

Research on the Coupling between the Efficiency of Green Economy and Social Equity Performance in China's Provinces under the Background of High-Quality Development

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Abstract

Using the super efficiency data envelopment method (US –SBM) including unexpected output and entropy weight method, this paper measures the green economic efficiency and social equity performance of 30 provinces in China from 2008 to 2019. With the help of the coupling degree model of deviation coefficient and panel Tobit model, The dynamic evolution law of the coupling degree between the two is explored from the provincial level, and the coupling mechanism and driving mechanism are clarified. The study found that the overall efficiency of the national green economy showed a downward trend first and then an upward trend, and has the characteristics of regional imbalance, while the social equity performance level of each province showed a steady trend of improvement over time, and the coupling degree of the two systems of green economic efficiency and social equity performance maintained a steady upward trend. The coefficient of variation of coupling degree in most provinces shows a law of decreasing first and then increasing, among which the coefficient of variation of coupling degree in the eastern region is generally higher than that in other regions; The type evolution of the coupling degree of each province is mainly to maintain the evolution from the original type to the adjacent type. In the late observation period, nearly 35% of the provinces are still in the coordinated development type below the primary level. In the discussion of driving factors, industrial structure, fiscal decentralization, scientific and technological innovation, opening to the outside world and environmental regulation all have a significant positive impact on the two systems and their coupling degree, while urbanization rate has an inhibitory effect on the growth of coupling degree; In the sub sample test, each factor has a stronger effect on the coupling degree in the eastern region.

Keywords

High Quality Development; Green Economic Efficiency; Social Equity Performance; Collaborative Coupling.

1. Introduction

Fairness and efficiency are the basic value pursuit and basic code of conduct with eternal significance in modern society . In China, the relationship between fairness and efficiency is closely related to the market-oriented economic reform. In the early stage of reform and opening up, China adhered to the principle of "giving priority to efficiency and giving consideration to fairness", and its economy showed a trend of rapid growth, achieving late development and catching up with some countries. However, the long-term implementation of this principle has helped to increase the factors of social disharmony, and the unbalanced and insufficient development in some aspects can no longer meet the needs of people to live a better life. The report of the 19th National Congress of the Communist Party of China put forward that "China's economy has changed from a high-speed growth stage to a high-quality development

stage". High-quality development has put forward new requirements for China's economic development mode, and is committed to.

Economic efficiency is the ability of a country or region to achieve the optimal allocation of resources or the optimal input-output combination in economic operation. It is a systematic integration of a series of efficiencies contained in various sectors and links of economic operation, such as scale efficiency, allocation efficiency, technical efficiency and institutional efficiency. It can generally be characterized by per capita GDP, input-output ratio and other indicators, Some scholars also measure it by building an economic efficiency index system that includes dimensions such as "economic efficiency", "economic vitality" and "technical efficiency". However, with the further development of society, the connotation of economic efficiency has been constantly expanded. Due to the increasingly prominent ecological problems such as resource shortage and environmental degradation, scholars pay more and more attention to the impact of resources and environmental factors when analyzing economic efficiency. Some scholars use green total factor productivity to characterize economic efficiency from the perspective of sustainable development. Compared with traditional economic efficiency, the "green" economic efficiency considering resources and environmental factors can more accurately reflect the economic development status of a country or region, and it is also more in line with the requirements of high-quality economic development. Social equity is a complex system that reflects the degree of equity in the allocation of resource elements, social management mechanism and the sharing of development achievements in social construction. Its measurement method has gradually evolved from a single index such as Nicky index, Theil index and coefficient of variation to a multi-dimensional comprehensive index system including "quality of life", "living environment", "political civilization" and "social security". The scope of research has also expanded from narrow income distribution equity to broad social equity.

Although domestic and foreign scholars have rich research on the efficiency of green economy and social equity, most of the literature is independent research on the two systems, and the research on the relationship between the two is still less, and most of the research focuses on the theoretical analysis and derivation level, and the research on the coordination and coupling relationship between the two using objective data empirical research is relatively scarce. Based on this, this paper attempts to use data envelopment model and entropy weight method to analyze 30 provinces in China. The efficiency of green economy and social equity performance from 2008 to 2019 are measured, and the dynamic evolution law and driving factors of the coupling degree of the two systems are analyzed by using system coupling degree model and panel Tobit model, in order to provide scientific reference and theoretical basis for the formulation of policies to promote the high-quality development of various provinces.

2. Synergistic Coupling Mechanism of Green Economic Efficiency and Social Equity Performance under the Background of High-Quality Development

The concept of "coupling" comes from physics, which refers to the phenomenon that two or more systems affect each other and even unite through interaction. Coupling is the unity of coordination and development. Coordination refers to the relationship of mutual promotion, harmonious symbiosis and virtuous cycle between two or more systems or between system elements, and development is the common upward trend of all systems. Coupling degree is a measure of the degree of mutual coordination and unity between systems in the development process, and it is the comprehensive level of coordination degree and development degree.

Efficiency is the premise of fairness. Only by improving economic efficiency and expanding social wealth can we create the necessary material basis for social fairness; Fairness is the guarantee of efficiency. Only by realizing relative fairness can we better coordinate social

material interests, mobilize workers' enthusiasm for production, and improve economic efficiency. The relationship between economic efficiency and social equity is similar to the above coupling phenomenon. In the stage of rapid economic growth, China has implemented the principle of "giving priority to efficiency and giving consideration to fairness", and the growth rate of the national GDP is obvious. However, the long-term implementation of this principle has also made China's social wealth structure increasingly unbalanced, which is not conducive to alleviating the social contradictions caused by the widening income distribution gap. The report of the 19th National Congress of the Communist Party of China put forward the strategic policy of "high-quality development", which requires to achieve more efficient, fairer and more sustainable development with the goal of meeting people's growing needs for a better life. Efficiency is a parameter reflecting social development and a dynamic mechanism of society; Fairness is a parameter reflecting social stability and a social stability mechanism. High-quality development requires good and stable social development, which requires the optimal combination of green economic efficiency and social equity, so as to maximize social welfare. At the same time, affected by the different economic development conditions and social development stages in different regions, their green economic efficiency and social equity performance levels are also different. In order to clarify the reasons for this difference and realize the coordinated development between regions, it is necessary to explore the key factors affecting the synergistic coupling of green economic efficiency and social equity performance and clarify its driving mechanism. Based on this, this paper analyzes the synergistic coupling mechanism between green economic efficiency and social equity performance in the context of high-quality development.

2.1. Driving Mechanism

High quality development conditions are the objective basis. Research shows that urbanization can promote the improvement of economic efficiency and social equity. The transformation of lifestyle and the growth of consumption caused by urbanization will bring about economic growth and the optimization of resource allocation efficiency. With the advancement of urbanization, the income level of the migrant population and the local urbanized population will increase, and the welfare level of residents such as education, medical treatment and living environment will be improved, which has promoted the improvement of the overall equity performance of the society from the two aspects of starting point equity and outcome equity. Other scholars believe that the optimization of industrial structure is also one of the important factors affecting economic efficiency and social equity performance.

2.2. Coupling Mechanism

The coupling relationship between green economic efficiency and social equity performance refers to a state in which the two systems optimize the overall situation through interaction driven by high-quality development conditions and high-quality policy regulation factors. On the one hand, the gradual improvement of green economic efficiency will improve the performance of local social equity: in some areas with high urbanization process, reasonable industrial structure and high decentralization of fiscal expenditure, there are endowment advantages in talent accumulation, development scale, income generation and government support, which can improve green total factor productivity through endowment effect to obtain economic and green benefits; In areas with poor resource endowment, we can also change the concept of development, introduce high-quality resources and advanced management experience, change the input combination of factors, save energy and reduce emissions, optimize the economic structure, and improve the efficiency of green economy through the implementation of strategic adjustments such as scientific and technological innovation, opening to the outside world and environmental regulation.

3. Data Sources

Taking into account the integrity and scientificity of data acquisition, in 2008, In, 30 provinces (autonomous regions and municipalities directly under the central government) except Tibet, Hong Kong, Macao and Taiwan were studied. The data of all economic and social statistical indicators come from China Statistical Yearbook, China Social Statistical Yearbook, China energy statistical yearbook, China Environmental Statistical Yearbook, China Education Statistical Yearbook and China real estate statistical yearbook. For the lack of indicator data in some years, interpolation method is used to supplement.

4. Empirical Analysis

4.1. Calculation Results and Analysis of Green Economy Efficiency

Using maxdea software, based on us –SBM model, calculate the green economic efficiency of each province in each year, the average change trend of China's regional green economic efficiency from 2008 to 2019, and the scores and rankings of green economic efficiency of each province in 2008, 2012, 2016 and 2019.

From the perspective of the whole country, the efficiency of China's green economy generally shows a trend of first decline and then rise, which is specifically reflected in the fluctuation decline from 2008 to 2012; It continued to decline from 2013 to 2017; From 2018 to 2019, it rose year by year. In the early stage of the evaluation period, the efficiency of the green economy showed a downward trend, which is consistent with the existing research. The reason may be that the extensive growth mode at the expense of the environment made the green efficiency insufficient. In addition, during the "12th Five Year Plan" period, affected by international market fluctuations, the upgrading of international trade barriers and other factors, the downward pressure on the economy increased, resulting in the continuous decline of economic efficiency. However, as China enters the stage of high-quality development, the concept of green development is gradually deepened, pollution prevention and control efforts are continuously increased, the ecological environment is significantly improved, resource utilization efficiency is continuously improved, and the efficiency of China's green economy is constantly warming up.

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4.2. Results and Analysis of Social Equity Performance Measurement

On the whole, the efficiency of China's green economy is on the rise, with an increase of 52.98% in 2017 compared with 2005, indicating that while pursuing economic development, all provinces should try their best to avoid the waste of resources and environmental pollution.

From the comparison of various regions, the eastern region has the highest average efficiency, which is significantly better than the central and western regions, which indicates that the development of green economy among regions in China is uneven, showing significant regional differences, which may be related to the differences in the level of financial development, industrial structure, government supervision and other aspects in various regions. This feature of green economic efficiency needs to be further verified by empirical analysis.

Based on the constructed social equity performance measurement index system, the annual social equity performance index of each province is calculated by entropy method. Table 4 shows the comprehensive scores of social equity performance of all provinces in China in 2008, 2014 and 2019 and the average scores of all provinces from 2008 to 2019. It can be seen from the table that the performance of social equity in China has been continuously improved from 2008 to 2019, and the level of social equity in all provinces has maintained a good and stable growth trend. It shows that since the new era, the development of social undertakings in China has been accelerating, the income distribution system, welfare security system, basic medical and health system have been gradually improved, social governance has been continuously strengthened and innovated, and social fairness and justice have been guaranteed and promoted.

4.3. Coefficient of Variation Analysis

In order to explore the difference of coupling degree in various regions of the country from the macro level, the difference value of coupling degree in various regions of the country is calculated according to the eastern, central, Western and northeastern regions with the help of the coefficient of variation formula, as shown in Figure 1. Among them, the smaller the coefficient of variation means that the coupling degree gap between provinces in a region tends to narrow.

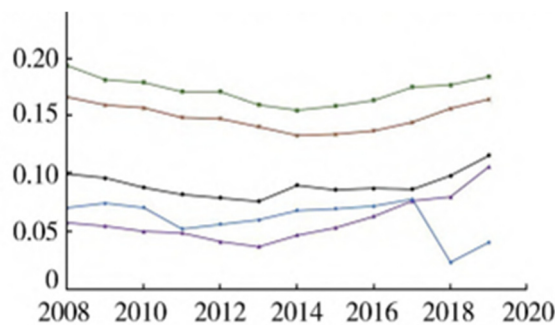


Figure 1. Variation Trend of coupling coefficient in various regions of the country

Figure 1 shows that the coupling degree difference among provinces in China as a whole shows a downward trend first and then an upward trend. Specifically, the coefficient of variation in the eastern region is the largest, always higher than the national average, indicating that the coupling degree development of provinces and cities in the eastern region is relatively uneven, the coupling degree of capital or economic center areas such as Beijing, Shanghai, Jiangsu, Guangdong is relatively high, while the level of coordinated development of the two systems in other provinces is relatively low, It shows that the economic center has a weak driving effect on the surrounding areas. In the follow-up, we should formulate reasonable policies to give full play to the spillover effect of advantageous areas and achieve comprehensive and coordinated shared development; Although the variation coefficient values in the central and eastern regions are lower than the national average, they also show the characteristics of first decreasing and then increasing, and the coefficient values in 2019 (0.106 in the central region and 0.116 in the western region) are higher than those in 2008 (0.057 in the central region and

0.100 in the western region), with a gradual expansion trend; The variation coefficient of Northeast China has the characteristics of fluctuation and decline, indicating that the development of coupling degree between provinces and cities in the region is gradually becoming balanced.

Using Markov chain method, taking 2014 as the boundary, the offset of the coupling degree of the two systems of economic efficiency and social equity in 30 provinces under different time spans is calculated. In order to simplify the writing complexity, the 10 types of coupling degree are numbered from 1 to 10 according to the D value from low to high. As shown in Table 1, the evolution of the coupling degree of each province during the sample period shows obvious phased characteristics, mainly maintaining the transformation from the original type to the adjacent type, and the phenomenon of leapfrog growth or decline is not significant. Specifically, among the 30 provinces in 2008, 12 were in the type of verging on imbalance, 14 were in the type of reluctant coordination, 2 were in the type of primary coordination, and 2 were in the type of intermediate coordination; As of 2019, there is only one province on the verge of imbalance, eight provinces of barely coordinated type, 13 provinces of primary coordinated type, five provinces of intermediate coordinated type, Jiangsu Province of good coordinated type, and Beijing and Shanghai have reached the stage of high-quality coordinated development. In addition, the higher probability values of the main diagonal in different stages and its adjacent left and right sides further confirm that the evolution of the coupling degree of each province is stable, and the probability value at the lower left of the main diagonal in the two stages is higher than that at the upper right, which also means that the change of the coupling degree type of each province is on the rise, which is consistent with the evolution law of the stable rise of the coupling degree mentioned above.

5. Driver Study

5.1. Variable Selection

In order to further explore the driving factors of the coupling degree of economic efficiency and social equity and the role of regional heterogeneity on it, based on the theoretical framework and relevant literature constructed in the above collaborative coupling mechanism, combined with the characteristics of China's economic and social development and the availability of data, six factors are selected, including urbanization rate, industrial structure, fiscal decentralization, scientific and technological innovation, opening up and environmental regulation. Use stata15.0 software to build a panel Tobit model to explore the influence of various factors on the coupling degree. Among the explanatory variables, urbanization rate, industrial structure, fiscal decentralization, scientific and technological innovation, opening up and environmental regulation are expressed by the proportion of urban population in the total population, the proportion of the added value of the tertiary industry in the total GDP, the proportion of provincial fiscal expenditure in the total national fiscal expenditure, the proportion of scientific and technological expenditure in the total fiscal expenditure, the amount of foreign capital actually used in the year, and the sewage charge respectively. At the same time, GDP, per capita GDP, the number of employees in each province, total investment in fixed assets and energy consumption are selected as control variables.

With the passage of time, China's financial development level has been greatly improved. From 2005, only Beijing and Guangdong were in the high-level stage of financial development, to 2017, eight provinces entered the high-level stage of financial development, which is consistent with the changing trend of green economic efficiency over time in the characteristic facts. It can be seen that there is a high correlation between financial development and green economic efficiency, but the specific causal relationship between the two needs to be further verified.

5.2. Driving Mechanism of Coupling Degree

This paper reports the effects of six core explanatory variables, namely, urbanization rate, industrial structure, fiscal decentralization, scientific and technological innovation, opening-up and environmental regulation, on green economic efficiency, social equity performance and their coupling degree. Columns 1, 2 and 3 are the regression results of various factors on green economic efficiency, social equity performance and coupling degree respectively.

In terms of urbanization rate, its coefficient on green economic efficiency, social equity performance and its coupling degree is 0.173, -0.130 and -0.121, which is significant at the levels of 1%, 5% and 5% respectively, indicating that the urbanization rate has a significant positive impact on the efficiency of green economy, and a negative impact on the performance of social equity and its coupling degree. This result is different from the conclusion of the previous theoretical analysis. The specific reason may be: at present, China is still in the middle stage of urbanization construction, and by 2021, there are nearly 40% of the rural permanent residents in the country, With the continuous deepening of urbanization, although the level of social equity in urban areas has been improved, the coordinated development between urban and rural areas has not been handled well, resulting in the widening gap between urban and rural areas, and the uneven opportunities of urban and rural residents in employment, education, access to medical resources and other aspects have become increasingly obvious. It can be seen that although urbanization improves the efficiency of resource allocation and then promotes the growth of economic efficiency through agglomeration and scale effect, it inhibits the improvement of social equity performance, and the increase of the deviation coefficient between the two leads to a negative effect on the coupling degree.

The coupling coefficient of environmental regulation on green economic efficiency and social equity performance and the two is 0.168, 0.086 and 0.103, respectively 1%, 5% and 1% levels are significant, indicating that the greater the intensity of environmental regulation, the higher the efficiency of green economy, social equity performance and the coupling degree of the two. Market incentive environmental regulation will drive enterprises to implement green innovation and other environmental protection behaviors, improve the greening process of local economic development and the well-being of residents, and then promote the efficient coupling and coordination of green economic efficiency and social equity performance.

Due to the differences in resource endowment and policy strength, there has been a long-term problem of regional imbalance in China's social development. There are great differences in economic efficiency and social equity in different regions, so the sensitivity of the coupling degree of the two systems to each element is also different. In order to investigate the heterogeneous effects of urbanization rate, industrial structure, fiscal decentralization, scientific and technological innovation, opening up and environmental regulation on the coupling degree of green economic efficiency and social equity performance in different regions and provinces, this paper divides the samples into the East (including the East and northeast) and the central and Western sub samples for grouping regression. The column in Table 6 reports the regression results of the last two columns of factors on the coupling degree between the East and the central and western regions, and the coefficients are basically significant at 10% or less. Among them, the coefficient of fiscal decentralization on the coupling degree between the central and western regions is not significant, which may be due to the small proportion of the overall fiscal expenditure of the central and western regions compared with the eastern region in the total national fiscal expenditure. In addition, it can be found that the absolute values of each factor coefficient in the eastern sub sample are greater than those in the central and Western sub samples, indicating that the impact of each factor on the coupling degree is stronger in the eastern region.

6. Conclusion and Suggestions

6.1. Conclusion

The overall efficiency of the national green economy shows a downward trend first and then an upward trend, but it has the characteristics of regional imbalance. Among them, the level of green economic efficiency in the eastern region has been higher than the overall level of the country, and there is a growing gap with the national level; However, the social equity performance level of each province has shown a steady improvement over time.

The coupling degree of the two systems in the whole country has maintained a steady upward trend. In the late observation period, most provinces have achieved the relative unity of development and coordination, but nearly 35% of the provinces are still in the coordinated development type below the primary level; The coefficient of variation of coupling degree in most provinces shows a law of decreasing first and then increasing, among which the coefficient of variation of coupling degree in the eastern region is generally higher than that in other regions; The type evolution of the coupling degree of each province is mainly to maintain the evolution of the original type to the adjacent type, and the phenomenon of leapfrog rise or fall is not obvious.

In the discussion of the driving factors of coupling degree, industrial structure, fiscal decentralization, scientific and technological innovation, opening to the outside world and environmental regulation all have a significant positive impact on the two systems of green economic efficiency and social equity performance and their coupling degree, while urbanization rate has an inhibitory effect on the growth of coupling degree; In the sub sample test, the absolute value of each factor coefficient in the eastern region is greater than that in the central and western regions, indicating that the influence utility of each factor on the coupling degree is stronger in the eastern region.

6.2. Policy Recommendations

Take the high-quality development strategy as an opportunity to optimize the structure of economic growth, firmly implement the concept of sustainable development, and drive the efficiency and energy level of economic development through industrial transformation and upgrading, innovation and technological progress. At the same time, we should speed up the reform of the income distribution system, further improve the level of public services such as education and medical treatment, strive to solve the contradiction between "the growing needs of the people for a better life" and "unbalanced and insufficient development", achieve the right balance between economic development and social equity, create a high-quality living environment with both material and spiritual prosperity for the people, and improve the well-being of residents in the whole society.

Guided by comprehensive and coordinated development, from the macro regional level, there is still a certain gap in the level of coupling between the central and western regions and the eastern regions of China due to the differences in resource factor endowments and policy tendencies. We should give full play to the coordinated development and radiation effects between provinces and regions. The western provinces should seize the development opportunity of the "the Belt and Road" and pay attention to the improvement of people's livelihood while prospering the economy. The central and northeastern provinces should take advantage of their regional advantages to actively cooperate with the eastern provinces, complement each other's advantages and promote the improvement of coupling. The eastern provinces should pay attention to the balance of development, and learn from each other's advanced experience to promote the coordinated development of the whole region; From the micro level of urban and rural areas, we should not blindly pursue the size of the city. Urban construction should focus on improving the quality and function, appropriately gather,

reasonably plan, and promote the integrated development of urban layout and function. At the same time, we should further deepen the integration of urban and rural areas, vigorously promote the strategy of rural revitalization, narrow the gap between the income of urban and rural residents and the level of public services, and realize the stability and coordination of urban and rural development.

References

- [1] R.F Liu. On the functional orientation of rural tourism towns under the background of rural revitalization [J]. *Modern Business*, 2019(10): 28-29.
- [2] C.Yang. Research on the development path of Lijiang characteristic tourist towns under the background of rural revitalization [J]. *Western Tourism*, 2021(05):17-19.
- [3] X Zhan, W.W Hu. Research on the development status and countermeasures of characteristic tourist towns in my country [J]. *Rural Economy and Technology*, 2017, 28(09): 84-85.
- [4] X.J Qiao. Smart tourism empowers the high-quality development of tourism [J]. *Tourism Journal*, 2022,37(02):10-12.