmk) and Yk (Y1k, Y2k...Ysk) indicate that each decision unit has s input variables and m output variables. The input vector is Xk=(X1k,X2k...Xmk) and the output variable is Yk=(Y1k,Y2k...Ysk). The CCR model is used to build the functional relationship according to the above method. The differences between the CCR model and the traditional methods include: The data model established based on the CCR model is obtained when the specific research method is unchanged. The θ of the formula is the overall

value of the j-th unit under consideration. When the number of studies satisfies $10 \leq \theta$, it means that the value of Y produced by an iconic unit in a certain research field is the linear relationship developed by all k research objects, which can influence the value of X and affect the compressibility of X. At this time, the value of the proportion of the study is θ, and θ is called the efficiency measurement value [2].When θ=1, it means that the target being studied is the point on the efficiency frontier, so this bit is valid. However, for an invalid cell of $1<\theta$, $\theta-1$ means that the k-th studied cell is larger than the input, which means that the input ratio can be reduced. For units that are effectively studied, the calculated efficiency value may be greater than one. If the calculated efficiency value is 1.2, it means that the research unit can maintain relatively effective in the researched area even if it is increased by another 20 percent[3]. Super data DEA models generally include ST, FG, BC2, and C2R, etc. When multiple DMUs are simultaneously valid, C2R and BC2 models often fail to achieve further comparison and evaluation of these parts. When the corresponding data is analyzed, if the number of samples is too small, the accuracy of the evaluation based on the BC2 model is not very high and therefore cannot effectively deal with the difference between technical efficiency and random disturbance. At present, our country has gone farther away from the road of socialist construction, and achieved the common progress and prosperity of the whole nation. In terms of urbanization, we should pay more attention to the goal of regional development and achieve common progress. In the study of the trend of urbanization in every city in China, it is more intuitive to show the status of urbanization in each city and the direction of efforts through the use of the data model of super data DEA, which can promote the development of the city more effectively[4].Therefore, through various studies, it shows that the leading organizations in China should put the urbanization construction in an important position. In the primary stage of socialism, the Chinese mainland has formed a demonstration effect after the reform and opening up.

3. Examples of DEA Evaluation of Differences in Urbanization of Each City

Among the researches based on the super-efficiency DEA model, which aims to study the urban construction of the cities in the whole country, there are few relevant data to comprehensively evaluate the geographical differences in the construction of urbanization. By consulting relevant data, the method of super data DEA[4] can effectively analyze the cultural differences in the urbanization construction of all cities throughout the country. The scale of urbanization and the input and output cannot be organically combined, which requires the corresponding structural adjustment for the development of the city. In the application of the super efficient DEA model, the extended DEA model is the super efficiency model (MDEA model) [5] used by many researchers. The traditional super data model cannot make further evaluation and comparison for many simultaneous and effective research units. At this time, the extended DEA model can be used as the super efficiency model (MDEA model).The model abandons the defects mentioned above, and enables effective units to compare with each other. As the model of super data is more attractive to researchers, according to the superiority of the super data model, we use the super data DEA model to compare the ordinary and original statistical methods in the study of the urbanization development difference. According to the existing data for experimental analysis, we can get the curve chart as shown in Figure 1. Using the super data DEA model can break the limitations of the traditional method, and allow the researchers find out the difference of the research object more intuitively. According to the data analysis of 7 selected cities with different geographical locations, the relative efficiency of urbanization in their location is evaluated. Two input indicators are selected. One is the annual input of cities that are related to the development of cities, and the two is the annual output of all the cities studied. The input and output indicators represent the manpower and funds invested, as shown in Table 1"the input/output index data rankings of the data envelopment analysis of the economic development in some cities of the country". It can be seen that the results of the ranking need to be amended. Due to the differences between the topographic factors, climatic factors, soil, accumulated temperature and human needs between the north and the south, the corresponding urbanization construction is quite different. According to the current situation of China, the small and medium cities in Western China have a economic volume and low industrial level, and the development situation is far behind the eastern cities in China. The relationship between topography and location largely causes the gap between cities: the quality of urban development and the level of urban economic development. After analyzing the data, we can pay more attention to the missing parts of some cities, so as to develop the economic construction of every city. In economic growth, the decision of some leading departments and enterprises with innovative ability are combined to form a high concentration of capital and fine technology, so that every city can gain a certain degree of economic benefit. The priority growth of regions with developmental advantages can also lead to the common development of adjacent areas. So some cities are still relatively backward. If we want to achieve the coordinated development of national economic development and construction, the result will be unfavorable. In the previous stage, a scholar set up an energy efficiency evaluation model for dozens of regions in China, and

studied the energy efficiency improvement in China. In Table 1, the efficiency of urbanization development from 2012 to 2017 is pointed out.

Table 1. Input/Output Indicators of Envelopment Analysis of Economic Development Data of Certain Cities in China

City	Output indicator (%)		Input indicator (%)	
Tianjin	1.216	1.354	1.378	1.437
Hangzhou	0.892	0.940	0.902	0.856
Nanjing	0.994	0.905	0.804	0.802
Shenyang	0.678	0.627	0.561	0.580
Harbin	0.902	0.856	1.354	0.795
Changchun	0.804	0.802	0.940	0.575
Langfang	1.030	0.985	0.933	0.986

According to the data analysis in Table 1, it can be concluded that Tianjin has the highest urbanization development efficiency score among these five cities during the past six years, with the mean value ranging from 1.167 to 1.473, which indicates that the urbanization of the city is closely related to the level of economic development.

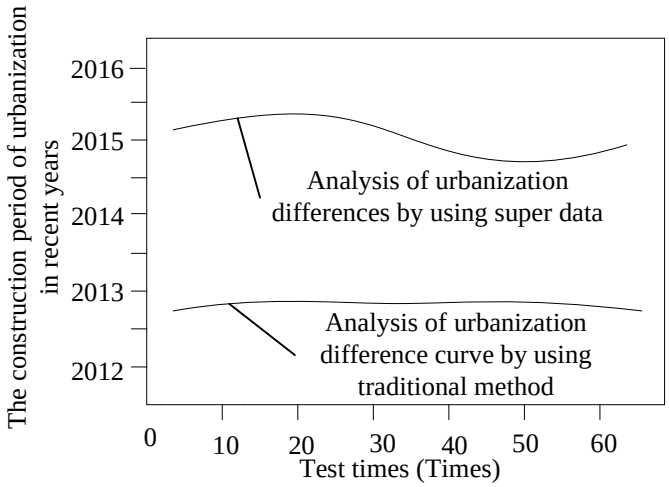

Figure 1. Curve Chart of Experimental Results

From Figure 1, it can be concluded that using the super data model can more intuitively observe the difference in urbanization development than the ordinary method. However, due to China's vast territory and abundant resources, there are great differences between North and south. And there is a big difference both in the region and knowledge and culture. In the course of urbanization construction in recent years, Tianjin has been very stable in the process of investing resources and utilizing resources, which is basically consistent with the development of the actual situation. Compared with other cities, the average score in Shenyang is lower, which is mainly due to the slow development of Shenyang's industry and tertiary industry, and the waste of resources. The super data DEA is a data envelopment analysis. It is a model based on linear programming and based on function. The super efficiency DEA includes several data models, such as CCR, BCC, SBM and so on. Material culture and spiritual culture should be inherited. This method is generally applied in the related researches, such as energy and efficient business applications. Anderson and Petersen improved the traditional DEA model[6] in 1993, and put forward the super efficiency DEA which can evaluate and compare the effective decision units at the same time and is more practical.

4. Conclusion

In this paper, we use the super data DEA model to analyze the differences between cities. It can be concluded that the development of urbanization and the utilization of resources in various areas of China are inconsistent. Compared with the ordinary method, the DEA model analysis method can be more intuitively observed the difference between urban and rural construction in big cities, and it is more practical and more scientific.

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