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Research on the Evaluation of the Efficiency of Beijing's High-Quality Economic Development

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Abstract

This paper constructs a three-level evaluation index system for the high-quality development of Beijing's economy from six dimensions and evaluates the efficiency of high-quality development of the economy from 2000 to 2019 by using the DEA model with non-expected outputs. The main conclusions are as follows: from the point of view of development efficiency, the comprehensive efficiency as a whole shows a first decline and then an increase, and there is little difference in scale efficiency, which is completely close to scale efficiency.

Keywords

High-quality development, data envelopment analysis,data envelopment analysis.

1. Introduction

Since the reform and opening up of China more than 40 years ago, China's economy has been developing rapidly, and its economic development has made remarkable achievements for all to see. However, in the face of intensifying world competition and economic globalization, the average annual growth rate of China's economy has been slowing down and stabilizing, and the economy has entered a "new normal", so that the previous model of crude development, which only pursued the speed of economic development and neglected the quality of economic development, cannot continue to promote the sustained progress of China's economy. At the same time, the quality of China's economic development is still far behind that of developed countries. In response to this phenomenon, the report of the 19th National Congress of the Communist Party of China (CPC) in 2017 pointed out that China's economy has shifted from the stage of high-speed growth to the stage of high-quality development, and is at a crossroads of transforming the mode of development, optimizing the economic structure, and transforming the power of growth, and that it is necessary to further promote the structural reform of the supply side and achieve the transformation of economic growth from quantity to quality. To sum up, the focus of China's economic development has changed from high speed to high quality, and the realization of "high-quality economic development" has become the latest strategic direction for China's economic development. Beijing is the capital of China and the political, economic, international communication, and cultural center of the country, its level of economic development has always ranked at the forefront of the country, so the study of high-quality development of the regional economy based on Beijing as an example will have a guiding and demonstrative effect on the enhancement of the high-quality development of the whole country's economy.

Starting from sorting out the current status of research on high-quality development at home and abroad, this paper constructs an evaluation index system for the high-quality

development of Beijing's economy in the light of the city's capital function positioning and analyzes the efficiency of high-quality development of Beijing's economy in a bid to provide theoretical support for deepening the high-quality development of Beijing's economy.

2. Literature Review

In 2017, the report of the 19th Party Congress put forward the concept of "high-quality development" for the first time, and considered that under the current level of development, China's economy has entered a new stage of high-quality development, and the 2018 Central Economic Work Conference further emphasized the importance and necessity of high-quality development, so there is no doubt that high-quality development has become the latest direction of China's economic development. It is no doubt that high-quality development has become the latest direction of China's economic development. As a result, scholars have gradually focused on the high-quality development of China's economy and studied the scientific connotation of high-quality development, arguing that high-quality development is not the same as high-quality economic growth and that the connotation of "development" includes not only the economic aspect but also ecological environment, society, and other aspects. Jin Beibei (2018) points out that from the perspective of economics, high-quality development is a mode of economic development that can more fully satisfy people's growing spiritual and material needs than before. Wei Min et al. (2018) argue that high-quality economic development can be summarized in 10 aspects, including the economic structure and its stability, products and services and their level of innovation, regional coordination and resource allocation, market mechanism, infrastructure, environmental level, and sharing of results. Xu Hui et al. (2020) point out that economic development, innovation drive, improvement of people's livelihoods, environmental conditions, and ecological conditions are five aspects that can be used as specific meanings of high-quality development. Yang Yongchun et al. (2020) believe that it is necessary to define the connotation of high-quality development from the perspectives of "economy, society, culture and environment". Ren Baoping (2018) points out that the five new development concepts of "innovation, coordination, greenness, openness, and sharing" have an important guiding value for high-quality development, and high-quality development is the upgrading mode of China's economic development: with the development of the real economy as the core, and an economic system characterized by an effective market mechanism, the vitality of micro-organisms, and the degree of macro-control. It is an upgraded model of China's economic development: with the development of the real economy at its core, characterized by an effective market mechanism, the vitality of micro-entrepreneurs, and an appropriate degree of macro-control, and based on an industrial system in which science and technology, innovation, modern finance, and human capital are developed in tandem, and in which productivity is enhanced through changes in quality, efficiency, and power.

In particular, a reading of the literature reveals that the core meaning of "high-quality economic development" is different from "quality of economic growth", and that there are distinctions and linkages between the two. Research on the quality of economic growth is well-grounded in academia and has a well-established evaluation system. Therefore, on the premise that the core connotations of "high-quality economic development" and "quality of economic growth" have been fully clarified, studying the existing normative research on the evaluation of the quality of economic growth will provide necessary assistance in constructing

a more comprehensive evaluation system for high-quality economic development. In terms of linkage, both "high-quality economic development" and "quality of economic growth" are not one-dimensional concepts, but are embodied in many aspects, including economic, ecological, social, and other fields, and both intend to point out that economic growth caused by pursuing quantitative surge and scale expansion is unreasonable. Both of them intend to point out that economic growth through the pursuit of quantitative growth and scale expansion is irrational and unscientific, and that attention should be paid to the optimization of the industrial structure, improvement of the production level, and enhancement of the efficiency of output. Huikang et al. (2009) pointed out that economic development should not only consider the "quantity" aspect, but also care about the "quality" aspect, and that realizing the coordination and unification of quantity and quality is the essence of high-quality economic development. In terms of differentiation, "high-quality economic development" was richer than "quality of economic growth", with "growth" encompassing less breadth and depth than "development". Growth" is not as broad and deep as "development", and high-quality economic development requires that more attention be paid to "quality". In addition, China's economy has now entered a new era, having shifted from a phase of high-speed growth to a phase of high-quality development, so "high-quality economic development" is more reflective of the stage-by-stage goals and characteristics of the economy in the new era than "quality of economic growth", reflecting the new ideas and new features of the times. Therefore, "high-quality economic development" is more reflective of the economic goals and characteristics of the times in the new era than "quality of economic growth", and it embodies the new thinking and changes of the times.

3. Construction of the evaluation index system for high-quality economic development

Due to the vast size of China and practical issues such as geographical location, resource endowment, and policy differences, the situation of high-quality economic development varies among different provinces and regions. At present, studies on the measurement of high-quality economic development in China mainly focus on two levels: provincial and regional. In this paper, by sorting out the connotation of high-quality economic development, it is considered that high-quality economic development in the new era is an economic development model of comprehensive and efficient economic development guided by the five major development concepts of "innovation, coordination, green, openness, and sharing", concerning Zhao Ruyu and Chang Zhongli, Li Jinchang et al, Ma Ru et al, and Wei Min and Li Shuhao. , Wei Min and Li Shuhao and other scholars' research results, combined with the actual situation of Beijing's economic development and fully considered Beijing's capital function, the evaluation index system of Beijing's high-quality economic development, which contains 15 secondary indicators and 33 tertiary indicators, is constructed from six primary indicators of economic development, innovation development, coordinated development, green development, open development, and shared development, as shown in Table 1.

Table 1: Evaluation index system of high-quality economic development in Beijing

Level 1 Indicators	Secondary indicators	Tertiary indicators	Efficacy
Economic Development	Economic Development（B1）（0.06）	Economic growth rate（C1）（0.04）	+

（A1）（0.21）		Share of economic development in the country（C2）（0.02）	+
	Income level（B2）（0.07）	GDP per capita（C3）（0.03）	+
		Disposable income per capita（C4）（0.04）	+
	Consumption level（B3）（0.08）	Total retail sales of social consumer goods（C5）（0.04）	+
		Consumer Price Index（C6）（0.04）	-
Innovative Development（A2）（0.14）	Innovation Inputs（B4）（0.06）	R&D investment intensity（C7）（0.03）	+
		R&D personnel investment efforts（C8）（0.03）	+
	Innovation Output（B5）（0.08）	Number of patents granted（C9）（0.04）	+
		Technology Market Turnover Share（C10）（0.04）	+
Coordinated Development（A3）（0.12）	Industry Coordination（B6）（0.06）	Contribution rate of primary industry（C11）（0.01）	+
		Contribution rate of secondary industry（C12）（0.02）	-
		Contribution of tertiary industry（C13）（0.03）	+
	Urban-rural coordination（B7）（0.06）	Disposable income ratio of urban and rural residents（C14）（0.02）	-
		Urbanization level（C15）（0.04）	+
Green Development（A4）（0.20）	Greening and environmental protection（B8）（0.07）	Urban greening coverage rate（C16）（0.03）	+
		Green space per capita（C17）（0.04）	+
	Energy saving and emission reduction（B9）（0.13）	Sewage treatment rate（C18）（0.03）	+
		Harmless disposal rate of domestic waste（C19）（0.01）	+
		Sulfur dioxide emissions per unit of GDP（C20）（0.03）	-
		Solid waste emissions per unit of GDP（C21）（0.02）	-
		Wastewater emissions per unit of GDP（C22）（0.04）	-
Open Development（A5）（0.10）	Foreign Investment（B10）（0.03）	The degree of foreign capital utilization（C23）（0.03）	+
	International Trade（B11）	Degree of foreign trade	+

	（0.07）	dependence（C24）（0.03）	
		Foreign trade quality（C25）（0.04）	+
Shared Development（A6）（0.23）	Cultural and educational level（B12）（0.06）	Number of students enrolled in undergraduate programs and above（C26）（0.02）	+
		Total number of books in the library（C27）（0.04）	+
	Medical and health care level（B13）（0.07）	Number of beds in medical and health institutions（C28）（0.04）	+
		Population mortality rate（C29）（0.03）	–
	Employment level（B14）（0.04）	Non-farm employment level（C30）（0.03）	+
		Urban registered unemployment rate（C31）（0.02）	–
	Infrastructure Development Level（B15）（0.05）	Urban road area（C32）（0.02）	+
		Public toilets per 10,000 people（C33）（0.03）	+

Note: "+ (-)" in the "Efficacy" column indicates that the measure is a positive (negative) indicator under the set measurement method.

4. Evaluation of the efficiency of high quality economic development

Among the efficiency evaluation methods, data envelopment analysis (DEA) is the most commonly used nonparametric statistical analysis method, and the input-output index system is the key to efficiency evaluation. Scholars such as Yuan et al, Zeng Xiangang and Niu Muchuan, Teng Tangwei and Ouyang Xin have established different efficiency evaluation index systems for high-quality development according to different research contents(Yuan et al.,2020; Zeng Xiangang et al.,2019; Teng Tangwei et al.,2019).

Based on the six dimensions of high-quality economic development, this paper selects economic growth from the economic development dimension, innovation input from the innovation development dimension, industrial coordination from the coordinated development dimension, greening and environmental protection from the green development dimension, foreign investment from the open development dimension, and employment level from the shared development dimension as input indicators, and the remaining indicators as output indicators to construct The efficiency evaluation index system of Beijing's high-quality economic development. In the part of output indicators, considering the influence of non-expected output on efficiency evaluation, the consumer price index under the consumption level indicator, sulfur dioxide emission per unit GDP, solid waste emission per unit GDP and wastewater emission per unit GDP under the energy conservation and emission reduction indicator, and population mortality rate under the health care level indicator are selected as non-expected output, and according to Seiford et al. proposed non-desired output

processing method, the non-desired output is transformed into desired output through data transformation, and the secondary evaluation index system is shown in Table 3(Seiford et al.,2002).

Table 2: Secondary Evaluation Index System for the Efficiency of Beijing's High-Quality Economic Development

Indicator Type	Secondary Evaluation Metrics	Non-desired outputs
Input Indicators	Economic Growth	—
	Innovation input	
	Industry Coordination	
	Greening and environmental protection	
	Foreign Investment	
	Employment level	
Output Indicators	Income level	—
	Consumption level	Consumer Price Index
	Innovation Output	—
	Urban-rural coordination	Disposable income ratio of urban and rural residents
	Energy saving and emission reduction	Sulfur dioxide emissions per unit of GDP Solid waste emissions per unit of GDP Wastewater emissions per unit of GDP
	International Trade	—
	Cultural and educational level	—
	Medical and health care level	Population mortality rate
	Infrastructure Development Level	—

In this paper, the CRS output-oriented DEA model with non-desired outputs is used to calculate the efficiency of high-quality economic development in Beijing from 2000-2019, and the calculation results are shown in Table 4. Since the comprehensive efficiency = storage technical efficiency × scale efficiency, this paper only conducts comparative analysis for comprehensive efficiency and scale efficiency, and the specific analysis results are as follows.

Table 3: Statistics on the efficiency of Beijing's high quality economic development, 2000-2019

Year	Comprehensive efficiency	Pure technical efficiency	Scale efficiency	Gain in size

2000	1.00	1.00	1.00	Unchanged
2001	1.00	1.00	1.00	Unchanged
2002	0.86	0.87	0.99	Incremental
2003	0.81	0.83	0.98	Incremental
2004	0.73	0.78	0.93	Decreasing
2005	0.87	0.93	0.93	Decreasing
2006	0.91	1.00	0.91	Decreasing
2007	0.97	1.00	0.97	Decreasing
2008	0.86	1.00	0.86	Decreasing
2009	0.91	1.00	0.91	Decreasing
2010	0.97	1.00	0.97	Decreasing
2011	1.00	1.00	1.00	Unchanged
2012	1.00	1.00	1.00	Unchanged
2013	1.00	1.00	1.00	Unchanged
2014	1.00	1.00	1.00	Unchanged
2015	1.00	1.00	1.00	Unchanged
2016	1.00	1.00	1.00	Unchanged
2017	0.97	1.00	0.97	Decreasing
2018	0.98	1.00	0.98	Decreasing
2019	1.00	1.00	1.00	Unchanged

As can be seen from Table 4, the comprehensive efficiency of the high-quality economic development in Beijing from 2000 to 2019 shows a first decrease and then an increase, with an arithmetic mean of 0.942 and the main distribution interval in [0.73,1], and the comprehensive efficiency of the high-quality economic development is relatively high from a general point of view.

The integrated efficiency values of 2000, 2001, 2011-2016, and 2019 are all equal to 1, indicating that the decision unit is DEA effective in these 9 years. 2000 and 2001 have an integrated efficiency of 1, indicating that the output is maximized under the conditions of input scale, technology level, and market price at that time. In 2004, the "Three Beijing's" development direction was proposed for the first time, and the importance of innovation and green development for Beijing was clarified, and the overall efficiency started to rise gradually, to 0.73 in 2004. In 2007, the overall efficiency rose to 0.97, close to the DEA validity. However, with the outbreak of economic crisis in 2008, the composite efficiency dropped again to 0.86. After 2009, as the economy heated up, the composite efficiency gradually rebounded to 1, and maintained from 2011 to 2016. 2017, China proposed high-quality economic development, resulting in small fluctuations in the composite efficiency in 2017 and 2018, and in 2019, the composite efficiency returned to to an effective value of 1.

Table 4: Scale efficiency distribution table

Distribution of efficiency values	Number of years	Percentage
$0 \le \theta < 0.90$	1	5%

$0.90 \le \theta < 0.95$	4	20%
$0.95 \le \theta < 1$	6	30%
θ=1	9	45%
Total	20	100%

The value of scale efficiency can reflect whether the size of the economy is in an optimal state for high-quality development. As can be seen from Table 4, the arithmetic mean of scale efficiency from 1985 to 2014 is 0.97, with a standard deviation of 0.04, and the main distribution interval is in [0.86,1], indicating that the scale efficiency of Beijing's high-quality economic development from 2000 to 2019 does not vary much, and is basically completely close to scale efficiency. As can be seen from Table 5, scale efficiency equals to 1 reaches 45% in the year, and scale efficiency greater than 90% reaches 95% in the year. 2008 has the lowest scale efficiency with only 0.86, indicating that 2008 did not make good use of the existing production conditions to choose the best scale for production.

5. Conclusion

Scientific and reasonable index system is the key to statistical analysis, this paper in-depth analysis of the connotation and characteristics of high-quality development of the economy on the basis of six dimensions from the economic development, innovation development, coordinated development, green development, open development and shared development to construct the evaluation index system of high-quality development of the economy of Beijing Municipality, the use of data envelopment analysis model with non-desired outputs to measure the 2000-2019 Beijing Economic high-quality development level efficiency, the main conclusion is that from the perspective of high-quality development efficiency, the comprehensive efficiency in 2000-2019 shows a first decline and then increase, the arithmetic mean value is 0.942, the main distribution interval is in [0.73,1], and the comprehensive efficiency of Beijing's economic high-quality development is relatively high from a general point of view. The arithmetic mean of scale efficiency is 0.97, with a standard deviation of 0.04, and the main distribution intervals are in [0.86,1], indicating that the difference in the scale efficiency of the high-quality development of Beijing's economy in the period of 2000-2019 is not large, and completely close to the scale efficiency.

To actively promote the high-quality development of Beijing's economy, the following policy recommendations are made based on the findings of the above study. Pay attention to the all-around high-quality economic development. High-quality economic development is a five-in-one development. Although the measurement level of high-quality economic development is progressing, the measurement level of some indicators remains the same or even tends to decline, so we should give full play to Beijing's advantages in science and technology and talents, increase the development of innovation, improve the level of modern service industry, expand high-tech foreign trade, and let more residents enjoy the green development and shared development brought by good life.

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