

Article

Research on the Efficiency of China's Fiscal Expenditure Structure under the Goal of Inclusive Green Growth

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Abstract: Inclusive Green Growth is a sustainable development mode that pays attention to the coordinated growth of the economy, society, and ecology. With the intensification of the contradiction between fiscal revenue and expenditure, adopting the goal of adjusting the fiscal expenditure structure is conducive to improving the efficiency of fiscal funds. This paper establishes a theoretical model of the efficiency of the fiscal expenditure structure under the goal of Inclusive Green Growth, and on this basis, it constructs an index system of Inclusive Green Growth. Then, it applies a DEA-Malmquist model to analyze the efficiency of the fiscal expenditure structure. The results show that from 2007 to 2018, the growth rate of Inclusive Green Growth index showed a downward trend, which was mainly due to the decline in the growth rate of economic development. It rebounded after 2016, and the growth of the inclusiveness level played a major role. In time and space, the development resources tend to the unbalanced development trend of the eastern region; the average total factor productivity of the fiscal expenditure structure in space is the lowest in the east. The fiscal expenditure should be inclined to social expenditure and green expenditure, the western region should be inclined to economic expenditure, and the allocation of the expenditure structure in the central region should imitate the high-efficiency areas. In order to achieve the comprehensive development goal, this paper provides an analytical idea for the adjustment of the fiscal expenditure structure.

Keywords: Inclusive Green Growth; entropy method; fiscal expenditure structure; efficiency evaluation; DEA-Malmquist model



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1. Introduction

The capitalist mode of production and its black development system under industrial civilization not only produce natural alienation but also materialization and alienation of human and society, which will inevitably lead to various problems related to income gap and social injustice, as well as ecological economic problems such as environmental overdraft and ecological deficit. In order to cope with this unsustainable development dilemma, following the development ideas of inclusive growth and green growth, The World Bank issued "Inclusive Green Growth: the road of sustainable development" [1], which pointed out that inclusive, efficient, and affordable green growth is essential to maintain the future economic development. As a new sustainable growth mode, Inclusive Green Growth requires overcoming political and economic constraints, abandoning deep-rooted behavior and social norms, and developing innovative financing tools to change incentive methods and promote innovation, so as to solve the phenomenon of market, policy, and system failures that lead to the excessive use of natural resources. The five development concepts of "innovation, coordination, green, openness, and sharing" proposed by the Chinese government are new development concepts to promote balanced, inclusive, and sustainable development under the logic of the new normal economy. On the one hand, these five new development concepts focus on inheriting and reflecting the most important aspects of the concept of inclusive growth. On the other hand, they highlight that China adapts to the era requirements of the world's green development trend under the rigid

constraints of resources and environment, and it is unified with high-quality development. Therefore, the specific concept of Inclusive Green Growth summarizes the historical, realistic, and logical requirements of the five new development concepts, and it embodies the core connotation of high-quality development.

In order to realize the sustainable growth road of Inclusive Green Growth, macro governance at the national level is essential. As one of the most direct and effective means of government governance, fiscal policy has new requirements in the new era and new goals. On the one hand, in order to stimulate market vitality, the government streamlines administration and decentralization, and it promotes the process of marketization, which means that the growth rate of fiscal revenue is bound to slow down relative to the growth rate of GDP, and the decline of GDP growth further aggravates the decline of fiscal revenue level. On the other hand, the new development concept requires the government to increase the necessary expenditure in promoting non-economic development, so as to promote the comprehensive development level of various regions. On the basis of the absolute scale of fiscal expenditure unchanged or even reduced, we must optimize the structure of fiscal expenditure to meet the current needs of the overall development of the country. Therefore, it is particularly important to improve the efficiency of government expenditure structure under the goal of Inclusive Green Growth.

Data envelopment analysis (DEA) and its extended form are mostly used in the research of fiscal expenditure efficiency, and the principle is roughly the same. In this method, an efficient production frontier possibility boundary is constructed by using linear programming, and then, the efficiency differentiation results are obtained by comparing the decision-making units with different efficiency values with the production possibility boundary. The distinction of fiscal expenditure efficiency is mainly reflected in the selection of input–output indicators. From the perspective of input, the existing literature can be divided into three categories: the first category uses the total scale of fiscal expenditure or the scale of fiscal expenditure per capita as the input index to measure the fiscal expenditure efficiency. For example, Worthington (2000) [2] and Afonso (2006) [3] (2008) [4] measured the fiscal expenditure efficiency of Australia and Portugal, respectively. The second category is to study the efficiency of financial expenditure with specific financial entries as input indicators. For example, Gupta (2001) [5] and Iavado (2009) [6] take medical and health expenditure as input indicators, Bardhan (2002) [7] takes public goods expenditure as an input indicator, Mikušová (2017) [8] takes education expenditure as an input indicator, while Wang (2018) [9] and Zhang (2019) [10] take environmental protection expenditure as an input indicator. The third category is to study the efficiency of different fiscal expenditure structures from a macro perspective. The earliest research can be traced back to Brueckne (1979) [11]; Li (2010) [12] and Deng (2019) [13] also conducted a series of studies on the efficiency of China's fiscal expenditure structure. From the perspective of output, most of the studies in the international literature are based on research on the efficiency of fiscal expenditure with economic growth or wage level as output [14,15]. With the continuous putting forward of various comprehensive objectives and requirements, scholars gradually put the comprehensive development index into the output for analysis. Taking Chinese scholars as an example, after the Chinese government proposed not to take economic growth as the only assessment index, scholars have invested in the research with a weighted index as the output index. Zhang (2017) [16], Fan (2018) [17], Jianmin (2021) [18], Zhang (2021) [19], and other scholars have constructed different weighted output indexes for different research purposes to study the efficiency of fiscal expenditure.

The existing research provides a lot of valuable reference value for this paper, but there are still the following three problems worthy of further consideration. First, most of the existing literature on the selection of investment indicators measures the investment in the absolute amount of the previous two types of expenditure, lacking the consideration of the overall fund allocation. Under the condition of the intensification of the contradiction between fiscal revenue and expenditure, how to adjust the fiscal expenditure structure with the comprehensive development goal has a certain research value. Second, the selection of

output indicators under different times needs continuous innovation, and Inclusive Green Growth, as a new road of sustainable development, is in line with international sustainable development evaluation and internally unified with China's high-quality development, which is very suitable for the needs of current social development. Third, the vast majority of studies on fiscal efficiency lack relevant theoretical foreshadowing and do not clarify the internal relationship between input and output. Therefore, based on the existing literature, this paper makes corresponding theoretical interpretation and model construction on the internal logical relationship between fiscal expenditure and Inclusive Green Growth.

In view of this, the arrangement of the article is as follows: the Section 2 explains the relevant theories, explains the internal logical relationship between fiscal expenditure and Inclusive Green Growth, and constructs a mathematical model of fiscal expenditure efficiency for the purpose of Inclusive Green Growth; In the Section 3, based on the theory of analysis and referring to the existing research literature, the evaluation index system of Inclusive Green Growth is constructed, and the relevant weights and indexes are calculated. The Section 4 studies the relative efficiency and spatial-temporal difference of government expenditure structure allocation with the sub-dimension index and composite index of Inclusive Green Growth as the output goal and the fiscal expenditure structure as the input. The Section 5 summarizes the full text and draws the main conclusions and policy recommendations.

2. Related Theoretical Explanation and Model Construction

2.1. The Theoretical Explanation of Inclusive Green Growth

With the rapid advancement of industrial civilization, it has caused "growth dilemma" problems such as a widening income gap, environmental overdraft, and ecological deficit. According to the WIND database, from the perspective of inclusiveness, in terms of income share, from the world average level, the pre-tax income of the richest 1% of the population accounts for about 18% of the gross national income, and the income share of the top 10% of the population is about 5.5 times that of the last 50%, and the share shows a slight upward trend, indicating that the problem of income inequality in the world has not been fully alleviated. In particular, the problem of income inequality in Latin America, Africa, and Oceania is more serious than that in other regions. Among them, in 2017, the share of pre-tax income of the richest 1% of the population in Latin America reached 28.8%; Oceania and Africa followed, accounting for 20.6% and 19%, respectively. In terms of the comparison between developed and developing countries, the problem of income inequality in developing countries is more serious than that in developed countries. Among them, South Africa and India have the highest deterioration rate, with an average annual growth rate of 5.17% and 4.82%, respectively. On the other hand, from the perspective of green development, from 1990 to 2016, the world average forest coverage decreased by about 2.87%, and among the developing countries with large population, Brazil and Indonesia decreased the most significantly, by about 9.73% and 23.22%, respectively, in more than 20 years. According to the analysis of the China economic network database, from 2000 to 2017, China's industrial fixed waste and wastewater discharge showed a continuous upward trend. In addition, according to the evaluation of the water resources quality of more than 700 rivers in China by the Ministry of water resources, the results show that the proportion of river length with water quality of classes IV–V accounts for 46.5%; the proportion of rivers with serious pollution and water quality inferior to class V is 10.6%, and China's water pollution has been spreading and infiltrating. These objective phenomena have led to the attention and research on the relationship between economic growth, income distribution, and environmental ecology, which produced the corresponding Inclusive Green Growth and development theory. From the origin and formation process of the concept of inclusive growth, since the mid-20th century, the concept of growth has experienced the evolution of simple emphasis on growth, broad-based growth, "growth friendly to the poor", and inclusive growth. The World Bank (1990) [20] put forward "broad-based growth" in 1990, and then the OECD (2001) [21]

defined the concept of “growth friendly to the poor”. Many countries have positive economic growth rates, but poverty is accumulating. Therefore, people have started to pay attention to and study how to realize the benign interaction between economic growth, inequality, and poverty reduction. From the perspective of green growth, its essence is a sustainable development economy with the coordinated development of ecological economy as the core. Pearce et al. (1989) [22] first put forward the concept of green economy in the blueprint of green economy, believing that it is within the scope of the natural environment and human tolerance. A sustainable economic development mode is one that will not lead to ecological damage, resource depletion, and social division due to economic growth. Inclusive Green Growth, as a new way of sustainable development, is a synthetic category of the evolution and combination of inclusive growth and green growth. Economic theories in different periods have different degrees of theoretical exploration on the topic of inclusive green development.

In the past decade, many international scholars have conducted relevant research on Inclusive Green Growth, mainly focusing on concept application, realization path, and measurement indicators. Dinda (2013) [23] analyzed the development mechanism of natural resource capital regeneration and promoting economic growth, put forward the corresponding theoretical model, and explained the sustainable development mechanism realized through productive consumption; Bartelmus (2013) [24] compared the concepts of economic growth, inclusive wealth, and green growth within the framework of a category of sustainable development, believing that green growth should be the main trend in the future. Bass et al. (2013) [25] pointed out that Ethiopia’s society, economy, and environment are so closely linked that if we want to solve the conflict and achieve synergy, we must conduct systematic analysis to achieve inclusive green development. Alfredsson (2014) [26] attempted to analyze the prospects of transforming economic growth into inclusive, green, and sustainable development, and identify the knowledge gaps so that further research may make an important contribution to the successful transformation. Bouma et al. (2015) [27] continued the research ideas of economic organizations, held a positive attitude toward Inclusive Green Growth, and pointed out that the previous intervention policies of the Dutch government have been proved unsustainable due to the lack of structural impact, so the Inclusive Green Growth policies with structural impact should be studied and implemented. Oginni (2016) [28] investigated the transition from Africa to green economy and analyzed the policy dilemma around fiscal reform to green economy. The research results show that Africa’s transition to Inclusive Green Growth is mainly funded through foreign aid programs. The Asian Development Bank (2018) [29] continues the research ideas of The World Bank, discusses the focus of Inclusive Green Growth in a deeper understanding, and reconstructs the evaluation index system of Inclusive Green Growth based on this. Kararach et al. (2018) [30] believed that African countries and societies must plan, manage, implement, and account for the results of policies and programs, because they are crucial to achieving Inclusive Green Growth. Zhou (2018) [31] constructed the evaluation index system of China’s Inclusive Green Growth with four dimensions of economic growth, social opportunity equity, green production and consumption, and ecological environment protection, and Zhou also conducted quantitative analysis such as temporal and spatial differences. Cooper et al. (2020) [32] pointed out that indigenous knowledge production capacity is the key to supporting African countries’ inclusive and sustainable economic and social development, and they believed that research investment in Inclusive Green Growth related to the capacity building of African knowledge production systems should be increased. Chen et al. (2020) [33] applied the Inclusive Green Growth measurement index to China’s Yangtze River Delta and evaluated the Inclusive Green Growth trend of various provinces in the region. Li et al. (2021) [34] evaluated the Inclusive Green Growth index of Pacific Rim countries and compared the specific current situation of Inclusive Green Growth internationally; Ahmad (2021) [35] affirmed that China’s experience is also applicable to many emerging markets, such as value-added tax, income tax, and other modern tax management measures, which have a significant impact

on policy recommendations and development cooperation, help to achieve the goal of global climate change, and ensure the creation of sustainable employment in a transparent and accountable manner.

Research on Inclusive Green Growth highlights a key issue. With the continuous progress of the development process, we should not separate the economic, social, and ecological development but rather take it as a whole for systematic analysis and research. Therefore, we believe that Inclusive Green Growth is a sustainable development mode that pursues the mutual coordination and promotion of economic growth, the ecological environment, and social equity. It is an important way and specific form to realize the coordinated development of society, ecology, and economy by changing and optimizing the mode of production to coordinate the contradictions and conflicts between man and nature and between people (Zhou, 2020) [36].

2.2. *The Internal Relationship between Fiscal Expenditure Structure and Inclusive Green Growth*

At the end of 2013, China (2013: Communiqué of the Third Plenary Session of the 18th Central Committee of the Communist Party of China (in Chinese), http://www.xinhuanet.com/politics/2013-11/12/c_118113455.htm, accessed on 20 August 2021) put forward the strategic layout of modernization of its national governance system and governance capacity. National governance capacity is the ability to use policy means to deal with all aspects of affairs, including economic, social, ecological, and other aspects. Inclusive Green Growth reflects the goal of national governance in the new era, and government fiscal policy is one of the most direct and effective means of national governance. To a certain extent, it reflects the strength of national governance ability.

According to the statistical classification of the government financial function of the International Monetary Fund (IMF, 2014) [37], the government expenditure structure is divided into three categories: economic constructive expenditure, general expenditure, and social expenditure. Considering the actual situation in China, due to the significant adjustment of the classification of government revenue and expenditure in 2007, in order to make the government expenditure structure comparable during the investigation period, this paper refers to the 2007 government revenue and expenditure classification subject (2006) [38] of the Ministry of Finance of China and the IMF expenditure classification standard. The financial expenditure structure is divided into four categories: economic expenditure, social expenditure, energy-saving and environmental protection expenditure, and other expenditure. This paper focuses on the efficiency evaluation of the first three categories of the financial expenditure structure. According to the specific entries of financial expenditure in China's statistical yearbook, the expenditure of science and technology, education, culture, sports and media, medical and health, housing, social security and employment, and assistance to other areas of social security expenditure have a direct effect on society. Energy-saving and environmental protection expenditure, which reflects environmental protection expenditure, has a direct effect on ecology. The urban and rural community affairs expenditure, agriculture, forestry, and water affairs expenditure, transportation expenditure, mining power information and other affairs expenditure, business services and other affairs expenditure, industrial and commercial finance and other affairs expenditure, post-earthquake recovery and reconstruction expenditure, land resources and meteorology and other affairs expenditure, grain and oil reserves and other management affairs expenditure, which reflect the economic and constructive expenditure, directly affect the economy. In summary, as shown in Figure 1, fiscal expenditure, as an input, directly acts on the three dimensions of society, ecology, and economy, which coincides with the three dimensions of Inclusive Green Growth as the output. It is scientific to calculate the efficiency based on this relationship.

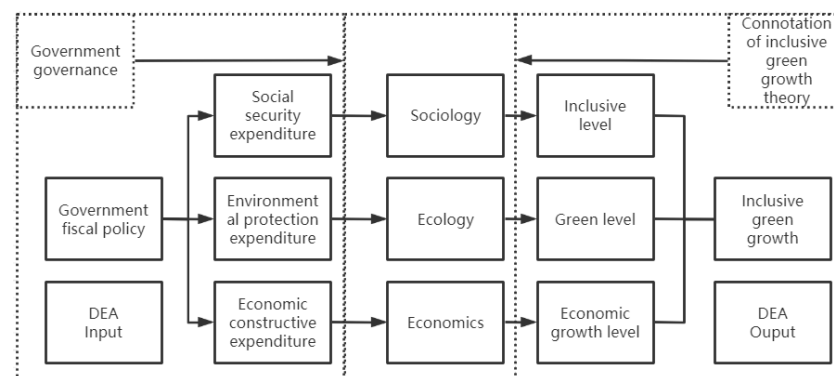


Figure 1. The internal relationship between fiscal expenditure and Inclusive Green Growth.

2.3. Theoretical Model Construction

Based on the above analysis, we use Solow model [39] for reference and introduce green capital to expand the production function:

$$f(L, K, E) = Y^t - C^t = (A^t \theta^t) [(L^t)^\alpha (K^t)^\beta (E^t)^\gamma]. \quad (1)$$

Starting from the concept of Inclusive Green Growth, the lack of inclusiveness means social injustice, which needs to be achieved through national governance and other ways, and national governance needs to invest corresponding costs. Therefore, as in the cost of environmental pollution control, it is regarded as introducing the cost of social injustice into Equation (1):

$$f(A, \theta, L, K, E) = Y^t - C_e^t - C_s^t = (A^t \theta^t) [(L^t)^\alpha (K^t)^\beta (E^t)^\gamma]. \quad (2)$$

In Equation (2), t represents the dynamic change of time, C_e represents the cost of environmental governance, and C_s represents the cost of unfair social governance. Then, $Y - C_e - C_s$ represents the output of Inclusive Green Growth, which is recorded as IGG^t , A and θ represent technological progress and efficiency factors, respectively. Since the efficiency in real production is generally not a percentage, so $\theta \in [0, 1]$, E represents the ecological resources that must be used in production, α, β, γ represent the elasticity of labor, capital, and ecology to output.

Next, introduce the government part and draw lessons from Barro's model setting [40]. Add the government expenditure variable to Equation (2). Assume that the labor input, social capital input, and ecological resource input in t year are exogenous fixed input. A certain expenditure G_i is regarded as the public goods investment to participate in production. δ is the elasticity of government expenditure to output. The efficiency factor θ originally expressed as the input portfolio becomes the efficiency factor μ of the combination of financial expenditure. As a result of the transaction cost, market failure, corruption, and other factors, the efficiency factor of fiscal expenditure $\mu \in [0, 1]$. The form of production function becomes:

$$f(A^t, \mu^t, G_i^t) = IGG^t = (A^t \mu^t) [(L^t)^\alpha (K^t)^\beta (E^t)^\gamma (G_i^t)^{\delta_i}]. \quad (3)$$

Take the logarithm of the above equation, mark $L^\alpha K^\beta E^\gamma = x$:

$$\text{Ln}IGG^t = \text{Ln}A^t + \text{Ln}\mu^t + x\delta_i \text{Ln}G_i^t. \quad (4)$$

Using the derivation of time t , we get:

$$\frac{\Delta A}{A} + \frac{\Delta \mu}{\mu} = \frac{\Delta IGG}{IGG} - x\delta_i * \frac{\Delta G_i}{G_i}. \quad (5)$$

When there are n items of government expenditure, the above equation becomes:

$$\frac{\Delta A}{A} + \frac{\Delta \theta}{\theta} = \frac{\Delta IGG}{IGG} - \sum_i^n x\delta_i * \frac{\Delta G_i}{G_i}. \quad (6)$$

When the government expenditure structure is divided in the form of Figure 1, the above equation is expressed as the difference between the change of a certain multiple of government economic expenditure, energy conservation and environmental protection expenditure, and social expenditure, and the change of Inclusive Green Growth output, which is reflected in the change of technological progress and expenditure structure efficiency. On the macro level, technological progress is mainly manifested as fiscal expenditure; the progress of production technology makes the production frontier expand the production possibility boundary, and it makes the low technological progress areas catch up with the high-tech areas in technical efficiency. Meanwhile, efficiency progress is mainly manifested in different efficiency coefficients caused by different allocation of the fiscal expenditure structure, which promotes the overall efficiency to move forward and low structural efficiency areas catch up with high structural efficiency areas, so as to promote the overall efficiency of expenditure structure.

3. The Construction of Inclusive Green Growth Index System and the Analysis of Spatial and Temporal Heterogeneity

In the theoretical analysis, the output of IGG only represents the difference between GDP and environmental governance cost and fair governance cost. However, in practical analysis, it is not easy to measure the environmental governance cost and fair governance cost. Therefore, we need to measure the Inclusive Green Growth index. The estimation of the Inclusive Green Growth index has two forms commonly used in academic circles. One is the calculation-based input–output method represented by Sun et al. (2020) [41], and the other takes the form of constructing an evaluation index system represented by The World Bank (2012) [1]. As far as the research purpose of this paper is concerned, it is necessary to systematically calculate Inclusive Green Growth according to the theoretical interpretation of Inclusive Green Growth, and it is weak to calculate it by the input–output method, because the evaluation dimension of this method is single and can not describe Inclusive Green Growth comprehensively. Therefore, this paper selects the method of constructing the evaluation index system for research; draws lessons from the measurement research on Inclusive Green Growth by The World Bank (2012) [1], The Asian Development Bank (2018) [27], Zhou (2018) [29], Chen (2020) [31], and Li (2021) [32]; constructs the Inclusive Green Growth evaluation index system; and calculates the index score.

3.1. The Dimension Setting of Inclusive Green Growth Indicators

Although some scholars have studied the design of an Inclusive Green Growth index system, there are several problems as follows. First, the existing literature on secondary indicators is not concise enough, resulting in cumbersome descriptions of the follow-up research. According to the theoretical explanation of Inclusive Green Growth, the most concise way is to design the indicator system around the three aspects of inclusive, green, and growth. Secondly, the definition of Inclusive Green Growth and the selection of most indicators are outcome indicators. There are a few input indicators in the existing literature, which hinder the follow-up research on input–output and influencing factors. Thirdly, in the aspect of data updating, because the setting of index weight depends on the objective entropy weight method, and the entropy weight method depends on the degree of index variation in different years, so with the data year updating, the measurement results are different, and the overall data need to be re-measured. To sum up, this paper constructs the evaluation index system of Inclusive Green Growth and sets the secondary evaluation indexes at an inclusive level, green level, and economic development level according to the relevant theoretical explanation.

3.1.1. Dimension Setting of Inclusion Level

According to the Inclusive Green Growth measurement literature and representative inclusive growth index system design (Ali and Song, 2007) [42] (Ali and Zhuang, 2007) [43], three three-level indicators are set under the inclusive level, which are social equity, social welfare, and social security. Social equity measures income equity by per capita GDP and the per capita income of rural residents/per capita income of urban residents. Medical and health care is an important part of people's livelihood security. Medical equity is measured by the number of health technicians per 10,000 people and the number of beds in health institutions per 10,000 people. Education equity is the biggest equity, and it is measured by the number of primary schools per ten thousand people and the number of ordinary secondary schools per ten thousand people. In social welfare, the supply of social welfare is measured by road mileage per capita, urban road area per capita, and public transport vehicles per ten thousand people. Social security is measured by urban gas penetration rate, endowment insurance coverage rate, and medical insurance coverage rate.

3.1.2. Dimension Setting of Green Level

The paper combines the index design of green industry with the Inclusive Green Growth concept by referring to the existing literature (China green development index report 2011, 2012) [44] (Kararach et al. 2018) [30], and it sets three levels of indicators, namely green production, green consumption, and environmental governance, at the green level. According to the index screening with the same statistical caliber from 2007 to 2018, industrial SO₂ emission per unit output value, volatile phenol emission per unit output value, COD emission per unit output value, and solid waste emission per unit output value were used to measure the impact on air, water resources, and production waste in the production process. The per capita electricity consumption, per capita water consumption, and per capita gas supply reflect the change of residents' green consumption consciousness. The green environment and environmental governance capacity are reflected by the per capita public green space area, nature reserve area, number of wastewater treatment facilities, number of waste gas treatment facilities, and comprehensive utilization of general solid waste.

3.1.3. Dimension Setting of Economic Development Level

The level of economic growth should not only pay attention to the current economic output but also pay attention to the evaluation of the growth power to promote output increase, especially the dynamic change caused by the supply side structural reform (Zhou and Wu, 2018) [31]. GDP, per capita income of urban residents, and per capita income of rural residents are used to measure regional economic aggregate, output of urban residents, and output of rural residents. Growth momentum is measured by the number of domestic three patents, capital stock, urban employment, and other outcome indicators.

To sum up, the index system of Inclusive Green Growth is shown in Table 1.

Table 1. Inclusive Green Growth index system.

Second-Level Indicators	Third-Level Indicators	Fourth-Level Indicators	Index Weight	Positive	Negative
Inclusive level(33.243)	Social equity (17.755)	PGDP	3.118	+	
		Per capita income ratio of rural residents	1.558	+	
		Number of health technicians per 10,000 people	3.486	+	
		Number of beds per 10,000 people in health institutions	3.719	+	
		The number of primary schools per 10,000 people	3.716	+	
		The number of ordinary middle schools per 10,000 people	2.158	+	

Table 1. Cont.

Second-Level Indicators	Third-Level Indicators	Fourth-Level Indicators	Index Weight	Positive Negative
Green level (32.134)	Social welfare (7.58)	Road mileage per capita	3.272	+
		Urban road area per capita	1.647	+
		Public transport vehicles per 10,000 people	2.661	+
	Social security (7.907)	Urban gas penetration rate	0.756	+
		Endowment insurance coverage	3.477	+
		Medical insurance coverage	3.675	+
	Green production (0.687)	Industrial SO ₂ emission per unit output value	0.211	—
		Volatile phenol emission per unit output value	0.063	—
		COD emission per unit output value	0.159	—
		Solid waste production per unit output value	0.254	—
	Green consumption (1.724)	Per capita electricity consumption	0.483	—
		Water consumption per capita	1.018	—
		Gas supply per capita	0.223	—
	Environmental governance (29.723)	Per capita public green space area	1.842	+
		Area of nature reserve	13.110	+
		Number of wastewater treatment facilities	5.468	+
		Number of waste gas treatment facilities	4.821	+
		Comprehensive utilization of general solid waste	4.483	+
Economic development level (34.623)	Economic output (12.15)	Gross Regional Product	5.064	+
		Per capita disposable income of urban residents	3.566	+
		Per capita income of rural residents	3.520	+
	Growth momentum (22.473)	Number of domestic three patents authorized	12.329	+
		Capital stock	6.257	+
		Number of urban employment	3.887	+

Note: The data of each variable in the table are from the statistical yearbook of the past years listed in Section 3.2.1 data sources, and the weight results are obtained after the data is processed by Equations (7)–(9).

3.2. Calculation and Analysis of Index Weight of Inclusive Green Growth

3.2.1. Data Sources

This paper uses the panel data from 2007 to 2018 to study the Inclusive Green Growth evaluation index system. The data of the evaluation index system comes from the *China Statistical Yearbook*, *China Population and Employment Statistical Yearbook*, *China Labor Statistical Yearbook*, *China Electric Power Yearbook*, *China Urban Statistical Yearbook*, and *China Environmental Statistical Yearbook*. For individual missing data, the two-year average interpolation method was used. Due to the lack of statistical caliber and data, Hong Kong, Macao, Taiwan, and Tibet are not included in the calculation.

3.2.2. Weight Processing Method and Calculation

The entropy method is an objective weighting method. The main idea is to determine the weight according to the variation degree of data. If the information entropy of an index is smaller, the variation degree will be greater, the amount of information provided will be more, and the weight will be greater in the comprehensive evaluation. Otherwise, the weight will be smaller. Thus, the entropy method is an objective evaluation method; according to the objective data evaluation, the conclusion has a certain degree of credibility

and scientificity, making it suitable for the calculation of cross period index variation degree of panel data and highlighting the focus of the government during the period. The more attention paid to a problem, the greater the variation of the representational index of the problem, and the more weight allocated.

The calculation steps are as follows:

The first step is data standardization. Since the entropy weight method needs to log the data in the calculation process, the data standardization makes the index $z_{ij} > 0$ and adopts the non-negative translation method of the polar difference.

$$\begin{aligned} z_{ij} &= \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})} + o(0), i, j \in [m, n], \quad x_{ij} \text{ is a positive indicator} \\ z_{ij} &= \frac{\max(x_{ij}) - x_{ij}}{\max(x_{ij}) - \min(x_{ij})} + o(0), i, j \in [m, n], \quad x_{ij} \text{ is a negative indicator} \end{aligned} \quad (7)$$

The second step is to calculate the information entropy E_j ,

$$E_j = -k \sum_{i=1}^m P_{ij} \ln P_{ij} = -\frac{1}{\ln m} \sum_{i=1}^m \frac{z_{ij}}{\sum_{i=1}^m z_{ij}} \ln \frac{z_{ij}}{\sum_{i=1}^m z_{ij}}. \quad (8)$$

The third step is to calculate the weight ω_j ,

$$\omega_j = \frac{d_j}{\sum_{j=1}^n d_j} = \frac{1 - E_j}{\sum_{j=1}^n 1 - E_j}. \quad (9)$$

3.2.3. Weight System Analysis

The weight of each index is obtained through the above weight calculation process, as shown in Table 1.

Since the panel data entropy weight method can reflect the variation degree of indicators in the panel period, we can find the different directions of China's focus from 2007 to 2018 to a certain extent from the weight system. From the perspective of four-level indicators, the indicators with smaller weight include urban gas penetration rate and green production and consumption. The reason why the gas penetration rate changes less is that the residents' gas coverage rate has reached a very high level after 2007. The smaller weight of each indicator in green production may be because the breakthrough of green technology is not easy, the improvement of pollutants per unit output value is not high, and the weight of each index in green consumption is small, which may be due to the rigidity of energy consumption, resulting in the per capita energy consumption having not decreased much in the past 12 years. The area of nature reserves and the number of patents authorized in China are the four indicators with greater weight, which indicates that the environmental governance and innovation ability has been significantly improved in the past 12 years. From the perspective of three-level indicators, social equity, environmental governance, and growth power have a large weight, which indicates that the indicators selected in their sub-dimensions vary greatly, representing the deepening of the Chinese government's concept of Inclusive Green Growth and putting it into practice. From the secondary dimension, the weight distribution of inclusive level, green level, and economic growth level is relatively average, which indicates that the evaluation index system selected and constructed is more in line with the theoretical analysis of Inclusive Green Growth, that is, the sustainable growth model of coordinated growth of society, ecology, and the economy.

3.3. Measurement and Analysis of the Change Rate of Inclusive Green Growth index

The Inclusive Green Growth index can be obtained by Equation (10):

$$IGG_{ij} = z_{ij} * \omega_j. \quad (10)$$

From 2007 to 2018, China's regional IGG index can be calculated, and Figure 2 describes the change rate of the national overall Inclusive Green Growth index and each dimension.

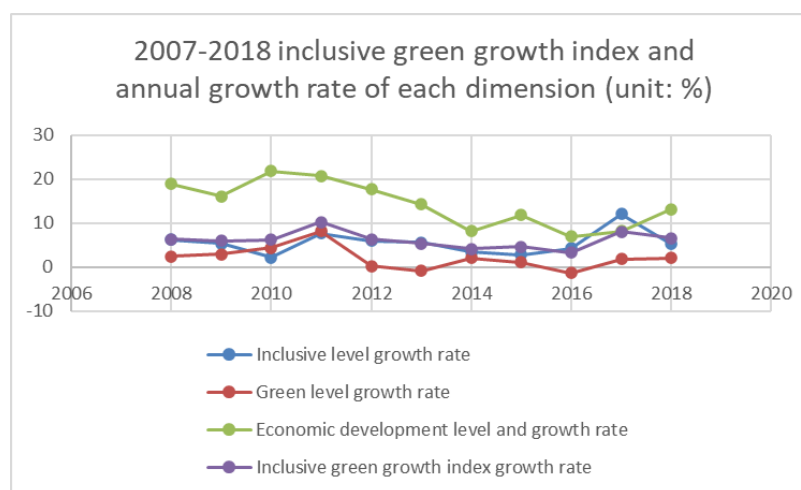


Figure 2. Inclusive Green Growth index and annual change rate of various dimensions in 2007–2018. Note: The growth rate of each dimension in Figure 2 is calculated from each dimension in Table 1.

The change rate of the Inclusive Green Growth index in 2007–2018 took the lead in rising and then decreasing, and it continued to rise after 2016, indicating that the supply-side structural reform carried out in the first year of 2016 has achieved certain results. The main pressure during the decline of the total index is the decline of the growth rate of the economic level, which does not change until 2016. The growth rate of the inclusive level reached its peak in 2017, indicating that the transformation of the main contradiction judgments has played a significant role in promoting Inclusive Green Growth in various provinces. The vast majority of provinces have focused on promoting social equity, social welfare, and social security, but the growth rate in 2018 has declined again. The change of green level fluctuates, and there is negative growth during the period. The growth rate of the whole period is lower than the growth rate of the Inclusive Green Growth index. It indicates that although the index change rate of environmental governance is large, the overall growth rate of green level is not high due to the difficulty of green technology breakthrough of green production and the rigidity of energy consumption of residents. We should increase the breakthrough of green technology and promote the energy consumption concept of low-carbon and environmental protection so as to promote the rise of green level and promote the rise of an Inclusive Green Growth index.

The spatiotemporal change map of each province is drawn by GEODA, as shown in Figure 3. The Inclusive Green Growth index of each province is classified according to six quantile breakpoints. The darker the color in different periods, the higher the Inclusive Green Growth index score. From the classification of Inclusive Green Growth index, it can be seen that from 2007 to 2013, the Inclusive Green Growth index of cities in Eastern and Western China was higher than that of other cities in the same year. Due to the high level of economic development, wide coverage of the social security system, and less heavy industrial production, the eastern region has low environmental pollution, so the comprehensive score of its Inclusive Green Growth index is relatively high. Although the economic development level of the western region is not as good as that of the eastern region, its own high resource and environmental endowment leads to a high green level, the income gap is far lower than that of the eastern region, and the level of inclusiveness is high. Since 2014, the comprehensive score of Inclusive Green Growth in the western region has begun to decline compared with the northern and eastern regions. China's economic growth has slowed down, resulting in a weaker economic growth level in the western region, and social welfare has not kept up with the development level of other

regions in the country. During the investigation period, the Inclusive Green Growth index of China's provinces gradually evolved from the high level in the east and west to the high level in the east and north, and then to the high level in the east, reflecting the imbalance and insufficiency of the comprehensive development of various regions in China. The resources are gradually concentrated in the eastern region, while most provinces and cities in the central region are on the contrary.

Due to the different initial endowments of different regions, it is not significant to calculate the index scores in the order of horizontal comparison. Therefore, this paper only makes a simple trend analysis of the national composite index, and the score change rate of each year can reflect the efforts of each province in Inclusive Green Growth, which can be compared horizontally and vertically, as shown in Table 2.

Table 2. Inclusive green index and growth rate of provinces in 2007–2018.

Year Region	2007 Index	2018 Index	2008 Growth Rate	2010 Growth Rate	2012 Growth Rate	2014 Growth Rate	2016 Growth Rate	2018 Growth Rate	Regional Average Growth Rate
Beijing	0.183	0.335	4.235	−1.599	7.987	8.197	4.962	3.551	5.243
Tianjin	0.143	0.242	5.634	7.998	6.486	2.121	4.314	−2.956	4.562
Hebei	0.187	0.359	9.412	10.333	3.711	3.057	7.331	4.585	5.634
Shanxi	0.162	0.265	6.706	5.241	8.438	0.291	−0.493	5.154	4.300
Inner Mongolia	0.207	0.345	5.278	6.517	2.826	4.755	1.840	2.324	4.370
Liaoning	0.179	0.297	8.695	7.521	5.766	3.465	−3.774	7.998	4.366
Jilin	0.130	0.234	6.853	7.929	5.373	3.227	1.327	10.956	5.022
Heilongjiang	0.164	0.270	7.177	4.525	4.871	3.899	1.906	4.183	4.264
Shanghai	0.182	0.304	−1.086	2.670	−4.980	5.396	5.465	4.115	4.525
Jiangsu	0.232	0.560	9.761	9.744	10.487	3.066	2.483	7.037	7.686
Zhejiang	0.209	0.466	11.661	10.932	11.349	4.299	8.533	8.109	6.994
Anhui	0.128	0.309	10.987	7.867	7.888	5.822	2.677	15.941	7.692
Fujian	0.153	0.320	7.862	1.783	10.363	1.688	4.614	8.650	6.396
Jiangxi	0.125	0.281	12.696	6.659	4.841	2.796	2.584	4.154	7.077
Shandong	0.231	0.492	8.116	8.993	6.189	4.345	3.721	4.625	6.563
Henan	0.171	0.387	5.884	5.624	8.001	5.862	3.568	6.879	7.095
Hubei	0.143	0.311	7.877	6.413	−3.002	6.052	4.067	5.787	6.813
Hunan	0.139	0.286	8.274	6.859	6.106	6.079	1.173	5.907	6.233
Guangdong	0.260	0.611	11.635	8.115	8.710	5.253	4.010	10.480	7.451
Guangxi	0.115	0.239	7.631	6.349	7.480	2.759	1.751	4.671	6.391
Hainan	0.098	0.188	8.906	5.605	4.548	2.735	1.488	13.461	5.692
Chongqing	0.108	0.245	12.722	5.776	18.643	3.410	1.546	3.729	7.220
Sichuan	0.203	0.382	4.928	5.893	6.821	1.861	4.446	7.800	5.421
Guizhou	0.092	0.232	8.284	8.072	9.731	6.999	2.112	22.755	8.123
Yunnan	0.141	0.261	−0.620	3.709	2.987	5.448	4.679	6.226	5.443
Shaanxi	0.141	0.265	8.082	16.230	4.785	5.271	4.293	13.037	5.518
Gansu	0.168	0.251	−4.419	2.448	4.919	7.764	0.878	2.539	3.515
Qinghai	0.264	0.329	0.598	0.657	1.491	2.068	5.536	1.733	1.899
Ningxia	0.096	0.192	6.261	3.065	17.882	5.293	2.188	3.914	6.064
Xinjiang	0.260	0.349	0.248	2.279	3.591	3.182	2.683	6.465	2.509
Annual average	0.167	0.320	6.676	6.140	6.476	4.215	3.064	6.794	5.669

Note: It is calculated by the numerical values of different regions in China from 2007 to 2018. Due to space constraints, only the index situation and annual growth rate in 2007 and 2018 can be displayed. The index situation of each year can be calculated from the displayed results.

It can be seen from Table 2 that the average change rate of the Inclusive Green Growth index of all provinces and cities from 2007 to 2018 is about 5.7%. From 2007 to 2012, the average annual growth rate of the index increased by about 6.4%, and the economic output showed a downward trend. The rise of the index benefited from the practice of inclusive growth and green development. During 2014–2016, the growth rate slowed down, and the growth rate of the three dimensions showed a downward trend, which may be due to the

greater resistance under the new normal economy, resulting in the decline of all aspects of the index level. From 2016 to 2018, the index growth rate of most cities rose rapidly, and the average annual growth rate of the index also rose to 6.8%, which is related to the practice of supply-side structural reform by regional governments, indicating that the reform has a certain effect on society, ecology, and the economy.

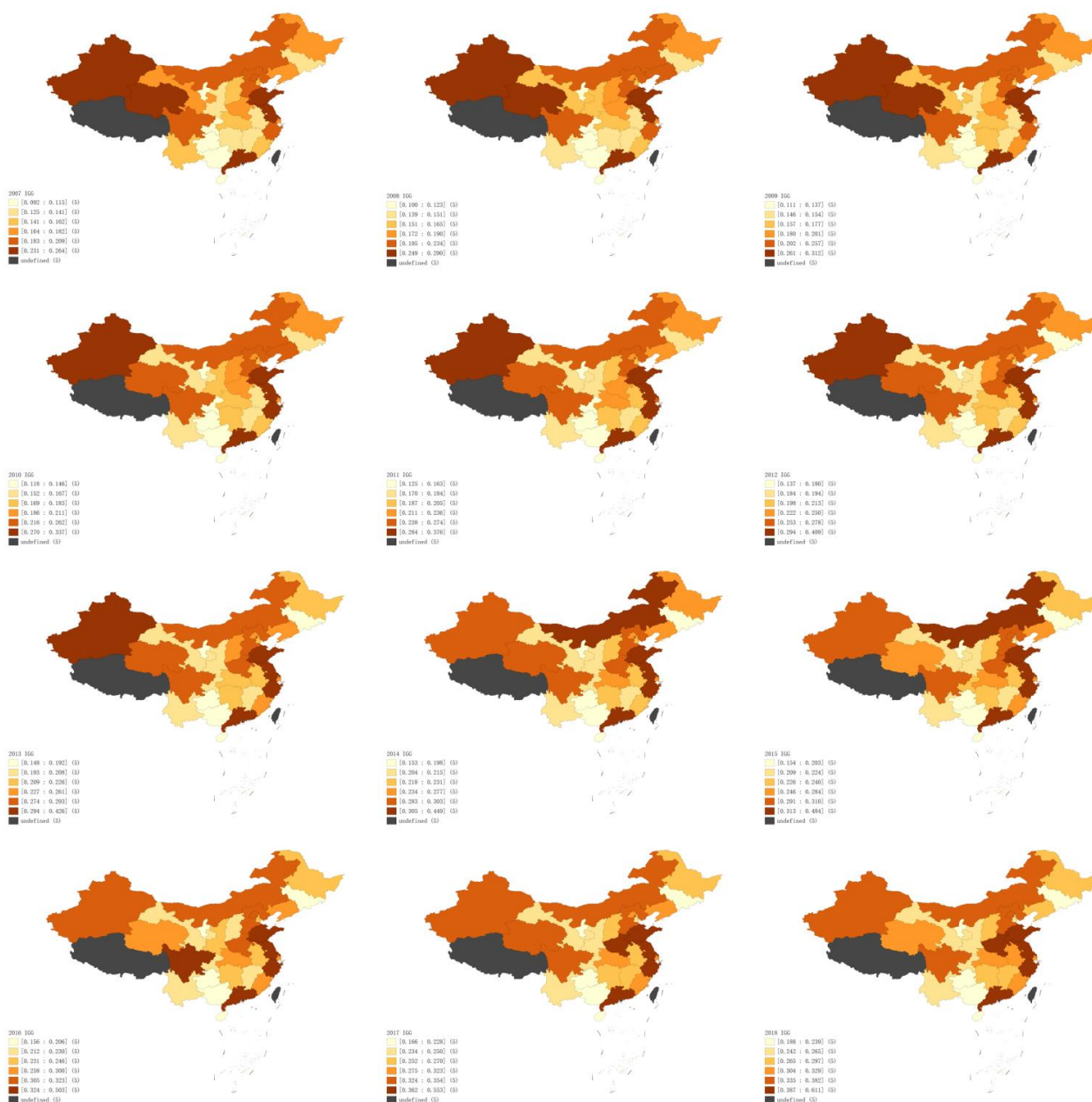


Figure 3. Temporal and spatial changes of the Inclusive Green Growth index in various regions of China from 2007 to 2018. Note: The Inclusive Green Growth index of each region in the figure is calculated according to the values of different years, which can also be calculated and tested through Table 2. The results are presented and a GEODA drawing is completed.

To sum up, from 2007 to 2018, China's Inclusive Green Growth index showed an overall upward trend. Under the resistance of the new normal economy, the increase in the index slowed down. During the period of economic growth level decline, the increase in the inclusive level will drive the rise of the overall index. As the economic growth rate will eventually return to the near steady-state growth rate, it will take a lot of time to lead the new round of growth technology progress. Therefore, under the condition that the

technology level has not been broken through, it is necessary to invest in innovation and research and development constantly, and paying attention to the inclusive and green growth mode is conducive to the improvement of social overall welfare. When the rise of the total index encounters resistance, the practice of supply-side structural reform plays a significant role in the rise of the total index. Therefore, we need to further promote the supply-side structural reform, break the shackles of economic development, provide more ecological capital and fair environment from the supply side, and provide more effective policy support and institutional environment for Inclusive Green Growth.

4. Relative Efficiency and Temporal Spatial Difference of Government Expenditure Structure under the Goal of Inclusive Green Growth

Fiscal expenditure is one of the most direct and effective means of government public governance. From the theoretical analysis, we can know that fiscal expenditure directly affects the three dimensions of Inclusive Green Growth, and the allocation efficiency of fiscal expenditure structure directly affects the output of Inclusive Green Growth.

In 2007, the financial expenditure entry was reformed on a large scale. Its purpose is to meet the needs of specific domestic expenditure items at that time, and to be in line with international standards to form a certain degree of international comparability of financial expenditure classification. According to the International Monetary Fund (IMF) government fiscal statistics and a large number of literature on the classification standard of fiscal expenditure structure, the fiscal expenditure structure is divided into economic constructive expenditure, social security expenditure, and other maintenance expenditure, and then the energy conservation and environmental protection expenditure, which has a direct impact on Inclusive Green Growth, as it is extracted from the economic constructive expenditure. The specific expenditure entry has been shown in the theoretical analysis part. This paper focuses on the structural allocation efficiency of financial expenditure of economic construction expenditure, social security expenditure, and energy conservation and environmental protection expenditure for the purpose of Inclusive Green Growth.

4.1. The Changing Trend of Fiscal Expenditure Structure

Figure 4 respectively reports the trend of the change of the absolute amount of fiscal revenue and expenditure in 2007–2018 and the comparative trend between the growth of fiscal revenue and expenditure and GDP growth. It can be found that before 2014, the growth rate of fiscal revenue was higher than that of GDP, and that in most years, it was higher than that of fiscal expenditure. In 2011, the growth rate of the three started to decline sharply. After 2014, the growth of fiscal revenue has been falling below three factors, and the growth of financial expenditure is accelerating. It shows that under the background of new economic normal and government simplification of government power and tax stimulation, the financial revenue is decreasing, and more and more places need financial expenditure investment. The growth rate of fiscal revenue in 2007–2018 reached 315% less than that of fiscal expenditure by 391%, and the absolute scale of national fiscal revenue in 2018 was only 97.90 billion yuan, while the absolute scale of fiscal expenditure in the same period reached 188,196,333 million yuan, and the gap still has a growing trend. Therefore, in the context of the aggravation of the contradiction between the fiscal revenue and expenditure, we should adjust the allocation of the financial expenditure structure with the development goal as the direction, so as to maximize the efficiency of the structure of financial expenditure.

Figure 5 shows the trend of absolute number and change rate of fiscal expenditure structure from 2007 to 2018. It can be seen from the figure that in most years, except for the proportion of other expenditures, the proportion of economic expenditure, social expenditure, and energy conservation and environmental protection expenditure increased, and the three accounted for the proportion of other expenditures. After 2015, due to the escalation of Sino US trade friction, the proportion of other expenditures increased to a certain extent. In the past 12 years, the proportion of economic expenditure increased from 27% to 33%, with a change rate of 22.7%. The proportion of social expenditure increased

from 40% to 46%, with a change rate of 15%. The proportion of energy conservation and environmental protection expenditure increased from 2.5% to 3.1%, with a change rate of 24%. It can be found that the government fiscal expenditure still bears more economic and constructive functions, the proportion of social expenditure is rising steadily, and the government has the trend of turning to service-oriented government. Although the change rate of energy conservation and environmental protection expenditure reaches 24%, the absolute proportion is still very low. In order to achieve the goal of Inclusive Green Growth, we should increase the investment in energy conservation and environmental protection and set up more detailed environmental protection input entries to study the impact of each entry on the environment.

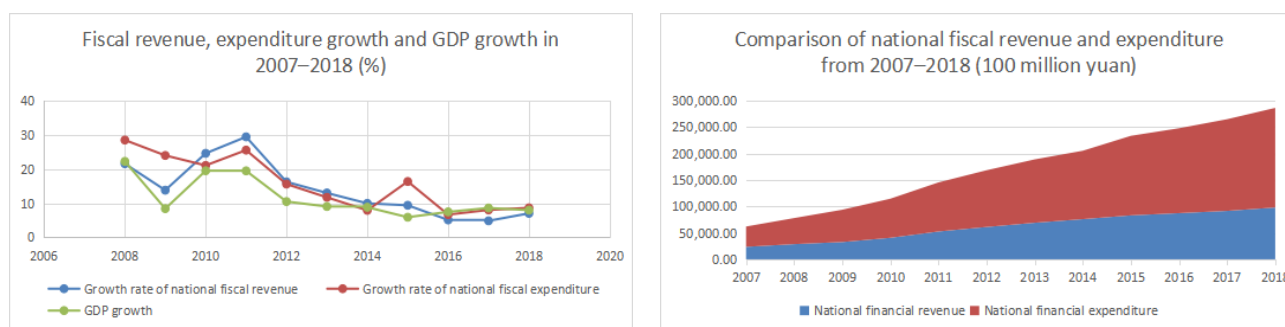


Figure 4. Comparison of national fiscal revenue and expenditure, fiscal revenue and expenditure growth, and GDP growth from 2007 to 2018. Note: The data in the figure come from the *China Financial Statistics Yearbook* over the years.

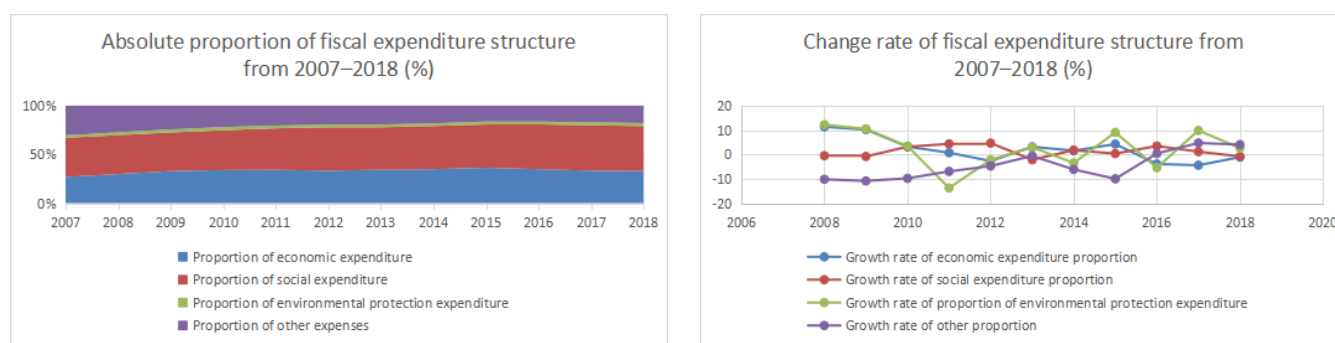


Figure 5. Proportion and change rate of national fiscal expenditure structure from 2007 to 2018. Note: The data in the figure comes from the *China Financial Statistics Yearbook* over the years. It is calculated according to the functional structure of financial expenditure.

4.2. Static Efficiency and Spatial Heterogeneity of Fiscal Expenditure Structure under Inclusive Green Growth Target

From Equation (6), we can see that the efficiency of government expenditure can be divided into technological progress and structural efficiency. Technological progress is whether the current optimal technological level is adopted in government expenditure, and structural efficiency is whether the combination of various types of government expenditure achieves the optimal allocation. This paper uses nonlinear DEA-CCR and DEA-BCC models to estimate the efficiency of the fiscal expenditure structure under the goal of static Inclusive Green Growth.

DEA was first proposed and applied by American operational research scientist Charnes (1978) [45]. The DEA-CCR model is the most basic model, which is based on the setting of constant returns to scale to calculate the comprehensive efficiency of the decision-making unit. After that, Banker et al. (1984) [46] introduced variable return to scale. The model is extended to DEA-BCC mode. The efficiency value calculated on the basis of constant returns to scale is the pure technical efficiency value. By simple division,

we can get the scale efficiency value, which equals the comprehensive efficiency value/pure technical efficiency value. This paper simply shows the calculation principle of the model.

The DEA-CCR model:

$$\min \theta, \text{ s.t. } y_0 \leq \sum \delta_j y_j \leq f(\theta \sum x_i), \delta_i \geq 0, i \in m, j \in n. \quad (11)$$

Among them, n represents the number of decision-making units in the model, θ represents the comprehensive efficiency value, x_i represents the i -th input factor, y_j represents the j -th output value, and y_0 represents the output value without considering the comprehensive efficiency. The condition of constant returns to scale $\sum \delta_j = 1$ is introduced in Equation (11), and the model is extended to the DEA-BCC model.

The DEA method can compare the static data, compare the decision-making units in the cross-section horizontally, and select the efficient decision-making units in different periods. Although it is impossible to compare the efficiency numerical value, it is still able to carry out the relative comparative analysis of the production frontier, for example, in a certain time period, whether the initial optimal efficiency frontier still maintains the frontier position in the final period.

According to the relationship between financial expenditure structure and Inclusive Green Growth in Figure 1 of the theoretical analysis, we regard financial and economic productive expenditure, social security expenditure, and energy conservation and environmental protection expenditure as input indicators as well as three secondary indicators of Inclusive Green Growth as output indicators. We used DEAP software to set the input orientation and scale variable parameters for calculation. The results show that the average of comprehensive efficiency, technical efficiency, and scale efficiency in 2007 are 0.689, 0.81, and 0.839, respectively, and the average of 18 years are 0.683, 0.922, and 0.734, respectively. For the efficiency frontier in 2007, both technical efficiency and structural efficiency are high. For the efficiency frontier in 2018, the overall utilization efficiency of production technology progress is higher, while the structural efficiency is 0.734, which means that referring to the frontier efficiency provinces, other provinces can save about 25% of the fiscal expenditure by improving the fiscal expenditure structure, so as to achieve Inclusive Green Growth and higher comprehensive efficiency of fiscal expenditure. The situation of each province in 2018 is shown in Table 3.

Table 3. Static relative efficiency of regional government expenditure structure in 2018.

DMU	Crste	Vrste	Scale		DMU	Crste	Vrste	Scale	
Beijing	0.729	0.985	0.74	drs	Henan Province	0.571	0.976	0.585	drs
Tianjin	1	1	1	-	Hubei	0.546	0.89	0.613	drs
Hebei	0.524	0.894	0.587	drs	Hunan	0.458	0.916	0.5	drs
Shanxi	0.551	0.827	0.666	drs	Guangdong	0.827	1	0.827	drs
Inner Mongolia	0.714	0.899	0.795	drs	Guangxi	0.823	0.946	0.87	drs
Liaoning	0.781	0.978	0.799	drs	Hainan	1	1	1	-
Jilin	0.589	0.845	0.697	drs	Chongqing	0.538	0.853	0.63	drs
Heilongjiang	0.469	0.806	0.582	drs	Sichuan	0.42	0.961	0.436	drs
Shanghai	0.723	0.824	0.878	drs	Guizhou	0.509	0.871	0.584	drs
Jiangsu Province	0.873	1	0.873	drs	Yunnan	0.446	0.795	0.561	drs
Zhejiang	0.898	1	0.898	drs	Shaanxi	0.563	0.894	0.63	drs
Anhui	0.52	0.84	0.619	drs	Gansu Province	0.482	0.822	0.586	drs
Fujian	0.854	0.99	0.863	drs	Qinghai	1	1	1	-
Jiangxi	0.571	0.837	0.682	drs	Ningxia	1	1	1	-
Shandong	0.711	1	0.711	drs	Xinjiang	0.797	0.998	0.798	drs

Note: The efficiency of each region in the table is calculated by DEAP, and the data comes from the selection of Inclusive Green Growth indicators and China's fiscal expenditure.

Table 3 shows the static relative efficiency values of the fiscal expenditure structure with Inclusive Green Growth as the goal in 2018. It can be seen that the efficiency of technological progress of fiscal expenditure in various regions is higher, and the efficiency of the fiscal expenditure structure varies greatly. Among them, Hebei, Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, and Gansu are the regions with comprehensive efficiency values lower than 0.6. The reason for the low comprehensive efficiency lies in the low efficiency of the capital allocation of the expenditure structure. We can catch up with the frontier by adjusting the financial expenditure structure; Tianjin, Hainan, Qinghai, and Ningxia are the regions with comprehensive efficiency of 1, which shows that these regions achieve Inclusive Green Growth DEA efficiency through reasonable fiscal expenditure structure adjustment.

Figure 6 reports the relative efficiency of the regional fiscal expenditure structure from 2007 to 2018 according to six equally spaced breakpoints. The darker the color, the better the efficiency of the regional fiscal expenditure structure. Compared with the temporal and spatial variation of the Inclusive Green Growth index in Figure 3, Figure 6 shows the differentiation of regional fiscal expenditure structure efficiency in the eastern, central and western regions. The level of economic development in the eastern region is relatively high, the distribution of fiscal expenditure is relatively reasonable, and the average level of structural efficiency is above 0.8. The green level in the western region is relatively high, and the average efficiency of the fiscal expenditure structure is also above 0.75. Meanwhile, the overall level of all dimensions in the central region is not high, and the efficiency of the fiscal expenditure structure is far from the regional production frontier. It is suitable to adjust the fiscal expenditure structure to improve the utilization of funds.

In order to more clearly analyze the relative ranking of the efficiency of the fiscal expenditure structure in two years, Table 4 shows the comparison of the efficiency of the fiscal expenditure structure in 2007 and 2018 in the form of a matrix. According to the staggered position of the two time points, the matrix can be divided into four blocks. It can be seen that Tianjin, Zhejiang, Fujian, Guangdong, Hainan, Qinghai, Ningxia, Xinjiang, Shandong, Jiangsu, and Guangxi have maintained a leading position in the efficiency of fiscal expenditure structure in the past two years. Chongqing, Hebei, Hubei, and Jiangxi are the regions with the relative decline, of which Hebei is the largest, with 13 places down. Shanghai, Liaoning, Inner Mongolia, and Beijing are the places where the relative ranking rises. Among them, Liaoning rises 18 places, with the largest increase; the other regions are in the lower position of structural efficiency in those two years.

Table 4. The relative rank of the efficiency of fiscal expenditure structure in different regions.

		2007 Financial Expenditure Structure Efficiency	
		Located at or Near the Efficiency Front	Far from the Efficiency Front
2018 financial expenditure structure efficiency	Located at or near the efficiency front	Tianjin, Zhejiang, Fujian, Guangdong, Hainan, Qinghai, Ningxia, Xinjiang, Shandong, Jiangsu, Guangxi	Shanghai, Liaoning, Inner Mongolia, Beijing
	Far from the efficiency front	Chongqing, Hebei, Hubei, Jiangxi	Jilin, Shanxi, Shaanxi, Anhui, Gansu, Henan, Guizhou, Heilongjiang, Yunnan, Hunan, Sichuan

Note: Through the efficiency of 2007 and 2018, various regional types are selected.

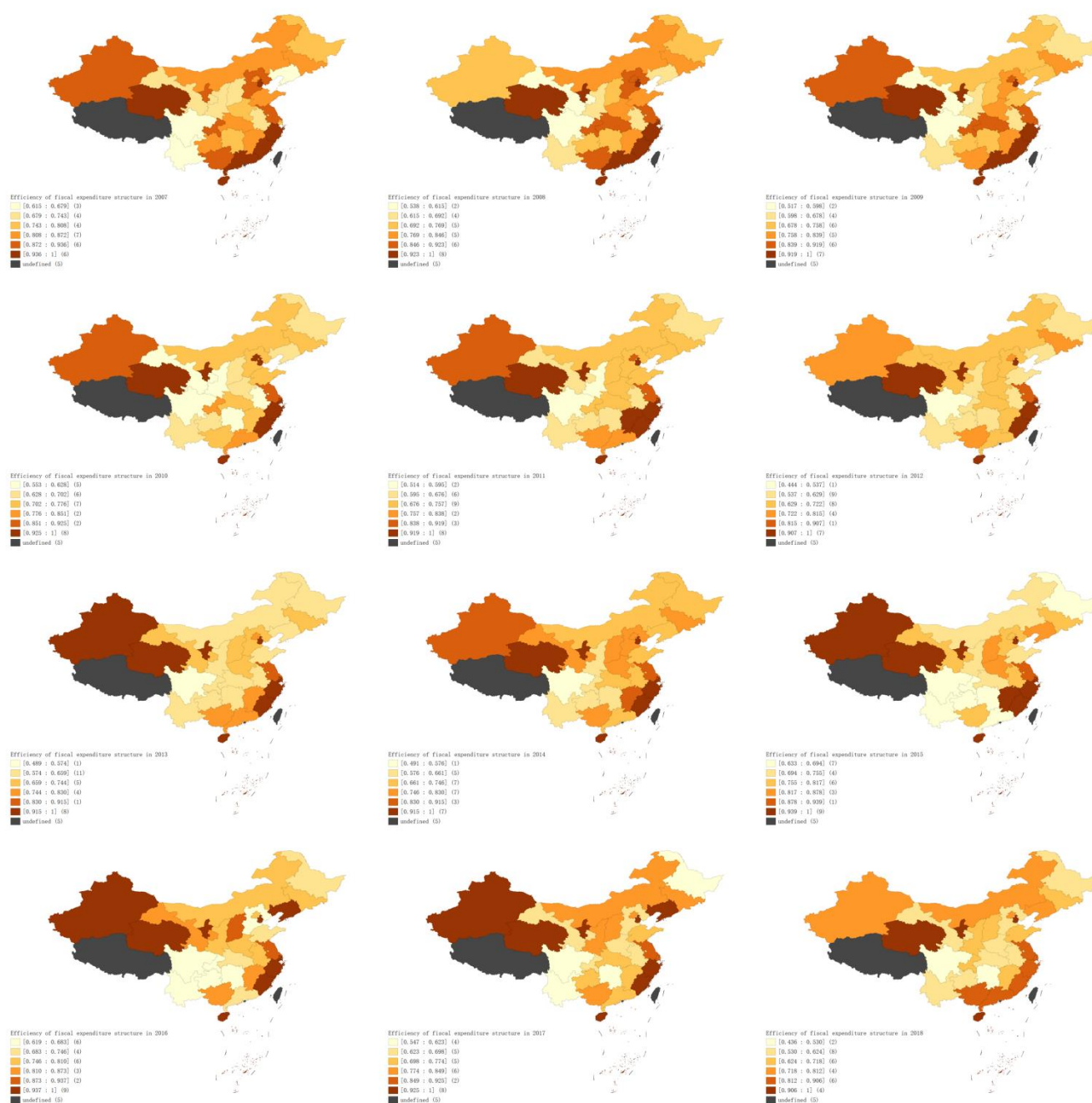


Figure 6. Efficiency of provincial fiscal expenditure structure in 2007 and 2018. Note: The results in the figure come from the DEA efficiency calculation results over the years, which are drawn by GEODA.

4.3. Dynamic Efficiency of Fiscal Expenditure Structure under the Goal of Inclusive Green Growth

DEA can only calculate the relative efficiency of static section data. Fare et al. [47] (1994) established the Malmquist productivity index to examine the growth of TFP. Furthermore, on the premise of introducing variable returns to scale, the product decomposition of distance function between two periods is applied to further decompose TFP into technical progress change (Tech), technical pure efficiency change (Pech), and technical scale efficiency change (sech). By using the distance function of two periods to describe the

cumulative dynamic rate of change of the three, it can process the dynamic panel data and make up for the deficiency of DEA. Under the condition of VRS, the Malmquist index is:

$$\text{Malmquist} = M(X^t, Y^t, X^{t+1}, Y^{t+1}) = \text{TC} * \text{PE} * \text{SE} = \frac{D^{t+1}(X^{t+1}, Y^{t+1} | \text{VRS})}{D^t(X^t, Y^t | \text{VRS})} \cdot \left[\frac{D^{t+1}(X^{t+1}, Y^{t+1} | \text{CRS})}{D^{t+1}(X^{t+1}, Y^{t+1} | \text{VRS})} * \frac{D^t(X^t, Y^t | \text{VRS})}{D^t(X^t, Y^t | \text{CRS})} \right] * \left[\frac{D^t(X^{t+1}, Y^{t+1} | \text{CRS})}{D^{t+1}(X^{t+1}, Y^{t+1} | \text{CRS})} * \frac{D^t(X^t, Y^t | \text{VRS})}{D^{t+1}(X^t, Y^t | \text{CRS})} \right]^{\frac{1}{2}} \quad (12)$$

In order to analyze the dynamic efficiency of the fiscal expenditure structure, we use the input–output of static efficiency and use DEAP software to set input-oriented and scale variable parameters for calculation. Table 5 reports the average total factor productivity and its decomposition of fiscal expenditure structure under the guidance of Inclusive Green Growth in each province from 2007 to 2018.

Table 5. Average total factor productivity of fiscal expenditure structure of provinces from 2007 to 2018.

Year	Effch	Techch	Pech	Sech	Tfpch
2008	1.27	0.597	1.099	1.156	0.759
2009	1.272	0.835	0.935	1.36	1.062
2010	0.888	0.632	1.02	0.87	0.561
2011	1.004	1.087	0.84	1.195	1.091
2012	1.193	0.573	1.29	0.925	0.684
2013	0.816	0.98	0.846	0.964	0.8
2014	0.98	1.019	1.161	0.844	0.999
2015	0.854	1.399	0.922	0.927	1.195
2016	1.349	0.506	1.048	1.288	0.682
2017	0.73	1.673	0.824	0.886	1.221
2018	1.213	0.59	1.29	0.94	0.716
mean	1.031	0.835	1.012	1.019	0.861

Note: The above table shows the average total factor productivity of the fiscal expenditure structure in various regions, and the input–output data sources are the same as those above. Calculate Equation (12) from DEAP.

From the overall average situation, the pure technical efficiency of finance and the structural efficiency of fiscal expenditure move to a more effective frontier,

Similar to the conclusion drawn from the static analysis, except for 2009–2010, the efficiency value of the fiscal expenditure structure efficiency in the early stage is greater than that in the later stage. In the dynamic changes, the efficiency of the fiscal expenditure structure in 2007–2008, 2008–2009, 2010–2011, and 2015–2016 is greater than 1, indicating that there is still a lot of room for adjustment of the fiscal expenditure structure aiming at Inclusive Green Growth. The reason for the biggest change of TFP accumulation rate is the fluctuation of technological progress. The efficiency values of technological progress in 2007–2008, 2011–2012, 2015–2016, and 2017–2018 are 0.57, 0.58, 0.51, and 0.59, respectively, indicating that fiscal expenditure did not use the technology owned by the frontier to produce in these years. Therefore, to improve the total factor productivity of fiscal expenditure, we should pay attention to technological progress and adjust the structure of fiscal expenditure.

As there are some differences in the government expenditure structure, Inclusive Green Growth level, and three-dimensional development level of local governments in different provinces, in order to further understand the total factor productivity change of the government expenditure structure in different regions of China, this paper gives the annual total factor productivity change radar chart of local government expenditure structure in different provinces. Furthermore, the total index of Inclusive Green Growth level weighted by the three dimensions is used as the dependent variable for comparative analysis, as shown in Figure 7.

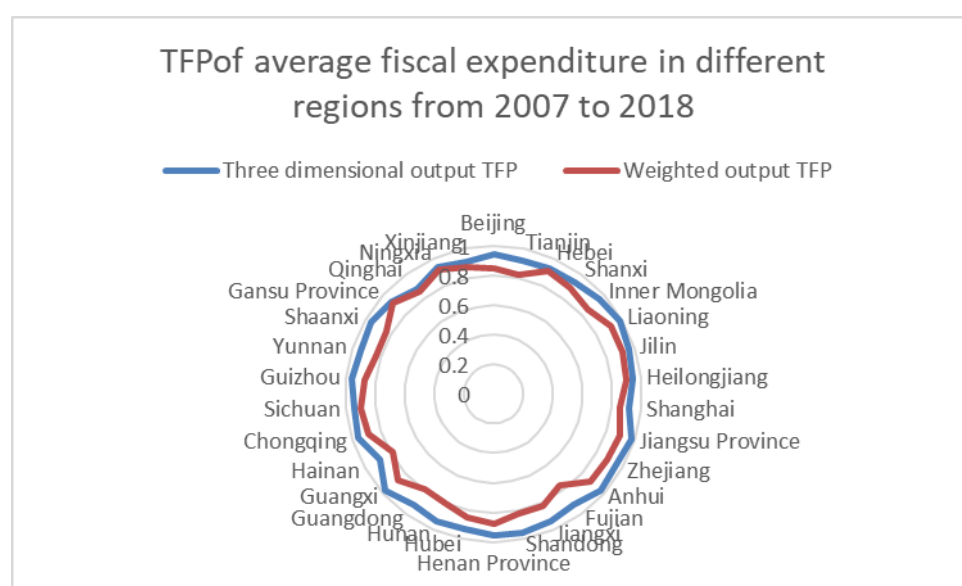


Figure 7. Total factor productivity of fiscal expenditure by region from 2007 to 2018. Note: The data source in the figure is Table 5. Calculate Equation (12) from DEAP.

From 2007 to 2018, the average total factor productivity of fiscal expenditure in different regions is 0.942 and 0.861, respectively. The weighted total index efficiency is slightly lower than that of the three-dimensional development level. The score analysis of the annual average total factor productivity of different regions also confirms this result. Table 6 reports the average fiscal expenditure structure of each region under the Inclusive Green Growth goal under the two output calculation methods and the regions with TFP at the average level and above or below.

Table 6. Comparison of average TFP in different regions from 2007 to 2018.

		Weighted Total Index Output TFP	
		On Average or Above	Below Average
Three-dimensional output TFP	On average or above	Liaoning, Jilin, Heilongjiang, Jiangsu, Zhejiang, Anhui, Henan, Guangxi, Chongqing, Sichuan, Guizhou	Beijing, Inner Mongolia, Jiangxi, Shandong, Yunnan, Shaanxi
	Below average	Hebei, Shanxi, Gansu, Ningxia and Xinjiang	Tianjin, Shanghai, Fujian, Hubei, Hunan, Guangdong, Hainan and Qinghai

Note: Through the average TFP of 2007 to 2018, various regional types are selected.

By comprehensively comparing Figures 3 and 6 and Table 6, we can find that different from the traditional GDP-oriented efficiency of fiscal expenditure structure, the TFP of fiscal expenditure in central and western cities may also be higher than that in eastern cities under the calculation of the efficiency of the fiscal expenditure structure under Inclusive Green Growth output. There are two reasons. One is that the absolute scale of financial expenditure in eastern cities is larger than that in central and western regions, and the corresponding inclusive level and green level cannot match the corresponding investment. The investment in western cities is smaller, but the green level is higher. The other reason is that the output considered by Inclusive Green Growth is the common result of economic, social, and ecological factors. For the east, the expansion of income distribution and the consumption of ecological resources caused by economic development make the total index decline, and the corresponding DEA output level is much lower than the traditional GDP output level. Therefore, this paper further calculates the average Malmquist index of

each region according to the division of eastern, central, and western regions, as shown in Table 7. Among them, the eastern region includes Liaoning, Beijing, Tianjin, Shanghai, Shandong, Hebei, Jiangsu, Zhejiang, Fujian, Guangdong, and Hainan; the central region includes Henan, Hubei, Hunan, Anhui, Shanxi, Heilongjiang, Jiangxi, and Jilin; the western region includes inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang.

Table 7. TFP of fiscal expenditure structure by region and its decomposition comparison from 2007 to 2018.

Three-Dimensional Output	Effch	Techch	Pech	Sech	Tfpch
Eastern Region	0.9949	0.9430	1.0018	0.9933	0.9383
Central Region	0.9970	0.9509	1.0209	0.9769	0.9479
Western Region	1.0082	0.9357	1.0211	0.9873	0.9431
Weighted Output	effch	techch	pech	sech	tfpch
Eastern Region	1.0235	0.8258	1.0178	1.0051	0.8450
Central region	1.0411	0.8329	1.0138	1.0269	0.8671
Western Region	1.0344	0.8455	1.0070	1.0273	0.8745

Note: The data of each region are calculated by DEAP after summing up the data of the eastern, central, and western regions, respectively.

The two calculation methods show that the total factor productivity of fiscal expenditure in the eastern region is the lowest, and the efficiency of the fiscal expenditure structure has room to improve compared with the optimal frontier production. Therefore, compared with the western region, the eastern region should pay more attention to the financial expenditure, the social expenditure, and the energy conservation and environmental protection expenditure, so as to promote the Inclusive Green Growth level, and then ease the contradiction between people and nature, people and people, so as to achieve high-quality development.

5. Main Conclusions and Research Prospect

With more than 70 years of economic and social development, although the comprehensive national strength has been greatly strengthened, the non-inclusive and non-green problems under the mode of capital production are gradually exposed. We should guard against the endless expansion of capital. Under the background of China's economic new normal and the transformation of main contradictions, Inclusive Green Growth, as a new sustainable development path proposed by the international community, not only reflects the worldwide yearning for fair distribution and green environment but also reflects the main connotation of China's high-quality development goals, which is the inevitable requirement to meet the people's yearning for a better life. Fiscal expenditure is the most direct and effective means of fiscal policy. The efficiency of the fiscal expenditure structure reflects the level of national governance ability. In the reality of fiscal revenue and expenditure contradiction, appropriate adjustment of the fiscal expenditure structure can make the allocation of fiscal funds more effective and achieve better goals with lower governance cost. Therefore, this paper first explains the theoretical connotation of Inclusive Green Growth, points out its specific connection with the fiscal expenditure entry, and then constructs a theoretical model of the structural efficiency of government fiscal expenditure under the goal of Inclusive Green Growth. Secondly, according to the relevant theories and existing research basis, the evaluation index system of Inclusive Green Growth is constructed, and the relevant indexes are calculated and analyzed. Finally, the paper takes Inclusive Green Growth as an output index and fiscal expenditure structure as an input index, and it conducts DEA Malmquist index static and dynamic analysis. Based on this study, we give the following conclusions and suggestions.

- (1) Different from the previous research results of Inclusive Green Growth from the perspective of counties (Li et al., 2021) [34] and counties (Chen et al., 2020) [33] or a few indicators (Sun et al., 2020) [41], this paper constructs an evaluation index system covering multiple dimensions from the perspective of regions, and it expands the application of Inclusive Green Growth at the provincial level. In particular, for China's fiscal policy system, the measurement results of Inclusive Green Growth at the provincial level can well match the regional fiscal expenditure. The fiscal expenditure efficiency is calculated, which provides a basis for the study of regional heterogeneity. The growth rate of the Inclusive Green Growth index shows a downward trend year by year under the background of the new normal economy. After the implementation of the supply-side structural reform in 2016, the downward trend of the growth rate has eased. The recovery of the overall index growth rate benefits from the increase in the growth rate of the inclusive level, while the growth rate of the green level has had little change in recent years. Therefore, at a time when the international trade is not optimistic, the domestic economy has great downward resistance, and the technological revolution has not yet arrived, the government should focus on technological breakthrough, social equity, and environmental protection, continue to deepen the supply-side structural reform, and do a good job in the internal adjustment of the country, so as to lay the foundation for the next economic boom.
- (2) The efficiency of fiscal expenditure structure with the goal of Inclusive Green Growth has a large space–time difference in the study period, and the difference has gradually expanded in recent years. The result is different from that of the traditional fiscal expenditure structure with GDP as output (Li, 2010) [12]. It is also different from the fiscal expenditure structure efficiency of green growth considering environmental factors (Qi and Zhao, 2020) [48] and inclusive growth considering social equity (Liu, 2020) [49] in recent years. The fundamental reason is that this paper studies inclusive green growth as a whole system. Without considering social equity and green environment, the efficiency of the fiscal expenditure structure measured only by GDP almost completely tends to increase the proportion of economic construction expenditure. China's eastern, central, and western regions should adopt this fiscal policy under the traditional thinking. However, the infrastructure construction in some areas of China is relatively perfect, and the problems of income distribution and environmental protection are becoming more and more prominent. The efficiency evaluation results of fiscal expenditure structure with Inclusive Green Growth as the new development goal show regional heterogeneity, and the tendency of fiscal expenditure structure in different regions should be different. For the eastern region, the average change rate of TFP of the fiscal expenditure structure under the Inclusive Green Growth goal is lower than that of other regions, and the fiscal expenditure structure should be inclined to social expenditure and green expenditure. In order to maintain the frontier of efficiency, the financial expenditure structure should focus on economic expenditure. There are great differences in the total factor productivity level of the central region's fiscal expenditure structure. Benchmarking cities should be set up to promote the demonstration effect.

In addition, there are some deficiencies in this paper, and we also put forward the prospect of future research. From the perspective of the index system, due to its coverage and cross period data availability and consistency, there may be a better choice of indicators. With the development of the times, future research topics may cover more dimensions. The research on the government's financial efficiency will be accompanied by constantly updated development goals. In terms of research methods, the entropy weight method will change with the different research period, so the data cannot be used directly in the future research; it should be updated and recalculated. From the empirical results, the regions with low efficiency of fiscal expenditure structure can learn from the regions with high efficiency in order to improve the efficiency of fiscal funds. However, in practice, due to the large differences in specific policies in different regions, the empirical results can

only provide a general adjustment direction, and the further implementation of specific fiscal policies needs further exploration.

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