ISSN: 2688-9323

Exploring the Development of Green Finance in the Yangtze River Delta Economic Belt Empowered by Digital Economy

Zhihao Zheng, Jie Ren, Fangxia Liu, Jiayi Xu

Anhui University of Finance and Economics, Bengbu 233030, China

Abstract

This project aims to construct a model of the development trend of green finance under the influence of various factors such as big data and the Internet of Things through literature review and hands-on practice. Based on the domestic "dual carbon" environment driving the vigorous development of the digital economy, it aims to solve the problem of the effects of differences in traditional financial systems, credit constraint mechanisms, and financial supervision on the development of green finance. Considering that green finance in the current Chinese market is only moderately developed, However, the development prospects are broad and can be further broken through with the development of the digital economy. Therefore, we need to explore and find the correct direction and reasonable development strategies to improve the quality and efficiency of China's financial market for further development.

Keywords

Double Carbon; Green Finance; Digital Economy.

1. Introduction

1.1. Policy Background

In March 2021, the "dual carbon" goal was included in the "14th Five Year Plan" and the long-term goals for 2035. [1].

1.2. Era Background

In recent years, China's green finance has flourished, providing important support for the demand for funds and the optimization of resource allocation in related fields. The development of green finance should be in line with the dual carbon work at the macro level, make up for infrastructure shortcomings at the medium level, and promote precise matching of financial product supply and demand at the micro level. China will incorporate the development of green finance into the carbon peak and carbon neutrality "1+N" policy system, and the green finance system will continue to improve. Some regions have taken the lead in exploring models that use green finance to assist in optimizing regional industrial structure and improving ecological environment; Many financial institutions are actively developing green financial products.

1.3. Innovation Points and Characteristics

The study considered multiple factors: in order to test the mechanism of the effect of green finance on the development of the digital economy, various factors were taken into account, such as the degree of advanced industrial structure, environmental regulations, per capita GDP, urban-rural income gap, and government intervention. The comprehensive effect of green finance on the high-quality development of the digital economy was further elaborated.

Asymmetry of research objects: mainly targeting green financial products such as green credit, green bonds, and green funds.

The dynamism of models: Traditional research often uses static models to analyze, but in reality, there are many factors that affect green finance, which is a dynamic and changing process. This

ISSN: 2688-9323

study can analyze the future direction of green finance more accurately by establishing benchmark models and intermediary models, taking into account factors such as policy factors, the impact of policy loopholes, and the uncertainty of policy implementation.

Multidimensional measurement of policy stability: Traditional policy stability measurement usually only considers the time interval of policy formulation and the consistency of policy implementation. However, in reality, policy stability also involves multiple aspects such as policy predictability, changes in policy background, and transparency in policy formulation. This study can comprehensively consider stability from multiple perspectives and explore multidimensional measurement methods for policy stability.

2. Research Significance

2.1. Theoretical Significance

Green finance is an important guarantee for maintaining sustainable economic development. The development of green finance is an inevitable path to promote the current adjustment of China's economic and financial structure, achieve sustainable economic and environmental development, and is the direction of China's future financial development. It is also an innovation and transformation in China's financial field. Green finance has shown great potential and value in promoting the green and low-carbon transformation of the entire society. Facing the future, it can empower and increase efficiency for China's high-quality development.

2.2. Practical Significance

Green finance can promote the linkage between the capital market and the carbon market, enabling the capital market to better improve the price discovery function of the carbon market, and enabling the carbon market to more effectively optimize the allocation of resources in the capital market, jointly supporting the green, low-carbon, and high-quality development of China's economy and society.

2.3. Literature Review

The concept of green finance was first proposed in 1991, and the United Nations Conference on Environment and Development adopted the Rio Declaration on Environment and Development and Agenda 21 (1992). Environmental protection and emission reduction became the focus of attention, and green finance was promoted. Guo Shuhua et al. (2003) believed that issuing green bonds was beneficial for improving the green finance system and constructed multiple regression equations by using weighted least squares method, Empirical analysis of the influencing factors on the interest rate of green bond issuance by Chinese enterprises. A review of green finance research "(Lietal., 2015) reviews the progress and achievements of green finance research in recent years, including the concept and definition of green finance, policy and institutional environment, market development, and green finance products, providing reference for green finance research. Green finance and sustainability: Financial performance and institutional investors (Cao et al., 2022) studied the market performance of green financial products and the investment decisions of institutional investors, and found that green financial products have good investment returns and risk control capabilities. Zhang Xiufan et al. (2023) studied ways to promote the development of the digital economy and support China's transition to a low-carbon economic development model, in accordance with China's active promotion of the dual carbon goals of "carbon peaking" and "carbon neutrality", and proposed countermeasures and suggestions for further developing the digital economy.

ISSN: 2688-9323

3. Overview of Green Finance Research

3.1. Proposed Problem Solving

3.1.1. How to Solve the Problem of Imperfect Green Finance Policy Framework and Governance System

China's green financial products have not received macro guidance or recognized shares from the government. On the other hand, the state has not strictly defined the responsibilities and obligations between major departments, and has not clearly defined the boundaries of jurisdiction. Our country's green financial products lack overall strategic planning guidance, relying solely on national theoretical promotion, which is completely unable to meet the overall development of green financial products. To achieve development, it is necessary to carry out some detailed industrial chain planning, and if the entire industrial chain can directly cooperate.

3.1.2. How to Strengthen China's Financial System

Our country's green financial system has developed and has inherent fragility. Since the International Monetary Fund officially evaluated our country's financial sector for the first time and announced some data reports, the International Monetary Fund stated in the report that although our country's financial system is in a stable state, some drawbacks are constantly being exposed, and fragility is also constantly emerging, influenced by global economic globalization, Against this backdrop, the financial system is becoming increasingly complex, and the global economy is becoming more unstable and risky. At the same time, China's financial reform has not been able to keep up with the pace of major international changes, which has put forward higher requirements for the transformation of China's financial system. It is necessary to increase a reform of the commercialization of the financial sector. At the same time, utilizing its financial regulatory measures to maintain the stability of China's financial system and promote the development of China's financial sector.

3.1.3. How to Strengthen Policy Signals

Our country's green finance has not yet formed a complete system, and the government has not clearly introduced relevant policies, and the policy signals are not clear enough. Even if the government has some policies, these policies are not fully in line with the actual situation, which will lead to these financial institutions not having the enthusiasm to produce, and these factors ultimately lead to insufficient implementation of national policies. At present, the government has not been able to introduce some incentive policies, which is very unfavorable for improving the production enthusiasm of financial institutions. It is precisely these green financial products that have been hindered in the market, thus seriously hindering the green and environmentally friendly economy.

3.1.4. How to Enhance the Role of Financial Institutions in Green Finance

In order to guide the people to establish the concept of green development, protect the environment, and reduce pollution, China has established green insurance. Green insurance, as an internationally recognized insurance, can enable these enterprises to purchase insurance in advance for the damage caused to the environment, if these enterprises cause significant damage to the environment during their production process. Then there will be insurance companies to compensate. However, for some large enterprises, green insurance may not be able to solve their pollution problems. So, it is necessary to establish a pollution liability system and improve China's green finance management system. We should also actively learn from foreign systems. However, we must not copy foreign systems, we should take their essence. Adopting a system that is suitable for China's national conditions, we can make new attempts on some enterprises with relatively serious pollution, or implement punitive systems on these enterprises with relatively large pollution. For those that cause significant environmental damage, we should implement a liability compensation system for them.

ISSN: 2688-9323

Until now, China has not fully implemented the pollution responsibility system, only in a small number of regions. It is also very difficult to fully promote the pollution responsibility system in China, and we need to work with the environmental protection department to contribute our own efforts to the development of green finance in China. China's financial institutions must strictly implement the principles of the Scientific Outlook on Development and continuously implement some energy-saving and emission reduction measures.

Major financial institutions in China also need to implement a green credit responsibility system for their enterprises, which puts forward higher environmental requirements for these modern enterprises. All major links of enterprise production should be supervised, and those that do not meet the standards should be rejected with one vote. China should increase its support for new energy enterprises. At the same time, it is necessary to investigate the fundraising of enterprises, promote strict adjustment of industrial structure, and continuously eliminate some outdated processes.

3.1.5. How to Expand the Innovation Power of Green Financial Products

The coverage of green financial products is small and the level of innovation is not high. There is a characteristic in the design of green finance products in China that only focuses on financing channels and neglects financing targets. They are mainly aimed at large environmental protection enterprises and large clean energy, energy-saving and emission reduction projects. There are very few green finance products targeting small and medium-sized environmental protection enterprises, individuals, and households, which makes it difficult for green finance products to penetrate various fields of society and limit their influence.

In the context of dual carbon, the development of green finance has ushered in very favorable opportunities. How to seize the trend of "dual carbon" and innovate green finance; How to perfectly integrate green finance with the digital economy is a question worth exploring and researching, as the digital economy can better empower and improve the quality and efficiency of green finance. [2].

3.2. Broad Development Prospects

3.2.1. The Empowering Role of the Digital Economy

In October 2021, the State Council issued the "Action Plan for Carbon Peak before 2030", proposing to promote the integrated development of digitalization, intelligence, and greenery in the industrial field. The digital economy, with its "precision", promotes the high-quality development of green finance. The digital economy can form a network like open ecosystem through digital technologies such as big data and cloud computing, providing upstream and downstream link platforms for green finance, establishing information sharing mechanisms, ensuring information security and effectiveness, improving investment and financing matching efficiency, reducing risks caused by information mismatch, thereby increasing investment and financing scale, and helping green finance better integrate into the industrial chain and value chain.

The digital economy promotes the high-quality development of green finance with its "inclusivity". The innovation of digital technology can lower the threshold for data acquisition, enhance the universality of financial investment and financing, and enable groups with limited financial professional knowledge to access more high-quality financial services. Relying on the inclusive nature of the digital economy, financial institutions can integrate and gather more social idle funds and high-quality financial resources, and invest these resources into economic operation, providing the possibility of reasonably utilizing more social capital for the high-quality development of green finance. Only by solving the problem of obtaining financial services for the long tail group can we solve the problem of imbalanced economic development; Only by obtaining financial support can we provide an economic foundation for the development of more underdeveloped regions to achieve leaps and create conditions for the formation of a more reasonable industrial system. The integration of digital economy and green finance can improve the efficiency of enterprise financing. [3].

3.2.2. Promotion Role in the "Dual Carbon" Environment

Green development is the fundamental solution to environmental problems and an inevitable requirement for building a modern economic system. In the context of green development, the transformation and development of traditional industries may become a key point in achieving carbon peak, and the transformation of traditional industries provides application scenarios and goal orientation for industrial digitization. [4] Ultimately, through the integration and development of green finance and digital economy, the "green finance+digital" structure is achieved. The transformation of green finance is a systematic engineering problem that China needs to solve in the process of achieving the dual carbon goals of "carbon peaking" and "carbon neutrality".

3.3. Research Foundation

3.3.1. Data Foundation

Collect and organize carbon emission data from the past few years, benchmark the development of green finance, and identify the influencing factors between the two. By constructing a differential sliding window model, utilize its advantages to capture the nonlinear characteristics of the data; Determine parameters such as window size and step size, perform sliding calculations on the data, and obtain the output of the differential sliding window model; Compare the effectiveness of the differential sliding window model and other traditional models (such as OLS model) in predicting carbon emissions.

3.3.2. Model Foundation

By creating a benchmark model:

$$ED_{it} = C + \alpha_0 GF_{it} + \sum_{j=1}^{n} \alpha_j \ control_{it}^{j} + \varepsilon_{it} \tag{1}$$

Study the quantitative relationship between the digital economy and green finance, and evaluate the comprehensive effect of the digital economy on the high-quality development of green finance under control variables such as the degree of advanced industrial structure, environmental regulations, big data, digital financial system, and government intervention using an intermediary model derived from the benchmark model.

An introduction to green finance "(Baker et al., 2021): Studied the market performance of green financial products and the investment decisions of institutional investors, and found that green financial products have good investment returns and risk control capabilities, and are also favored by more and more institutional investors. Zhang Xiufan et al. (2023) studied ways to promote the development of the digital economy and support China's transition to a low-carbon economic development model, in accordance with China's active promotion of the dual carbon goals of "carbon peaking" and "carbon neutrality", and proposed countermeasures and suggestions for further developing the digital economy. The review of domestic green finance research based on bibliometrics (Deng Wenyi, 2023) focuses on themes such as financial development, economic green transformation, green financial products, and green credit. The research content evolves along five paths in four directions, with a trend of theme fusion at the forefront of research. At the same time, it indicates that inclusive finance and green finance reform and innovation pilot zones will be important directions for future research.

3.3.3. Environmental Fundamentals

The development of green finance in the Yangtze River Delta Economic Belt ranks among the top in the country. Green finance has significant development in the Jiangsu Zhejiang Shanghai Anhui regions, and various indicator data have been continuously increasing, making it a good research object and source of data, information, and information.

Under the "dual carbon" environment, the development of green finance is conducive to enhancing the sustainability of economic development by reducing future compensation costs; Promote the allocation of financial resources to tilt towards protecting the environment and enhance the ability of the entire society to resist risks; At the same time, it helps financial enterprises cope with environmental risks and provides them with business opportunities.

3.4. Impact Mechanism

3.4.1. Macro Impact Mechanism

In the process of achieving the goals of "carbon peaking" and "carbon neutrality", the low-carbon economic transformation of green finance is an important means and means of integrating and promoting both sides, and it is necessary to fully utilize and coordinate these two important levers. Based on panel data from provincial-level administrative regions in China, a spatial simultaneous equation model is established to examine the endogenous interactive effects and spatial spillover effects of green finance and digital economy. [5].

There is a two-way promoting effect between green finance and the digital economy, and the development of the digital economy can effectively promote the transformation of green finance, and vice versa. Cross regional green finance has a crowding out effect on the development of green finance in other regions, and the transformation of low-carbon economy in neighboring regions has also brought adverse impacts on the development of local green finance.

The development of green finance in neighboring areas has a promoting effect on local low-carbon economic growth, and the expansion of the digital economy in neighboring areas has also brought a positive boost to the development of local green finance.

3.4.2. Micro Impact Mechanism

The imperfect green finance system limits the development of green finance. China's financial reform has not been able to keep up with the pace of major international changes, which has put forward higher requirements for the transformation of China's financial system. It is necessary to increase a reform of the commercialization of the financial sector.

The financial regulatory mechanism has drawbacks that affect the development of green finance. The state has not provided macro guidance or recognized its shares. On the other hand, the state has not strictly defined the responsibilities and obligations between major departments, and has not clearly defined the boundaries of jurisdiction.

Policy information and signals affect the digital economy, which in turn has an impact on green finance. China's green finance has not yet formed a complete system, and the government has not clearly introduced relevant policies, and the policy signals are not clear enough.

The coverage of green financial products is not broad and still needs to be further expanded. There are very few green financial products targeting small and medium-sized environmental protection enterprises, individuals, and households, which makes it difficult for green financial products to penetrate various fields of society and limit their influence.

The lack of innovation makes green finance lack the driving force for sustainable development. Under the constraints of traditional financial models, the development of green finance requires the courage to innovate and creatively transform.

The pattern of universal participation has not yet been established, and there are difficulties in promoting green finance. In the context of dual carbon, the development of green finance has

ISSN: 2688-9323

ushered in a very favorable opportunity. How to seize the trend of "dual carbon", perfectly combine green finance with the digital economy, drive the participation of the whole people, and better empower the digital economy with green finance to improve quality and efficiency.

4. Building A Model

In order to test the effect mechanism of the digital economy on the development of green finance, a benchmark model is first established to evaluate the comprehensive effect of the digital economy on the high-quality development of green finance under control variables such as the degree of advanced industrial structure, environmental regulations, big data, digital finance system, and government intervention,

$$ED_{it} = C + \alpha_0 GF_{it} + \sum_{j=1}^{n} \alpha_j \; control_{it}^{j} + \varepsilon_{it} \tag{2}$$

Among them, i represents the regional unit, t represents time, represents the degree of digital economy development in the i-th region at time t, represents the level of green finance development in the i-th region at time t, and (j=1, 2,... m) is a series of control variables. By adjusting the coefficients of the core explanatory variables in the benchmark regression equation (1) α Conduct a test to determine whether it is significant at a confidence level, in order to determine the comprehensive effect of green finance on promoting the development of the digital economy. [6].

The impact of green finance on the development of the digital economy is achieved through two paths: technological innovation and industrial structure upgrading. In order to test the mechanism of green finance's impact on the digital economy, the focus is on the intermediary effect, examining the mechanism of digital economy promoting the development of green finance through technological innovation (TI) and industrial structure upgrading (IS). [7] Based on equation (1), adding technological innovation and industrial structure upgrading as intermediary variables to the benchmark model, the following model is formed:

$$\mathrm{ED_{it}} = \mathrm{c_1} + \alpha_{01}\mathrm{GF} + \sum_{\mathrm{j=1}}^{\mathrm{n}} \alpha_{0\mathrm{j}} \; \mathrm{CONTROL_{it}^{j}} + \varepsilon_{\mathrm{it}} \tag{3}$$

$$\mathrm{TI_{it}} = \mathrm{c_2} + \alpha_{11}\mathrm{GF} + \sum_{\mathrm{j=1}}^{\mathrm{n}} \beta_{1\mathrm{j}} \; \mathrm{CONTROL_{it}^{j}} + \varepsilon_{\mathrm{it}} \tag{4}$$

$$\mathrm{ED_{it}} = \mathrm{c_3} + \alpha_{21}\mathrm{GF_{it}} + \alpha_{22}\mathrm{TI_{it}} + \sum_{\mathrm{j=1}}^{\mathrm{n}} \delta_{2\mathrm{j}} \, \mathrm{CONTROL_{it}^{j}} + \varepsilon_{\mathrm{it}} \tag{5}$$

$$\mathrm{IS_{it}} = \mathrm{c_2} + \alpha_{11}\mathrm{GF} + \sum_{\mathrm{j=1}}^{\mathrm{n}} \beta_{1\mathrm{j}} \; \mathrm{CONTROL_{it}^{j}} + \varepsilon_{\mathrm{it}} \tag{6}$$

$$\mathrm{ED_{it}} = \mathrm{c_3} + \alpha_{21}\mathrm{GF_{it}} + \alpha_{22}\mathrm{IS_{it}} + \sum_{\mathrm{j=1}}^{\mathrm{n}} \delta_{2\mathrm{j}} \; \mathrm{CONTROL_{it}^{j}} + \varepsilon_{\mathrm{it}} \tag{7}$$

Verify the mediating effect by combining the hierarchical regression modeling (HRM) method. Drawing on the research of Baron and Kenny (2021), as well as Wen Zhonglin et al. (2022) in China.

5. Conclusion and Recommendations

5.1. Conclusion

Through the benchmark model and intermediary model mentioned above, it is not difficult to infer that there is a strong positive relationship between the development of the digital economy and green finance. The development of the digital economy will undoubtedly drive the progress of green finance, and the big data, 5G, Internet of Things, and other factors involved in the digital economy will all be the influencing factors of green finance. The development of green finance cannot be separated from the joint action of various financial products such as green credit, green bonds, green insurance, green funds, etc. Green finance will be the mainstream and direction of this future financial development direction, and the traditional financial industry will undergo green transformation and innovative upgrading.

Green finance is an important guarantee for maintaining sustainable economic development. Developing green finance is an inevitable path to promote the current adjustment of China's economic and financial structure, achieve sustainable economic and environmental development, and is the direction of China's future financial development. It is also an innovation and transformation in China's financial field. Green finance can promote the linkage between the capital market and the carbon market, enabling the capital market to better improve the price discovery function of the carbon market, and enabling the carbon market to more effectively optimize the allocation of resources in the capital market, jointly supporting the green, low-carbon, and high-quality development of China's economy and society.

5.2. Suggestions

Firstly, it is necessary to establish a sound green finance policy framework and governance system. Secondly, it is necessary to strengthen the green finance system. Secondly, it is necessary to enhance the innovation and creativity of green finance. Secondly, it is necessary to expand the coverage of green finance products and strengthen policy support. Finally, it is necessary to form a pattern of nationwide participation and co construction.

Acknowledgments

Thanks to the financial support of the Anhui University of Finance and Economics Research Fund (project number: XSKY23084), and thank the teachers of the School of Finance for their support.

References

[1] Tina Analysis on the Development of Green Finance in Commercial Banks under the "Dual Carbon" Goal [J]. Economist, 2023 (8): 105-106.

[2] Liu Jun, Deng Qingguo, Zhao Kun Reform, innovation, and excellent services ignite the "strong engine" of development [N] Shiyan Daily, 2023-11-01 (006).

[3] Zhang Quanjun, Chen Jian. Empirical Study on Green Finance Supporting the Development of Digital Economy [J]. Modern Finance, 2022 (9): 40-46.

[4] Chen Chumeng. Identification of Opportunities and Path Selection for Rural Industrial Development under the Background of Green Economy [J]. Southern Agricultural Machinery, 2023,54 (21): 136-139.

[5] Liu Chao, Zheng Chuiyong, Ding Chenhui, et al. Digital Economy, Green Finance, and Green Technology Innovation: An Empirical Study Based on Intermediary and Spatial Effects [J]. Technology Economy and Management Research, 2023 (06): 7-12.

ISSN: 2688-9323

[6] Zhang Quanjun, Li Jing. Research on the High Quality Development of Manufacturing Industry Empowered by Digital Finance: Based on the Perspective of Regional Innovation [J]. Fujian Finance, 2022 (09): 8-14.

[7] Xiao Junfu, Chen Demin, Gao Yanhong Research on the Carbon Reduction Effect and Mechanism of Renewable Resource Utilization under the "Dual Carbon" Goal [J/OL]. Journal of Chongqing University (Social Science Edition): 1-13 [2023-11-03] http://kns.cnki.net/kcms/detail/50.1023.C.20231018.1515.004.html.