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Measurement and Analysis of China's Green Economic Development Level—Evidence from Provincial Panel Data

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Abstract: *Resource depletion and environmental pollution have become global challenges. How to develop a green economy that can both develop the economy and protect the resources and environment is gradually becoming a popular issue of academic interest. This paper constructs a system of indicators to measure the green economy development level according to the relevant theories of economics, and adopts the methods such as the Topsis entropy weight method to measure and analyze the level of green economy development in each province of China from 2011 to 2020. The results show that China's green economy development level index shows a trend of increasing year by year, but the development of green economy in the eastern, central and western regions of China is uneven. Based on the above research results, this paper proposes that we should timely change the concept of economic development, facilitate the development of regional economic coordination, increase the investment in green science and technology, in order to facilitate the development of green economy.*

Keywords: *Green economy; Topsis entropy; Weight method of space-time difference*

1. Introduction

In the World Bank's 2022 research report "Global economic recession looms", it is pointed out that for energy commodities, policymakers should promote an accelerated transition to low-carbon energy and take measures to reduce energy consumption [1]. The World Meteorological Organization published greenhouse gas concentrations, extreme weather and other relevant data in the report "State of the Global Climate 2022". The report points out that the global climate is facing more potential threats, and humanity must coexist peacefully with nature. As a practitioner of the green development concept, China proposes to implement the new development idea and abandon sloppy development. According to the white paper "China's Green Development in a New Era" released by the State Council on 2023 January 19, China has incorporated the systemic concept throughout the entire process of economic and social development and ecological environmental protection. It will build the economic system of green, low-carbon and circular development, and promote ecological priority and green development. The white paper points out that China has integrated the system concept into the overall process of economic and social development and ecological protection. However, many problems still exist in the process of green development in China. The imbalance of economic structure, the asymmetry of supply and demand, the unreasonable industrial structure and the serious resource and environmental problems brought by the extensive development have not been solved. Therefore, how to realize the green long-term development of China's economy is one of the urgent problems to be solved.

The concept of "green economy" was first proposed by David Pierce, a professor of environmental economics at the University of London in his book "Green Economy Blueprint". He believes that a green economy can be equated with a sustainable development economy and explores ways to reach sustainable development by taking the perspective of environmental economy. Since then, the academic community has officially entered the exploration of green economy. This paper combs the existing research from the macro level and the micro level. Some scholars conduct research from a macro level. Jeong proposed the application of green economy in the field of PC-TPP materials, and studied the problem of combining coal-fired power generation with power production efficiency technology and greenhouse gas control technology [2]. Song et al. pointed out that it is necessary to coordinate regional development while increasing economic openness and R & D investment, so as to achieve green economic growth [3]. Liu et al. discussed the impact of Asian tourism development and industrial structure changes on green economy and environmental performance, and concluded that the long-term decline and structural changes in tourism have significantly reduced green growth[4]. Liu examined the impacts of factors such as natural resources on China's long-term economic regeneration measures, and conducted a DID analysis to test the data and found that the cost of carbon emissions significantly affects the Chinese economy[5]. Other scholars conduct research from a micro level. Clemens studied the relationship between green performance, financial performance and green economic stimulus of small businesses and suggested that green economic incentives should be adopted[6]. Cheng et al. empirically analyzed the impact of policies on the green economic growth of resource-based cities, and found that the implementation of policies can significantly improve the green economic efficiency of resource-based cities[7]. Qian et al. studied the impact and mechanism of AI on green economic growth and found that it has a siphoning effect on green economic development in surrounding cities [8]. Lin et al. found that green financial policies have a positive impact on the recovery of the green economy by examining the efficiency of renewable energy firms in contributing to the recovery of the green economy [9]. Sun et al. adopted the super-efficient dynamic SBM model to measure the green economic growth efficiency of 41 cities in the Yangtze River Delta city cluster, and explored the long-term development model and transformation path of green economic growth efficiency in the Yangtze River Delta city cluster[10]. It can be found from the above research that the application of green economy has covered most of the fields of society, and the continuous updating and iteration of the theoretical system of green economy also provides new opportunities for the development of a higher level.

Although the available literature has provided a research foundation for this paper, the following deficiencies still exist. On the one hand, existing studies mostly measure the development level of green economy by a single indicator, and there is less relevant literature on constructing indicator system from provincial level. On the other hand, few literature have studied the spatial and temporal differences of green development level. Based on the actual environment and the limitations of similar research, this paper constructs a green economy development index system, and uses Topsis entropy weight method, δ convergence analysis and absolute β convergence analysis to comprehensively evaluate Green Economy Development by Region in China from 2011 to 2020. The relevant conclusions lay the foundation for proposing a green development path.

2. Research methods

2.1 Topsis entropy weight method

In the construction of the index system, the most commonly used methods are principal component analysis, analytic hierarchy process and Topsis entropy weight method. Among them, the principal component analysis method needs to be based on specific elements, and the principal components extracted are very strict, which is easy to cause great deviation to the experimental results. The analytic hierarchy process is divided into quantitative analysis and qualitative analysis. It has more qualitative analysis, which easily leads to low weight reliability and inconsistent experimental results. In contrast, the entropy weight Topsis method is simple in calculation process, has no clear requirements for evaluation objects and indicators, and the measurement results are objective, fair and reasonable, which fully reflects the development status of green and high-quality development evaluation in each demonstration area. Therefore, this paper uses the Topsis entropy weight method to measure the green high-quality development index of the demonstration area. The detailed steps are as follows:

The first step is to multiply each row of X by the corresponding weight to obtain a normalized matrix $C = \{Y_{ij} \times W_j\}_{m \times n}$.

In the second step, C determines the positive and negative ideal solutions C^{+}, C^{-}.

$$C^{+} = (\max c_{i1}, \max c_{i2}, \cdots\cdots, \max c_{in}) \tag{1}$$

$$C^{-} = (max\, c_{i1}, max\, c_{i2}, \cdots\cdots, max\, c_{in}) \tag{2}$$

The third step is to compute the Euclidean distance between each demonstrator and the positive and negative ideal solutions d_i^{+}, d_i^{-}.

$$d_i^{+} = \left\{ \sum_{j=1}^{n} \left(c_{ij} - c_j^{+}\right)^2 \right\}^{1/2} \tag{3}$$

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$$d_i^- = \left\{ \sum_{j=1}^{n} \left(c_{ij} - c_j^- \right)^2 \right\}^{1/2} \tag{4}$$

The fourth step is to calculate the close value of each demonstration area Q_i.

$$Q_i = \frac{d_i^-}{d_i^- + d_i^+} \tag{5}$$

The close value Q_i is between 0 and 1. The larger the value, the better the green high-quality development level of the demonstration area. On the contrary, it shows that the green high-quality development level of the demonstration area is low. According to the size of the close value, the evaluation objects are sorted.

2.2 Convergence analysis

2.2.1 δ convergence test

The δ convergence test reflects the trend of China's green economy development level. Generally, the standard deviation and coefficient of variation are used to measure the dispersion degree of each sample data. If the dispersion degree decreases with time, it shows that there is δ convergence in different samples in the study area. On the contrary, it shows that different samples in the study area have δ divergence. Y_{ij} represents the green economic development level index of region i in year t, $\overline{Y_t}$ represents the average value of the green economic development level index of each region in year t, N represents the number of regions, S_t represents the standard deviation of year t, CV_t is the coefficient of variation of year t. The standard deviation and variation coefficient calculation formulas of China's green economic development level index are as follows:

$$S_t = \sqrt{\frac{1}{N-1} \sum_{i=1}^{N} (Y_{it} - \overline{Y}_t)^2} \tag{6}$$

$$CV_t = \frac{1}{\overline{Y}_t} \sqrt{\frac{1}{N-1} \sum_{i=1}^{N} (Y_{it} - \overline{Y}_t)^2} \tag{7}$$

In order to further test the δ convergence of China's green economy development level index and ensure the reliability of the above conclusions, the following model is constructed:

$$\sigma_{it} = a + \lambda t + \mu_{it} \tag{8}$$

Among them, σ_{it} represents the standard deviation of China's green economic development level index, a is a constant term, t is a time variable, and μ_{it} is a random disturbance term. If the regression coefficient λ is less than 0 and it passes the significance test, it shows that there is δ convergence in China's green economic development level index. If the regression coefficient λ is greater than 0 and it passes the significance test, it shows that there is no δ convergence in China's green economic development level index. If the regression coefficient λ is equal to 0, it shows that the difference of China's green economic development level index has maintained the original state, neither narrowed nor expanded.

2.2.2 Absolute β convergence test

The absolute β convergence test can further verify whether the green economic development level index of each region in China converges to the same steady-state equilibrium value. This paper will continue to test whether there is absolute β convergence between regions in China, and build an absolute β convergence model. T represents the time dimension of the investigation, Y_{it} and Y_{io} represent the green economic development level index of region i in the t-year and initial year respectively, $\frac{1}{T}\ln\left(\frac{Y_{it}}{Y_{io}}\right)$ stands for the average annual growth rate of green economic development. Level index of region i in the T-period, α and β represent the regression coefficients to be estimated, ε_{it} represents the random error term. If β < 0 and passes the significance level test, it shows that the index of green economic development level in various regions of China will converge to a certain stable level, there is absolute β convergence. The absolute β convergence model of green economic development level is as follows:

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$$\frac{1}{T} ln \left(\frac{Y_{it}}{Y_{io}}\right) = \alpha + \beta ln\ Y_{io} + \varepsilon_{it} \tag{9}$$

$$\lambda = -\frac{1}{T} ln(1 + T\beta) \tag{10}$$

2.3 Indicator selection and data sources

This paper selects indicators from three dimensions. The first dimension is economic sustainability. In terms of economic development, referring to the per capital gross regional product and the growth rate of the tertiary industry in the green development evaluation index system constructed by Wang et al. [11], this paper selects GDP and the share of tertiary industry as the indicator system. The selection of GDP is conducive to better reflecting the economic development of a country or region in a certain period of time. Ratio of added value of tertiary sector to GDP is an important statistical indicator, reflecting the stage of economic development and the overall level of economic development of a country or region. The second dimension is industrial pollution and utilization of the environment. According to the existing survey, most of the pollution of the ecological environment is caused by industry, including industrial waste gas emissions, industrial solid residues, industrial wastewater emissions, etc. This paper selects the most serious air pollutants sulfur dioxide and nitrogen oxides as research indicators, aiming to reflect the degree of industrial pollution to the ecological environment. According to the statistics of the existing articles, it is found that most scholars have paid more attention to the pollution caused by industrial wastewater, but less attention to the residue of industrial solids and whether to make full use of them. Based on the evaluation index system of eco-economic efficiency constructed by Sun et al.[12], the discharge of wastewater, waste gas and solid waste and the treatment effect of three wastes. In this paper, the comprehensive waste output of general industrial solid waste is selected as the index system of this paper, which aims to focus on whether the pollution of industrial solid waste in the region has a significant impact on the green economy. The third dimension selected in this paper is green city and natural environment. Ecological environment includes natural ecology and urban ecology. In terms of natural ecology, this paper focuses on the forest coverage rate. In terms of urban ecology, we mainly study the green area of the city and the rate of harmless disposal of domestic waste. The purpose is to reflect the degree of greening and human awareness of environmental protection in the area through the above three index systems. The data are obtained from EPS, National Research Network, China Economic Network and Statistical Yearbook. The specific indicators are selected as in Table 1.

Table 1: Green economy development index system

Target	First-level indicators	second level indicator	attribute
Green Economic Development	Sustainable Economic Development	per capita GDP	+
		Tertiary industry share(%)	+
	Industrial pollution of the environment and utilization	Industrial sulfur dioxide emissions (tons)	-
		Industrial nitrogen oxide emissions (billion tons)	-
		Output of general industrial solid waste(Million tons)	-
	Green city and Natural environment	Urban green space area (ha)	+
		Household waste disposal rate without harm (%)	+
		Forest coverage (%)	+

3. Empirical analysis

This paper uses the above-mentioned Topsis entropy weighting method and convergence analysis method. The data related to the indicator system of 31 provinces in China from 2011 to 2020 were collected and the green economic development index of each province was calculated. As Table 2.

3.1 Time dimension analysis of Topsis entropy weight method

According to the index system, the Topsis entropy weight method is used to measure the green economic development level index of 31 regions in China during 2011-2020, as shown in table 2.

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Table 2: Green economic development index of 31 provinces and cities in China from 2011 to 2020

	Province	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Average value	Rank
Eastern region	Beijing	0.3377	0.3415	0.3461	0.3665	0.3747	0.3796	0.3836	0.3881	0.3917	0.3941	0.3704	6
	Tianjing	0.1789	0.1811	0.1841	0.1902	0.1948	0.2081	0.2167	0.2196	0.2217	0.2214	0.2017	24
	Hebei	0.2407	0.2432	0.2427	0.2534	0.2586	0.2679	0.2748	0.2801	0.2862	0.2921	0.2640	21
	Liaoning	0.2807	0.2982	0.3017	0.3087	0.3138	0.3182	0.3254	0.3276	0.3321	0.3480	0.3154	13
	Shanghai	0.2906	0.2976	0.3044	0.3166	0.3229	0.3345	0.3424	0.3474	0.3629	0.3693	0.3289	10
	Jiangsu	0.5037	0.5116	0.5226	0.5317	0.5428	0.5525	0.5637	0.5734	0.5783	0.5878	0.5468	2
	Zhejiang	0.4308	0.4435	0.4485	0.4522	0.4591	0.4757	0.4852	0.4975	0.5041	0.5109	0.4708	3
	Shandong	0.3996	0.4102	0.4266	0.4362	0.4474	0.4590	0.4703	0.4777	0.4880	0.5006	0.4516	4
	Guangdong	0.7336	0.7313	0.7449	0.7601	0.7797	0.8022	0.8138	0.8340	0.8450	0.8533	0.7898	1
	Hainan	0.3036	0.3063	0.2987	0.3053	0.3064	0.3083	0.3096	0.3124	0.3138	0.3147	0.3079	14
	Fujian	0.3666	0.3689	0.3708	0.3752	0.3778	0.3819	0.3889	0.3935	0.3965	0.3987	0.3819	5
Central region	Heilongjiang	0.2647	0.2668	0.2683	0.2726	0.2764	0.2818	0.2807	0.2837	0.2850	0.2880	0.2768	18
	Shanxi	0.1434	0.1464	0.1486	0.1625	0.1785	0.1871	0.2020	0.2011	0.2038	0.2070	0.1780	27
	Anhui	0.2424	0.2469	0.2540	0.2626	0.2674	0.2757	0.2856	0.2969	0.3031	0.3083	0.2743	20
	Jilin	0.2374	0.2386	0.2402	0.2470	0.2510	0.2577	0.2603	0.2802	0.2914	0.2933	0.2597	22
	Jiangxi	0.3204	0.3219	0.3240	0.3295	0.3325	0.3360	0.3415	0.3482	0.3500	0.3546	0.3359	8
	Hebei	0.2697	0.2750	0.2790	0.2906	0.2948	0.3078	0.3206	0.3332	0.3409	0.3482	0.3060	16
	Hubei	0.2876	0.2943	0.3023	0.3116	0.3157	0.3229	0.3319	0.3425	0.3462	0.3518	0.3207	12
	Hunan	0.3110	0.3149	0.3178	0.3278	0.3324	0.3373	0.3451	0.3496	0.3516	0.3562	0.3344	9
Western region	Chongqing	0.2565	0.2577	0.2587	0.2771	0.2804	0.2883	0.2916	0.2951	0.2976	0.2997	0.2803	17
	Sichuan	0.2924	0.2986	0.3048	0.3115	0.3146	0.3289	0.3432	0.3550	0.3628	0.3694	0.3281	11
	Guizhou	0.2284	0.2294	0.2300	0.2546	0.2587	0.2640	0.2701	0.2744	0.2777	0.2793	0.2567	23
	Yunnan	0.2812	0.2843	0.2869	0.3072	0.3097	0.3139	0.3191	0.3214	0.3223	0.3234	0.3069	15
	Xizang	0.1775	0.1801	0.1806	0.1816	0.1837	0.1829	0.1820	0.1769	0.1778	0.1704	0.1793	26
	Shanxi	0.2493	0.2520	0.2563	0.2641	0.2752	0.2813	0.2887	0.2942	0.2908	0.2961	0.2748	19
	Gansu	0.1313	0.1346	0.1396	0.1443	0.1543	0.1689	0.1788	0.1809	0.1829	0.1846	0.1600	29
	Qinghai	0.1509	0.1499	0.1477	0.1521	0.1564	0.1602	0.1583	0.1591	0.1591	0.1608	0.1555	31
	Ningxia	0.1372	0.1406	0.1482	0.1521	0.1550	0.1660	0.1670	0.1693	0.1713	0.1733	0.1580	30
	Xinjiang	0.1300	0.1319	0.1369	0.1425	0.1545	0.1668	0.1754	0.1839	0.1907	0.1961	0.1609	28
	Neimenggu	0.1601	0.1637	0.1684	0.1786	0.1864	0.2008	0.2092	0.2114	0.2119	0.2127	0.1903	25
	Guangxi	0.3184	0.3209	0.3240	0.3380	0.3455	0.3492	0.3540	0.3576	0.3495	0.3522	0.3409	7
National average		0.2792	0.2833	0.2873	0.2969	0.3033	0.3118	0.3187	0.3247	0.3286	0.3328	0.3067	
Eastern average		0.3697	0.3758	0.3810	0.3906	0.3980	0.4080	0.4158	0.4229	0.4291	0.4356	0.4026	
Central average		0.2596	0.2631	0.2668	0.2755	0.2811	0.2883	0.2960	0.3044	0.3090	0.3134	0.2857	
Western average		0.2094	0.2120	0.2152	0.2253	0.2312	0.2393	0.2448	0.2483	0.2495	0.2515	0.2326	

3.1.1 The overall development level of China's green economy has been greatly improved

According to the index obtained from the measurement analysis in Table 2, it can be found that the province with the highest average green economic development index is Guangdong (0.7898), and the lowest province is Qinghai (0.1555). The former is 5.08 times that of the latter, and the range is 0.6343. The province with the second average green economic development index is Jiangsu (0.5468), and the third is Zhejiang (0.4708). The penultimate province with the average green economic development index is Ningxia (0.1580), and the penultimate province is Gansu (0.1600) , as shown in Figure 1.

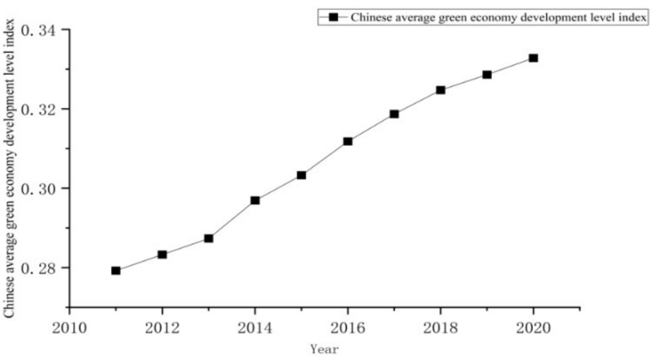

Figure 1: China's annual average green economic development level index

The overall level of green economic development in various provinces and cities shows two changing trends. First, the level of green economy in some provinces and cities is increasing year by year, such as Guangdong, Jiangsu, Zhejiang and other places, and mostly distributed in the central and eastern regions. Secondly, the development level of green economy in some provinces and cities fluctuates year by year, such as Shaanxi, Guangxi and other places, mostly in the western region.

3.1.2 Large differences in the level of development of green economy in the three regions

According to the data in Table 2, the average index of green economic development level in the eastern region is 0.3697 in 2011, and the average index of green economic development level in the national, central and western regions are 0.2792, 0.2596 and 0.2094 respectively in the same year. In 2020, the average index of green economic development level in the eastern region is 0.4026. In the same year, the average index of green economic development level in the national, central and western regions are 0.3067, 0.2857 and 0.2326 respectively. Figure 2 shows the green economic development level of the three regions.

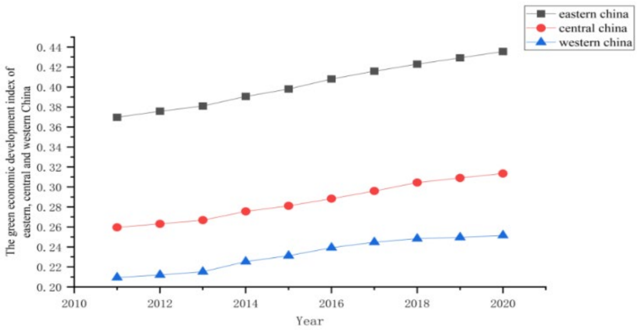

Figure 2: Green economy development level index of three regions

Overall, the three regions show a trend of "higher level of green economy development in the eastern and central regions and lower level of economic development in the western region". This is because the eastern region is mostly developed provinces and cities with superior geographical conditions, strong comprehensive innovation-driven capability and perfect infrastructure. The western region is close to the inland, with high altitude, mostly mountains and hills, and inconvenient transportation.

3.2 Convergence analysis

3.2.1 δ convergence analysis

Table 3: The convergence analysis of China's green economic development level index

Year	Standard Deviation	Coefficient Of Variation
2011	0.1229	0.4402
2012	0.1235	0.4360
2013	0.1258	0.4378
2014	0.1270	0.4279
2015	0.1288	0.4247
2016	0.1306	0.4190
2017	0.1322	0.4148
2018	0.1356	0.4175
2019	0.1374	0.4180
2020	0.1397	0.4197
Average value	0.1304	0.4256

According to the standard deviation formula (7) and the coefficient of variation formula (8) constructed above, the green economic development level index calculated by the Topsis entropy method is calculated, and the results are shown in Table 3.

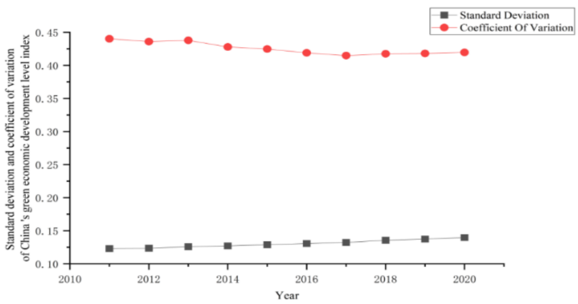

Figure 3: SD and CV of China's green economic development level index

From the standard deviation of China's green economy development level index, the annual average standard deviation of China's overall green economy development level index from 2011 to 2020 is

0.1304. Standard deviation increases each year in chronological order, reaching the maximum standard deviation of 0.1397 in 2020, as shown in Figure 3. The minimum standard deviation was 0.1229 in 2011. The standard deviation discrete value of China's green economy development level index increases year by year, that is, it does not meet the δ convergence test condition. From the perspective of the coefficient of variation of China's green economy development level index, the annual average coefficient of variation of China's overall green economy development level index from 2011 to 2020 is 0.4256. The coefficient of variation fluctuated year by year in chronological order, reaching the maximum coefficient of variation of 0.4402 in 2011. The minimum coefficient of variation was 0.4148 in 2017. The discrete value of the coefficient of variation of China's green economic development level index fluctuates year by year, and does not meet the δ convergence test conditions.

Table 4: The δ convergence test results of China's green economy development level index

Coefficient	Coefficient value	t-statistic	R-squared
α	-3.716201***	-22.50	0.9855
λ	0.0019085***	0.000082	

Note: λ is the regression coefficient of Equation (10), ***,**,*respectively represent the significance test at the significance level of 1%,5%,10%.

Through the table 4 δ convergence test results, it can be seen that the coefficient of China's green economic development level index λ is positive, and through the 1% significance level test, this further verifies the previous conclusion: the difference of China's green economic development level index has an expanding trend with time, and there is no δ convergence.

3.2.2 Absolute β-convergence

Table 5: The absolute β convergence test results of China's green economy development level index

Coefficient	2011-2020
α	0.0057952**
	(0.0056513)
β	-0.0093537**
	(0.003998)
R^2	0.1588
Adjusted R^2	0.1588
F-statistic	5.47
λ	0.009820507

Note: λ is the regression coefficient of Equation (10), ***,**,*respectively represent the significance test at the significance level of 1%,5%,10%.

Table 5 is the result of the absolute β convergence test of China's green economic development level index. From the regression results, the regression coefficient β value of 2011-2020 was-0.0094, and passed the 5% significance level test. It shows that there is a negative correlation between the growth value of China's green economic development level index and its initial value, and finally the regions will converge to the agreed steady-state equilibrium value, with a convergence rate of 0.98%.

Through the above δ convergence test and absolute β convergence test, it can be found that there is no δ convergence in the development level of green economy in various regions of China, indicating that the development level index of green economy in China is quite different. However, there is an absolute β convergence in the development level of green economy in each region, which indicates that the regions with low index of green economy development level in China have a "catch-up effect" on the high regions, and gradually converge to the same steady-state equilibrium level.

4. Conclusions and suggestions

4.1 Conclusion

4.1.1 China's Green Economy as a whole is at a low level of development

From 2011 to 2020, China's overall average green economic development level index is lower than 0.35. In the past 10 years, the overall level of green economic development has shown an upward trend. The Green Economic Development Level Index growth rate in 2014 was the highest level in the study range at 0.33%, while it was the lowest level in 2019 at 0.12%. It can be seen that the growth rate of China's overall green economic development shows irregular changes.

4.1.2 China's uneven level of green economy development in different regions

According to the green economic development index of 31 provinces and cities in China (Table 2), the development level of China's green economy shows a trend of "high in the east and middle, low in the west". The average development level of the eastern region is 0.4026, while the average development level of the western region is 0.2326, the former is 1.73 times that of the latter. There are also differences between different regions in the overall and partial directions of green economy development. Some provinces are ahead of others in the whole level of green economy development, but lag behind others in a certain direction.

4.2 Recommendations

4.2.1 Changing the concept of economic development

The government and enterprise departments should implement the green development as the main policy, carry forward the concept of "green water and green mountains are invaluable assets", incorporate the green economic development indicators into the assessment system of enterprises and government departments, and enhance the awareness of green economic development in various departments. Relevant departments and enterprises should actively develop green economy from the aspects of rules and regulations, innovative technology and human capital, and promote the dual cycle development of green and economy.

4.2.2 Promoting the coordinated development of the regional economy

The government and enterprises should adopt targeted green economic development strategies, build more scientific and reasonable development roads, accelerate the construction of transportation networks or afforestation in the western region, and promote the transformation of green areas in the western region. Play the role of counterpart support from high level regions to low level regions, and strengthen resource sharing, talent sharing and aid exchange in the east, middle and west regions. Finally, help low-level regions achieve high-quality development of green economy and narrow the gap between regions.

4.2.3 Increasing investment in green technology R&D

The government and the corporate sector should play a leading role in increasing investment in green technology research and development. There is a need to break the constraints of the traditional economy, get rid of the inherent ideas and technologies, cultivate a new concept of green economic development, and solve the existing problems of resources and environment. Apply new energy and green technology to heavy industry to reduce industrial pollution of resources. Improve waste recycling classification and green treatment to effectively prevent energy waste and reduce environmental pollution.

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