

# Research on the Path of Green Finance Helping the Construction of Ecological Fragile Areas in the Yangtze River Delta

## -- Taking the Coal Mining Subsidence Area of Huainan City as an Example

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### Abstract

Huainan City in Anhui Province has unique geographical and resource advantages. It is one of the few energy cities in the three provinces and one city in the Yangtze River Delta. Due to the over exploitation of coal mines, it has caused the ecological imbalance restricting local development, and the impact of Green Finance on ecological construction is becoming increasingly prominent. Firstly, this paper uses the principal component analysis method to process the captured data, so as to obtain the two principal components of green finance in the Yangtze River Delta, and then uses the coupling coordination model to analyze the coupling relationship between the green finance indicators of three provinces and one city in the Yangtze River Delta and the comprehensive indicators of ecological construction, The results show that in order to improve the coupling degree between green financial development level and ecological construction in the Yangtze River Delta, we also need to focus on indicators such as green credit and environmental protection investment. Combined with the above indicators, this paper puts forward the path of ecological restoration according to the current situation of green finance and ecological construction in Huainan City.

### Keywords

Green finance; Ecological construction; Changjiang delta; Principal component analysis; Coupled co scheduling.

### 1. Introduction

There are 18 articles in the civil code promulgated by China in 2020 that are directly related to the ecological environment, which directly shows that ecological construction has been an important consideration in the process of regional comprehensive construction. As one of the three major economic circles, the Yangtze River Delta has a place in the overall situation of national strategic promotion, and Huainan City is one of the few energy cities in the three provinces and one city in the Yangtze River Delta, There is a serious ecological imbalance after over exploitation of resources. According to the fact that green finance plays a substantial role in realizing the construction of ecological civilization, this paper studies the coupling degree between various indicators of green finance development and comprehensive indicators of ecological construction, and explores the path of ecological restoration in Huainan City from the perspective of green finance.

Many relevant professionals conduct quantitative research from the perspective of social benefits and economic structure transformation of green development, while most scholars only qualitatively elaborate the impact of green financial development on ecological construction, and there are few quantitative researchers on ecological construction by various

indicators of green financial development. Sonia Labatt (1997) [1] Carbon finance is a branch of green finance, including a large number of financial products, which can not only reduce financial risks, but also create a huge investment and financing scale in the clean energy market. Chen Shuang (2017) [2] It is pointed out that projects with good environmental benefits but high risks or insufficient collateral, such as environmental protection science and technology development projects, energy-saving product development projects, energy conservation and emission reduction projects of small and medium-sized enterprises and small-scale ecological agriculture projects, are difficult to obtain the support of green finance. Wang Yujing et al. (2017)[3] It is pointed out that there is a dialectical relationship between green finance, environmental protection and climate change. It is necessary to integrate environmental elements into core business and correctly deal with the relationship between economic, environmental, ecological and social development. Li Hong et al. (2019) [4] This paper quantitatively measures the coupling between the comprehensive indicators of green financial development and the comprehensive indicators of ecological environment, and obtains the result that the coupling degree of the Yangtze River Delta has exceeded 0.45 in recent years, that is, it is considered that the development of green finance can better improve the ecological environment, and the two can develop in coordination, which shows that green finance is an important starting point for the development of ecological economy. Liu Xiaobin (2020)[5] This paper expounds the inherent advantages of green finance development in the Yangtze River Delta from the aspects of economy, finance and openness. Qiu Zhaoxiang (2020) [6] It is considered that green finance can guide and optimize the allocation of financial resources, so that all kinds of financial resources can reach the Pareto optimal state in promoting ecological environment protection and economic and social development.

## 2. Construction of Green Finance Index System

Combined with the development of green finance in the Yangtze River Delta and referring to the existing research experience of previous scholars, this paper selects seven relevant indicators reflecting the development level of green finance, They are the market value of environmental protection enterprises (x1), environmental protection investment (x2), green credit (x3), the number of Clean Development Mechanism projects (x4), local financial environmental protection expenditure (x5), estimated annual carbon emission reduction (x6) and interest expenditure of Industrial Enterprises above Designated Size (x7).

### 2.1. Data Processing and Applicability Test

Firstly, SPSS software standardizes the collected data, uses the range method to deal with the interest expenditure X7 of Industrial Enterprises above the scale of negative indicators, and then carries out the first Kom test and Bartlett sphere test. The data test results of provinces and cities are as follows: Table 1

**Table 1.** Result of Kmo and Bartlett test

<b>Kmo and Bartlett test</b>					
Areas		Anhui	Zhejiang	Jiangsu	Shanghai
Kmo sampling suitability quantity		0.635	0.684	0.732	0.614
Bartlett sphericity test	Approximate chi square	79.582	63.611	59.6	42.251
	Freedom	15	15	15	15
	Significance	0	0	0	0

According to the test results, the kmo values of provinces and cities in the Yangtze River Delta are greater than 0.6, indicating that there is a certain correlation between the indicators. The sig value of Bartlett sphericity test in each city is 0, which is far less than 0.05, indicating that the original assumption that the correlation coefficient matrix after standardization is the unit matrix is rejected, and the six variables are not independent of each other. Therefore, the six variables selected in this paper have strong correlation and meet the variable requirements of principal component analysis. The following is analyzed by principal component analysis.

## 2.2. Principal Component Analysis

Through the analysis results of Anhui Province, Zhejiang Province, Jiangsu Province and Shanghai City, it is concluded that the first two principal components can explain all variances to a large extent, so the first two principal components are selected and recorded as  $Y_{a1}$ ,  $Y_{a2}$ ,  $Y_{b1}$ ,  $Y_{b2}$ ,  $Y_{c1}$ ,  $Y_{c2}$ ,  $Y_{d1}$ ,  $Y_{d2}$ . The eigenvalues of the extracted sum are square calculated to obtain  $A1 = 2.13$  and  $A2 = 1.04$ . Taking Anhui Province as an example, the principal components and their coefficients are obtained through numerical calculation as follows:

$$Y_{a1}=0.420X1+0.412X2+0.335X3+0.435X4+0.423X5-0.416X7$$

$$Y_{a2}=0.155X1-0.357X2+0.653X3-0.313X4+0.398X5+0.406X7$$

It can be seen from the above formula that the absolute values of the coefficients of the market value of environmental protection enterprises ( $x1$ ), the number of CDM projects ( $x4$ ) and the local financial environmental protection expenditure ( $x5$ ) are greater than other variables. Therefore, it comprehensively reflects the driving force of the government and the capital market for the development of local green finance, indicating that the role of the rise of local green finance business in Anhui is the Anhui government.

From the final comprehensive score and ranking results of the principal components of green finance indicators of three provinces and one city, it is not difficult to see that the development of green finance in various provinces and cities has gradually improved over time, which reflects that local government institutions are paying more and more attention to the development of green finance. Zhejiang and Anhui provinces scored the highest score in 2018, which shows that green finance in Zhejiang and Anhui provinces is thinking of a better direction. The development of green finance in Jiangsu and Shanghai reached the best level in 2015 and 2017 respectively, and then showed a downward trend. Therefore, we infer that after the economy enters the new normal development, the development of green finance in developed areas has stagnated, while the economy in underdeveloped areas is growing and driving the development of green finance in underdeveloped areas at the same time.

## 3. Coupling and Co Scheduling of Green Finance and Ecological Construction

### 3.1. Data Standardization Processing

This paper obtains the relevant data of ecological construction from the statistical yearbook of three provinces and one city and the official website of the Department of ecological environment. Anhui, Zhejiang, Jiangsu and Shanghai have different preferences for ecological construction, so it is necessary to use the index data of different ecological construction to form a comprehensive index, because the obtained data are accompanied by differences in nature and order of magnitude, Therefore, SPSS software is used to standardize the original data by range method, so as to build a more effective comprehensive index system of ecological construction in three provinces and one city, see Table 2:

**Table 2.** Data of three provinces and one city

Anhui	-0.11	-0.16	-0.05	0.11	0.45	0.17	-0.14	-0.28	0.05	-0.05
Zhejiang	0.01	0.02	0.00	-0.01	-0.05	-0.02	0.01	0.03	0.00	0.00
Jiangsu	0.01	0.02	0.00	-0.01	-0.05	-0.02	0.02	0.03	-0.01	0.01
Shanghai	0.01	0.02	0.01	-0.01	-0.06	-0.02	0.02	0.04	-0.01	0.01

### 3.2. Establishment of Coupling Coordination Degree Model

Through the coupling analysis of the green finance index obtained by the component acquisition method in the second part and the comprehensive index of ecological construction of three provinces and one city, the coupling degree can directly reflect the interaction degree between the two systems.

The results of the coupling coordination degree of the comprehensive indicators of ecological construction of three provinces and one city and the principal component indicators 1 and 2 of Green Finance show that the coupling coordination degree of the two systems of three provinces, one city basically showed a fluctuating growth from 2009 to 2018, with a trend from imbalance to coordination, indicating that the effect of green finance in helping ecological construction is increasing year by year, and green finance is a new grasp of ecological construction in the Yangtze River Delta. However, the horizontal comparison also shows that the coupling coordination degree between ecological construction and green finance in Anhui Province is lower than that in other provinces and cities, especially the coupling coordination degree between principal component 2 of green finance index and ecological construction is still moderately unbalanced in recent years, indicating that the development of green finance in Anhui Province has failed to achieve the coordinated development with ecological construction, From the weight analysis of principal component 2, it is concluded that green credit and environmental protection investment are needed to improve the development level of green finance in Anhui Province and better help the ecological construction of Anhui Province.

## 4. Conclusion

From the principal component analysis of green finance indicators of three provinces and one city in the Yangtze River Delta, it is concluded that in the process of integration of the Yangtze River Delta, provinces and cities pay more attention to the development of green finance year by year. In terms of the characteristics of regional green finance development, the Yangtze River Delta mainly takes green credit and environmental protection investment as the foothold of green finance development. From the analysis of the coupling coordination degree between the green finance index system and the comprehensive index of ecological construction in three provinces and one city in the Yangtze River Delta, it is concluded that compared with other provinces and cities, there are still deficiencies in the coupling coordination degree between green finance and ecological construction in Anhui Province, indicating that the role of green finance in promoting ecological construction in Anhui Province has not been brought into full play, Combined with the development requirements of the integration of the Yangtze River Delta and the comparison results of other provinces and cities, Anhui Province as a whole needs to strengthen the implementation of relevant policies. Through data query, it is concluded that from the early stage of the development of green finance to now, the implementation degree of green finance is gradually improving, but the green financial products are still relatively single and lack of local characteristics.

## 5. Suggestions on Ecological Restoration Path of Coal Mining Subsidence Area in Huainan City Assisted by Green Finance

Huainan is a pilot city for comprehensive treatment of key coal mining subsidence areas in China (area), capital and technology are the two core issues in the governance of coal mining subsidence areas. It is impractical for the funds for ecological restoration to only come from the government. Diversified investment mechanism must be adopted to guide the participation of social funds and encourage third-party enterprise governance. Green finance is the driving force to guide the flow of capital to ecologically fragile areas and better serve the development of ecological economy. Based on principal component analysis Based on the results of coupling coordination degree, this paper explores the path of green finance to help the ecological restoration of coal mining subsidence area in Huainan City.

### 5.1. Implement the Green Finance Policy and Deploy Local Collaborative Strategies

In order to carry out ecological construction, Panji District of Huainan City has completed a total of 497 mu of afforestation in five years. There are 9 provincial-level ecological townships and 23 provincial-level ecological villages in the region. Huainan coal mining subsidence area plans to build 24000 square meters of Wetland Park in 2007. 120 million funds were invested in the first phase. In 2015, the East will steadily implement the nine World Bank ecological restoration loan projects in coal mining subsidence areas with a total investment of 200 million US dollars, an average investment of 100 million yuan is required for each square kilometer of governance [7]. From the data of ecological construction, it can be seen that the development level of green finance in Anhui Province is relatively backward. Since the state strongly encourages the development of green finance, green finance projects in other provinces and cities are advancing steadily, while Anhui Province shows fluctuating and slow growth. As an ecological imbalance area in Anhui Province, Huainan needs to respond to the call of the national development of green finance from environmental protection investment Based on green credit and other indicators, implement green financial policies and provide financial support for local wetland parks and afforestation projects. At this stage, China's financial institutions generally take profit maximization as the business goal, and investing in green industries will face the problems of high investment risk and low rate of return. Although "there are policies", some large financial institutions and even state-owned enterprises still "have countermeasures" and only make superficial efforts while maintaining the corporate image, it simply can not play a substantive role in promoting the development of green industry. The main reason is that China's laws and regulations on green financial development and ecological construction are not perfect, there is a lack of external incentives for financial institutions and enterprises, there is no policy preference in finance and taxation, and there is a large opportunity cost in investment. In order to mobilize their enthusiasm, we must give certain policy preferences, reduce taxes or financial investment, carry out policy incentives from the outside, reduce the opportunity cost of investors, expand the market share of green industries and attract capital inflows.

### 5.2. Strengthen Local Financial Innovation and Establish Characteristic Financial Projects

European countries generally solve the problem of market failure in green industry investment and financing by establishing special environmental banks and policy financial institutions. Relevant ministries and commissions can explore the establishment of a national green bond issuing bank with development or policy, rely on national credit, systematically build a financing mechanism through market-oriented methods, and support the construction of green industry and ecological civilization. The essence of finance is to serve the real economy. Green



finance adhering to the concept of environmental protection and sustainable development and serving the digital economy is an unshirkable mission. According to the geographical and resource advantages of Huainan, the ponding stable subsidence area formed after coal mining is built into a floating photovoltaic power station on water, which has the advantages of saving resources and using the reflective principle to generate power efficiently. Previously, photovoltaic power generation and wind power generation have been successfully applied in southwest and Northwest China, and the economic and environmental benefits are obvious to all [8], but due to the high requirements for floating equipment and difficult construction of water photovoltaic power stations, and the huge amount of capital investment in the early stage, commercial banks need to comply with the policy requirements for the standardized development of green credit, help the construction of photovoltaic projects, promote the generation of green credit and improve the green credit management system. It not only makes use of local environmental problems that cannot be eradicated in a short time, but also improves land use efficiency; In order to promote the generation of green credit products such as pollution control, clean energy, energy conservation and emission reduction and promote local sustainable development, it is necessary to increase the research and development of innovative products of green finance, give full play to the role of green finance in ecological restoration and stimulate the leverage effect of green Finance in the construction of ecological civilization.

### **5.3. Strengthen Financial Supervision and Raise the Threshold of Green Finance**

Restricted by its own bad environment, Huainan has seriously restricted the development of green economy in Anhui Province and even the coordinated development of ecology in the Yangtze River Delta. After fully understanding the long-term significance of the central government in promoting the construction of ecological civilization, Huainan Municipal government should increase the constraints on local enterprises, pay attention to the standard emission of enterprises and the establishment of environmental protection enterprises, actively participate in the construction of public investment in environmental protection and green financial system. When policy support and external incentives are strong, it is bound to attract upstream and downstream enterprises in the green industry to enter the industrial chain. Nowadays, the domestic photovoltaic market is mixed. Many enterprises defraud people's money under the guise of photovoltaic loans for their own self-interest. In order to speed up the process of ecological restoration, Huainan has vigorously implemented photovoltaic projects in recent years, this may become a "business opportunity" in the eyes of illegal enterprises. At this time, a higher market access threshold must be set for new enterprises. Relevant regulatory authorities, especially financial supervision, should strengthen financial supervision to ensure that it will not pollute or adversely affect local ecological construction. At the same time, conduct internal green training for new enterprises before entering, enhance their green business development concept, encourage the use of low-energy equipment, innovate production technology, reduce material consumption, increase innovation output, minimize the pollution to the bad environment and reduce the possibility of local environmental pollution from the source.

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## References

- [1] Sonia Labatt. External Influences on Environmental Decision Making: A Case Study of Packaging Waste Reduction. 1997, 49(1): 105-116.
- [2] Chen Shuang. Current situation, problems and suggestions of green finance supporting the construction of Ecological Civilization--Based on the development practice of Zhangzhou [J]. Wuhan finance, 2017 (11): 83-85.
- [3] Wang Yujing, Jiang Hangxiang. Path analysis of promoting the development of low-carbon industry with green finance [J]. Wuhan finance, 2017 (04): 54-56.
- [4] Li Hong, Yuan Yingchao, Wang Na. Evaluation of coupled and coordinated development of regional green finance and ecological environment [J]. Statistics and decision making, 2019,35 (08): 161-164.
- [5] Liu Xiaobin. Exploration on the development path of green finance in the Yangtze River Delta -- Investigation and research from Huzhou City, the national green finance reform and innovation experimental area [J]. Financial theory and teaching, 2020 (04): 15-20 + 29.
- [6] Qiu Zhaoxiang, Liu Yongyuan. Promoting the construction of ecological civilization with green finance [J]. Theoretical exploration, 2020 (06): 83-89.
- [7] Panji district to forge ahead [n] Huainan daily, 2021-01-08 (A02).
- [8] Chen Kai, Chen Qingtong, sun Qingxian, Liu Yixin Construction of photovoltaic demonstration base in Datong coal mining subsidence area and application of grouting treatment technology in goaf [J] Coal mine safety, 2018,49 (08): 169-172.