

Analysis of the Current Situation of Sustainable Development of the Yangtze River Economic Belt based on SDGs

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Abstract

This paper evaluates the level of sustainable development of 11 provinces and cities in the Yangtze River Economic Belt from 2011 to 2020, and analyzes its spatial and temporal differentiation and trend evolution characteristics. This paper adopts the coupling coordination model based on CRITIC-entropy weight combination weight, spatial autocorrelation model, spatial Markov chain and other methods, based on the measurement indicators of the United Nations Sustainable Development Goals, and conducts a comprehensive evaluation from four aspects: innovation-driven, welfare guarantee, resources and environment, and economic development. The research results show that the sustainable development level of the Yangtze River Economic Belt presents the characteristics of continuous improvement, regional difference, hierarchical leap, spatial dependence, spillover effect, etc. According to the research findings, this paper puts forward some suggestions, such as strengthening regional coordinated development, optimizing spatial planning and governance, coordinating policies and work, promoting rule of law and innovation, etc., aiming to promote the high-quality development of the Yangtze River Economic Belt, achieve the coordinated development of economy, society and ecology, and localize the SDGs. This paper's research has important theoretical significance and practical value for deeply understanding the current situation and problems of sustainable development of the Yangtze River Economic Belt.

Keywords

Yangtze River Economic Belt; Sustainable Development Goals; Chinese Path to Modernization; Coupling Coordination Degree Model.

1. Introduction

In September 2015, United Nations Summit on Sustainable Development adopted the "Transforming Our World: The 2030 Agenda for Sustainable Development by 2030" which established the Sustainable Development Goals (SDGs). On October 16, 2022, Chinese President Xi Jinping stated in his report at the 20th National Congress of the Communist Party of China that "Chinese modernization is the modernization of harmony between humanity and nature" and "China is committed to sustainable development". Sustainable development is not only a requirement for Chinese modernization but also a global trend and a common goal for world development. It considers the interlinkages between social development, economic development, and environmental protection, and it serves as the "key" to addressing the ongoing problems and emerging challenges faced by humanity and the world. In order to achieve coordinated and sustainable development in population, socio-economy, and resource environment, the SDGs involve cross-cutting and universally applicable goals, aiming to promote the health and rationalization of global governance. To quantitatively evaluate the implementation effectiveness of sustainable development in different countries and regions,

the United Nations has released 231 indicators, but the localization of these indicators is relatively weak.

2. Research Status

Sustainable development has become the global and era development trend, sparking extensive discussions among experts both domestically and internationally. Tobias Heimann (2019) studied the relationship between SDGs and the bioeconomy[1]. Liu Shaoyang (2019) and others analyzed SDG 15 from a county-level perspective [2]. Samuel Stevenson et al. (2021) analyzed the extent to which the pursuit of climate action (SDG 13) interacts positively and negatively with other SDGs[3]. Shao Chaofeng et al. (2021) proposed the design principles and ideas for constructing a localized evaluation index system for SDGs in China, and established an SDGs localization index framework system consisting of 142 indicators[4]. Ma Tao et al. (2022) constructed a central-local scale-down decomposition framework for SDGs and clarified the decomposition relationship between SDGs and the "14th Five-Year Plan" of each province[4]. Jia Jun et al. (2022) constructed an indicator system for land sustainable development in the middle and lower reaches of the Yellow River based on SDGs[6]. Wang Huijuan and Lan Zongmin (2022) constructed an indicator system for sustainable development in China based on SDGs, utilizing entropy method and factor analysis[7]. Chen Sihan et al. (2022) constructed an indicator system for the sustainable development of Chenzhou Resource-based City Demonstration Zone based on SDGs[8].

Zhang Pingdan et al. (2018) conducted an investigation on the coordinated development of the Yellow River, Yangtze River Delta, and Pearl River Delta regions from the perspectives of industrialization, informatization, urbanization, agricultural modernization, and greening [9]. Tang D et al. (2019) analyzed the relationship between the spatial structure of the Yangtze River Economic Belt and sustainable development[10]. Guo Fuyou et al. (2020) conducted an analysis and research on the four green dimensions of the Yangtze River and Yellow River basins from the perspectives of economy, society, environment, and governance[11].

This study, based on the perspective of SDGs, investigates the state of regional coordinated development in the Yangtze River Economic Belt. It helps to align the process of localizing SDGs with global development trends and plays a positive role in determining the development positioning of the Yangtze River Economic Belt. Chinese modernization is the modernization of harmony between humanity and nature, and the Yangtze River Economic Belt holds important ecological significance. Exploring the sustainable development of the Yangtze River Economic Belt reflects the research on harmonious coexistence between humans and nature in modernization.

3. Research Design

3.1. Index System Determination

The construction of the indicator system is a modification based on the SDGs China localization evaluation indicator system developed by Shao Chaofeng et al.

Table 1. Indicator System for Evaluating the Sustainable Development of the Yangtze River Economic Belt

System Level	Pillar Level	Indicator Level
Innovation Drive	Labor Resources	Literacy Rate of Working-Age Population
		Labor Productivity per Worker
	Technology Innovation Drive	Total Number of Research and Development Personnel in Industrial Enterprises above Designated Size
		Number of Patents above Designated Size
		Per 10,000 People Research and Development
		Research and Development (R&D) Manpower Input Intensity
Well-being Assurance	Healthy Living	Mortality Rate
		Number of Licensed (Assistant) Physicians per Capita
	Social Stability	Urban Registered Unemployment Rate
		Gini
		Coefficient Number of Participants in Urban Workers' Basic Pension Insurance
	Government Functions	Road Density
		Green Coverage Rate
		Fiscal
		Proportion of Local Tax Revenue to Local Fiscal Revenue
		Effective Irrigated Area
Resources and Environment	Environmental Pollution	Total Emissions of Industrial Smoke and Dust per Unit of Industrial Output Value
		Total Discharge of Industrial Wastewater per Unit of Industrial Output Value
		Total Emissions of Industrial Exhaust Gas per Unit of Industrial Output Value
		Geographically Averaged Annual PM2.5
	Environmental Governance and Sustainable Guarantee	Annual Artificial Afforestation Area
		Sewage Treatment Rate
		Harmless Treatment Rate of Municipal Solid Waste
		Comprehensive Utilization of General Industrial Solid Waste
		Investment in Industrial Pollution Control and Treatment Completion
		Wetland Area
		Groundwater Resources Quantity
	Energy Efficiency	Energy Output Rate
		Water Consumption GDP of 100 Million Yuan
Economic Development	Economic Condition	Per Capita Regional GDP
		Per Capita Disposable Income of Urban and Rural Residents
		Service Trade Competitiveness Index
		Passenger Turnover
		Goods Turnover
	Economic Structure	Proportion of Foreign Direct Investment in GDP
		Proportion of Secondary Industry
		Proportion of Tertiary Industry
		Proportion of Employees in Tertiary Industry

3.2. Data Source and Processing

To ensure the accuracy and comparability of data analysis, the sources of data used in this study include the National Bureau of Statistics of China, statistical yearbooks of various provinces in the Yangtze River Economic Belt, and so on. In order to provide a more accurate reflection of these influences during the data analysis process, all data in this study underwent dimensionless processing.

3.3. Methodology

This study uses the combination weights determined by the CRITIC-Entropy Weight Method to calculate the coupling coordination degree and analyze the level of coordination and development. The CRITIC method, proposed by Diakoulaki et al. in 1995, is an objective weighting method that evaluates the subjective weights of indicators based on their comparative intensity and conflict. However, it does not measure the level of dispersion between indicators[12]. The entropy weight method is a technique that determines weights based on the dispersion among indicators. Building upon this, Wu Zhong et al. (2019) proposed an objective weighting model based on the CRITIC-Entropy Weight Method, which utilizes the entropy weight method to address the limitations of the CRITIC method[13]. In the CRITIC method, standard deviation represents comparative intensity but has dimensions. On the other hand, correlation coefficient represents conflict, but it can have negative values. In reality, conflict only depends on the absolute value of the correlation coefficient and is independent of its sign[14]. To address this issue, Fu Weizhong et al. (2020) made improvements by introducing the standard deviation coefficient to eliminate dimensionality impact and taking the absolute value of the correlation coefficient to remove the influence of its sign[15].

4. Results Analysis

4.1. Measurement of Sustainable Development Level

4.1.1. Overall Characteristics

According to Figure 1, the coupling coordination degrees of the provinces and cities in the Yangtze River Economic Belt show an overall increasing trend.

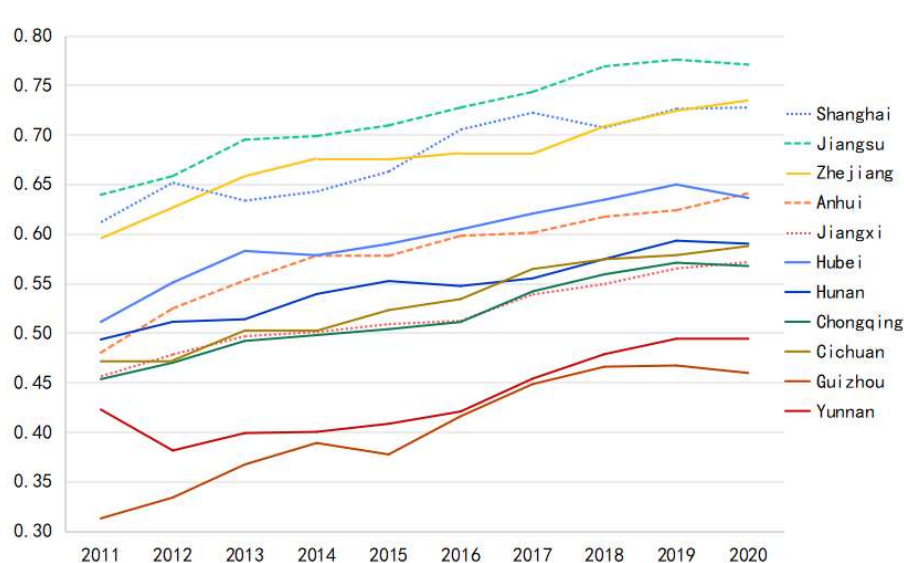


Figure 1. Sustainable Development Levels of Provinces and Cities in the Yangtze River Economic Belt

Based on the range of coupling coordination degree values, the Yangtze River Economic Belt can be divided into three groups. Group 1 includes Shanghai, Jiangsu, and Zhejiang. From 2011 to 2020, their coupling coordination degree levels were between 0.6 and 0.8, which is the highest among the three groups. Over time, Shanghai, Jiangsu, and Zhejiang have transitioned from primary coordination to intermediate coordination, indicating their excellent performance in sustainable development. Group 2 consists of Anhui, Jiangxi, Hubei, Hunan, Chongqing, and Sichuan. Their overall coupling coordination degree ranges between 0.4 and 0.65. From 2011 to 2020, the coordination levels of Anhui and Hubei have transitioned from primary coordination to intermediate coordination, while Jiangxi, Hunan, Chongqing, and Sichuan have transitioned from imminent imbalance to tenuous coordination. Compared to Group 1, Group 2 has relatively weaker economic strength, innovation capacity, and regional coordination ability. They need to accelerate the pace of transformation and upgrading, face challenges in ecological environment protection and restoration, strengthen social development and improve people's livelihood. Their coordination level in urbanization is not high, and the quality and level of public services need to be further improved. Geographically, Group 2 is mainly located in the middle reaches of the Yangtze River, with good ecological conditions and industrial foundation. However, they face difficulties in transformation and upgrading, as well as regional coordination problems. Group 3 consists of Guizhou and Yunnan. Their overall coupling coordination degree ranges between 0.3 and 0.5. From 2011 to 2020, the coordination levels of Guizhou and Yunnan have transitioned from tenuous coordination to imminent imbalance, indicating that although Guizhou and Yunnan are at a relatively low level of sustainable development, they show a positive trend overall. This is related to their geographical location. In the Yangtze River Economic Belt, Guizhou and Yunnan have lower levels of sustainable development, mainly due to their relatively low economic development level, with indicators lower than the average level of the Yangtze River Economic Belt. They also have a relatively single economic structure.

4.1.2. Local Characteristics

The sustainable development level calculated in this paper is based on four aspects: innovation-driven, well-being assurance, resources and environment, and economic development. In order to gain a more detailed understanding of the development of the Yangtze River Economic Belt from 2011 to 2020, the analysis will be conducted from four aspects.

The innovation-driven level of each province and city in the Yangtze River Economic Belt has shown an upward trend from 2011 to 2020. This indicates that the technological innovation capacity of the Yangtze River Economic Belt has been continuously enhanced, providing strong impetus for economic and social development. In terms of the absolute level of innovation-driven scores, the levels of Jiangsu, Zhejiang, and the eastern provinces and cities of Shanghai are significantly higher than those of the central and western provinces and cities. Their scores have increased from 0.4161, 0.4117, and 0.3251 in 2011 to 0.9101, 0.6880, and 0.7176 in 2020, representing growth rates of 118.7%, 120.8%, and 67.2% respectively. This indicates the advantages of the eastern regions in terms of resources, environment, and policies related to technological innovation. In terms of spatial distribution, the innovation-driven level of the Yangtze River Economic Belt shows a decreasing gradient from east to west. Although the innovation-driven level in the western regions is lower compared to the eastern regions, it is also continuously improving. Yunnan and Guizhou, for example, have increased their scores from 0.0276 and 0.0167 in 2011 to 0.1276 and 0.1059 in 2020, representing growth rates of 362.3% and 535.3% respectively. Additionally, there are also differences within each province and city. For example, the innovation-driven level in cities like Nanjing and Suzhou in Jiangsu Province is higher than in other cities, and the same applies to cities like Chengdu and Mianyang in the central and western regions.

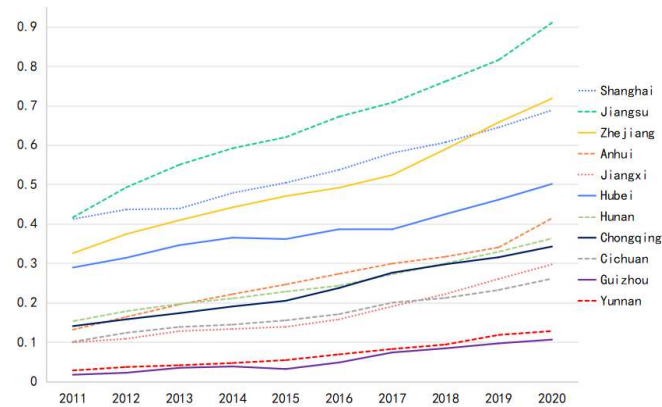


Figure 2. Innovation Drive

In terms of well-being assurance level, we observed differences compared to the innovation-driven level. With the exception of Jiangsu, Zhejiang, and Shanghai which maintained relatively stable levels fluctuating around a certain point, the well-being assurance level of other provinces and cities generally showed an increasing trend. In terms of the absolute level of well-being assurance, although Jiangsu, Zhejiang, and Shanghai still occupy a high position compared to other cities, their well-being assurance levels did not show significant growth from 2011 to 2020. On the contrary, the well-being assurance levels of other cities generally showed an overall upward trend with some fluctuations. For example, Sichuan Province had a well-being assurance level of 0.3639 in 2011, which decreased to 0.2882 in 2012, and then gradually increased to 0.4468 in 2020, representing a growth of 55%. Yunnan Province's well-being assurance level increased from 0.2283 in 2011 to 0.3231 in 2020, representing a growth of 41.5%, making it one of the provinces with faster growth in the Yangtze River Economic Belt. Guizhou Province's well-being assurance level increased from 0.1870 in 2011 to 0.2189 in 2020, representing a growth of 17%. While the growth rate is not high, considering that Guizhou Province is a relatively poor province, this achievement is still commendable. Well-being assurance is influenced by various factors. The investment and coverage of well-being assurance in each province and city of the Yangtze River Economic Belt may vary. Eastern provinces and cities such as Shanghai and Jiangsu have higher investment and coverage in social security and healthcare compared to the central and western provinces and cities. At the same time, due to various factors, the investment in the central and western provinces and cities may be more focused on improving people's livelihood. Therefore, while there are disparities in well-being assurance, the gap between the central and western regions and the eastern regions is continuously narrowing.

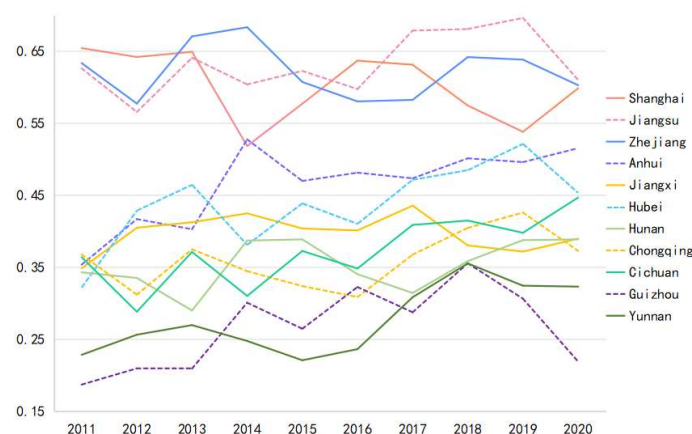


Figure 3. Well-being Assurance

In terms of resources and environment, the main measurements include industrial impact on the environment, investment and effectiveness of industrial pollution control, air quality, and energy utilization efficiency. Overall, the resources and environment level of the Yangtze River Economic Belt is on the rise. In terms of the absolute level of resources and environment, Jiangsu and Sichuan have relatively high levels, with their scores increasing from 0.3930 and 0.3940 in 2011 to 0.6232 and 0.5429 in 2020, representing growth rates of 58.6% and 37.8% respectively. This indicates that these regions have good policies or measures in terms of resource utilization and environmental improvement. Meanwhile, Shanghai's data for resources and environment increased from 0.2088 in 2011 to 0.3251 in 2020, representing a growth of 55.8%. However, it is still relatively low compared to the rest of the Yangtze River Economic Belt, indicating that Shanghai faces challenges in terms of resources and environment as an international metropolis. Unlike innovation-driven and well-being assurance, the natural resources and environment in the central and western regions have inherent advantages due to geographical conditions, such as abundant water resources and forest resources. From 2011 to 2020, Sichuan, Guizhou, Yunnan, and other central and western provinces and cities showed faster growth in resources and environment levels, indicating that these areas have effectively utilized their ecological resource advantages to promote green and high-quality economic development, achieving significant results.

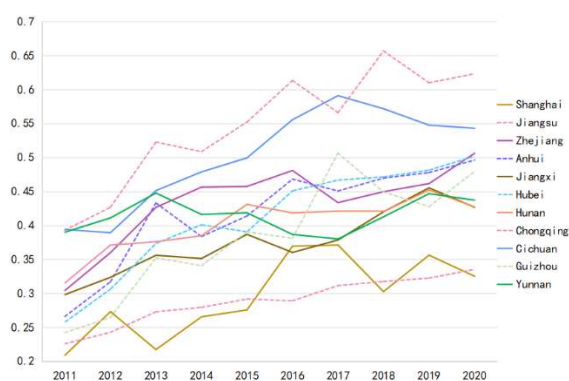


Figure 4. Resources and Environment

Economic development is an important foundation and prerequisite for sustainable development. Only with economic development can we improve people's livelihoods, enhance social innovation capabilities, provide more resources and conditions, protect natural resources and the ecological environment, and create a favorable environment for sustainable development. Overall, the economic development level of the provinces and cities in the Yangtze River Economic Belt shows a growing trend. In terms of the absolute level of economic development, Shanghai leads by a large margin, with its score increasing from 0.3478 in 2011 to 0.5854 in 2020, representing a growth of 68.4%. Similarly, the eastern cities of Jiangsu and Zhejiang also have higher economic development levels compared to cities in the central and western regions. Their scores increased from 0.2725 and 0.2517 in 2011 to 0.3594 and 0.3868 in 2020, representing growth rates of 31.9% and 53.7% respectively. Although Anhui's economic development level is not as high as Shanghai, Jiangsu, and Zhejiang, it has also made significant progress, with its score increasing from 0.2288 in 2011 to 0.269 in 2020, representing a growth of 17.6%. However, the economic development level of other cities in the central and western regions is relatively low, but there has been some growth. Jiangxi, Hubei, and Hunan, for instance, increased their scores from 0.1821, 0.1944, and 0.2125 in 2011 to 0.2299, 0.2351, and 0.2437 in 2020, representing growth rates of 26.2%, 20.9%, and 14.7% respectively. Chongqing witnessed one of the fastest growth rates in economic development, with its score increasing from 0.1533 in 2011 to 0.2514 in 2020, representing a growth of

63.9%. However, according to Figure 5, it can be observed that Yunnan Province's economic development level decreased from 0.4266 in 2011 to 0.1171 in 2012. This may be due to the slowdown of China's economy since 2012, which may have impacted Yunnan Province's economic development to some extent. It may also face constraints such as resource and environmental issues that restrict its economic development.

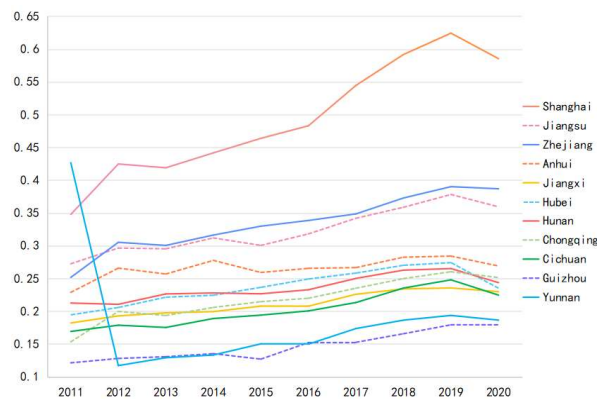


Figure 5. Economic Development

4.2. Dynamic Evolution of Coupling Coordination Degree

4.2.1. Overall Distribution Dynamics

This study uses kernel density estimation to estimate the coupling coordination degree from 2011 to 2020, depicting the form and dynamic evolution pattern of the distribution. According to Figure 6, from 2011 to 2020, the overall sustainable development level of the Yangtze River Economic Belt gradually moves to the right, indicating a gradual increase in the sustainable development level. It effectively promotes the coordinated development of innovation, well-being assurance, resources and environment, and economic development in the Yangtze River Economic Belt. However, it is observed that the width of the main peak keeps increasing, indicating a differentiated trend in the sustainable development level of the Yangtze River Economic Belt. In 2011, there are two distinct peaks, indicating a polarized phenomenon in the sustainable development level of the Yangtze River Economic Belt. Overall, the height of the peak in the distribution curve shows a process of initial decline, then stabilization, and finally slow increase, but always lower than the height of the 2011 peak, indicating a slow growth of the overall sustainable development level of the Yangtze River Economic Belt with gradually increasing differences. Compared to the two distinct peaks in 2011, over time, the overall differences in sustainable development in the Yangtze River Economic Belt gradually decrease.

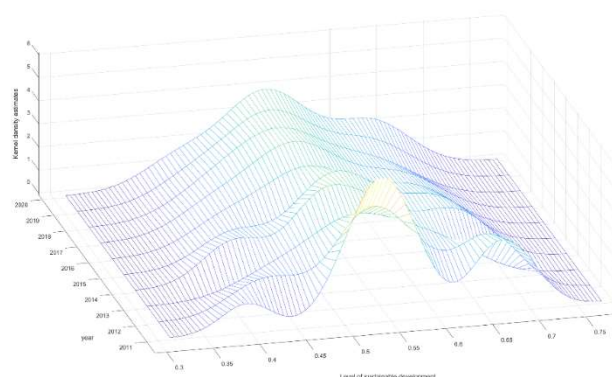


Figure 6. Kernel Density Estimation of the Sustainable Development Level in the Yangtze River Economic Belt

4.2.2. Dynamics of Different Regional Distributions

The provinces and cities are divided into the upper, middle, and lower reaches of the Yangtze River, as shown in the table below.

Table 2. Regional Division

	Upper Reaches of Yangtze River	Middle Reaches of Yangtze River	Lower Reaches of Yangtze River
Provinces or Cities	Chongqing, Sichuan, Guizhou, Yunnan	Jiangxi, Hubei, Hunan	Shanghai, Jiangsu, Zhejiang, Anhui

According to Figure 7, the upper reaches of the Yangtze River show a relatively small trend of moving to the right. Moreover, it is observed that over time, the presence of two distinct peaks in 2011 gradually develops into a single peak with a smaller height and a wider width. This indicates that from 2011 to 2020, the polarized phenomenon among the provinces and cities in the upper reaches of the Yangtze River shifts towards a more homogeneous pattern, although general differences still exist. In the middle and lower reaches of the Yangtze River, the sustainable development level exhibits intermittent changes from a single peak to double peaks. This indicates that in recent years, there have been fluctuating and non-significant changes in the differences in the sustainable development level among provinces and cities in these regions.

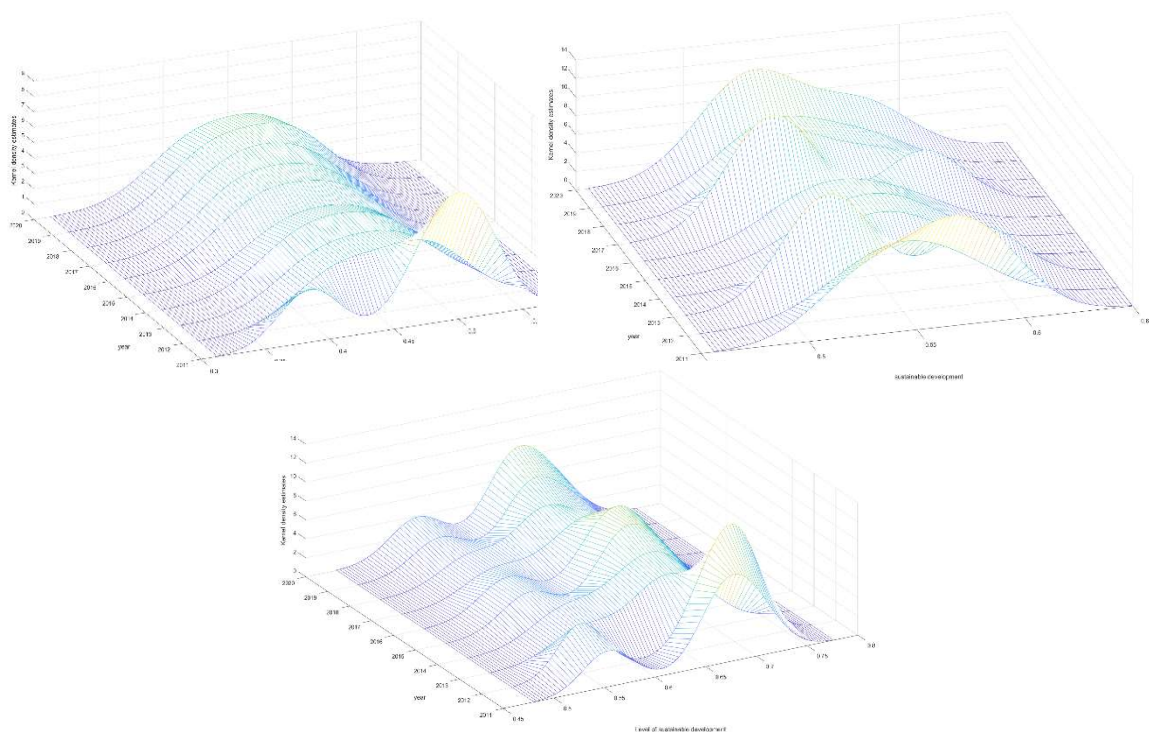


Figure 7. Estimation of the Kernel Density of the Sustainable Development Levels in the Upper, Middle, and Lower Reaches of the Yangtze River

4.3. Spatial Disparities of Coupling Coordination Degree

4.3.1. Overall Regional Differences

Figure 8 reflects the overall regional disparities in the sustainable development level in the Yangtze River Economic Belt. From the figure, it can be seen that from 2011 to 2020, the overall

Gini coefficient of the sustainable development level of the 11 provinces and cities in the Yangtze River Economic Belt shows a decreasing trend, decreasing from 0.0984 to 0.0853. This indicates that the sustainable development level in these regions has become more balanced, and significant development disparities have not emerged. In recent years, the Yungui, Chuanyu, and Xianggan regions have achieved simultaneous social development alongside their rapid economic growth. The Jiangsu, Zhejiang, Shanghai, and Anhui regions have maintained their high-level development momentum, continuously innovating social service concepts and methods.



Figure 8. Overall Gini Coefficient of the Sustainable Development Level in the Yangtze River Economic Belt

4.3.2. Intra-regional Differences

According to Figure 9, the Gini coefficient in the upstream region is consistently higher than in the middle and downstream regions. This indicates that there is a larger disparity in the sustainable development level of the upstream region. The Gini coefficient in the middle reaches is consistently lower than in the upstream and downstream regions, suggesting a smaller disparity in sustainable development level. This could be attributed to factors such as abundant water resources, numerous tributaries, good ecological environment, and coordinated regional development. The Gini coefficient in the downstream region falls between the upstream and middle reaches, indicating a moderate level of disparity in sustainable development. According to results, analyzing the trend of changes, it can be observed that the upstream region has the largest decrease in Gini coefficient, from 0.0762 to 0.0541, a decrease of 29.01%. This indicates a gradual reduction in the disparity in sustainable development level in the upstream region. The middle reaches show the smallest decrease in the Gini coefficient, dropping from 0.0251 to 0.0241, a decrease of 4.36%. This indicates a relatively stable disparity in the sustainable development level in the middle reaches. The downstream region has the second smallest decrease in the Gini coefficient, decreasing from 0.0531 to 0.0345, a decrease of 35.02%. This suggests a gradual decrease in the disparity in sustainable development level in the downstream region.

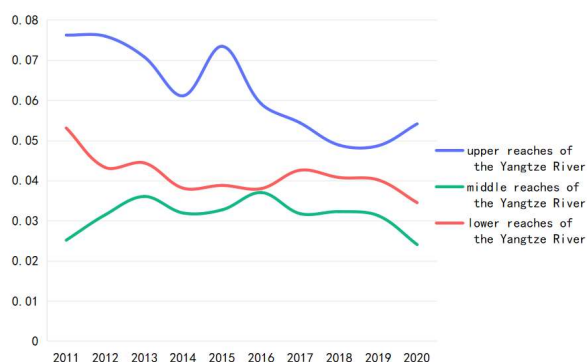


Figure 9. Intra-regional Differences of the Sustainable Development Level in the Yangtze River Economic Belt

4.3.3. Interregional Regional Differences

According to Figure 10, the differences between provinces and cities in the upper, middle, and lower reaches of the Yangtze River Economic Belt are gradually decreasing, indicating a reduction in the disparity in the sustainable development level of the Yangtze River Economic Belt. The greatest disparity in sustainable development level exists between the upstream and downstream regions of the Yangtze River. However, over time, the disparity in sustainable development level between the upstream and middle reaches is relatively smaller, suggesting a relatively close level of sustainable development in these two regions. From 2011 to 2020, the differences among the 11 provinces and cities in the Yangtze River Economic Belt have been continuously decreasing.

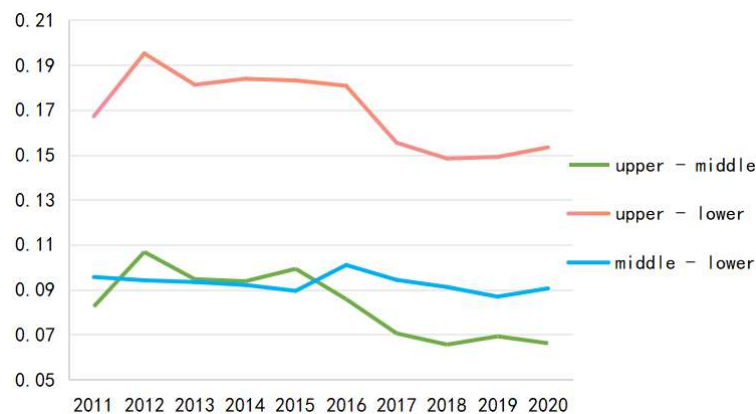


Figure 10. Interregional Regional Differences of the Sustainable Development Level in the Yangtze River Economic Belt

4.4. Spatial Analysis

4.4.1. Moran's I Index

In order to analyze the spatial correlation of the sustainable development level among the 11 provinces and cities in the Yangtze River Economic Belt, this study uses a spatial geographic matrix calculated based on latitude and longitude as the weight matrix to calculate the global Moran's I index. The results are shown in Table 3.

Table 3. Global Moran's I Index

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Moran`I	0.195	0.261	0.252	0.278	0.260	0.276	0.247	0.244	0.249	0.273

According to Table 3, the global Moran's I index for the years 2011-2020 is greater than 0.1, indicating a positive spatial correlation in the sustainable development level among the 11 provinces and cities in the Yangtze River Economic Belt. The sustainable development levels of neighboring or adjacent provinces and cities tend to be similar.

4.4.2. Markov Chain

Next, we conduct an analysis of Markov chains. According to the results of the traditional Markov chains: (1) The sustainable development level of provinces and cities in the Yangtze River Economic Belt is generally at a lower level in most cases. (2) The probability of no change in the sustainable development level is at least 71.44%, indicating a certain level of stability in the development pattern that is not easily disrupted. It is also observed that the provinces and cities in the intermediate coordination level exhibit a "club convergence" characteristic. (3) The sustainable development level in the imminent imbalance level is more likely to experience

level jumps compared to other levels. (4) The probability values greater than 0 off the diagonal in the table are closely adjacent to the diagonal, indicating that the evolution of sustainable development level only occurs between adjacent levels.

According to the results of the traditional Markov chains and Spatial Markov chains, it is not difficult to observe the following: (1) Spatial geographic factors play an important role in the dynamic evolution process of regional sustainable development levels. (2) There is still a certain level of stability in the sustainable development level. However, it can be observed that compared to the traditional Markov transition probability matrix, the spatial Markov transition probability matrix shows a trend where the non-zero values on the diagonals are equal to or closer to the values off the diagonals, mainly in the areas of imminent imbalance and fragile coordination. (3) Overall, provinces and cities exhibit a "spatial spillover" effect in their sustainable development levels.

5. Conclusion

This article selects the 11 provinces and cities in the Yangtze River Economic Belt as the research object, and based on the data from 2011 to 2020, it conducts an evaluation and analysis of the sustainable development level in the Yangtze River Economic Belt. The following are the main research conclusions:

The Yangtze River Economic Belt has pursued economic growth while also focusing on guaranteeing resources, environment, and well-being, striving to achieve coordinated development in economy, society, and ecology. But there were significant regional disparities. At the same time, the sustainable development level in the Yangtze River Economic Belt exhibited significant disparities but achieved cross-level transitions.

The sustainable development of the Yangtze River Economic Belt is influenced by innovation, welfare, resources and environment, and economic development. There are regional differences in these aspects, with the eastern region generally performing better in innovation and welfare, while the central and western regions are showing improvement. Resource and environmental levels are high in Jiangsu and Sichuan, but Shanghai faces challenges. Economic development is strongest in Shanghai, followed by Jiangsu and Zhejiang, with the central and western regions showing growth despite lower levels.

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