

Green Finance and Sustainable Development: An Empirical Study Based on Chinese Data

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Abstract

With the continuous development and progress of the socio-economy in recent years, various sectors within the socio-economic development have been advocating the concept of sustainable development. Along with the improvement of the production level of enterprises and the continuous growth of the economy, the increasingly deteriorating ecological environment has risen to the status of an international strategic concern. The grim situation of the ecological environment has to some extent hindered the sustainable development of society. To promote the sustainable development of the economy in the financial sector, green finance has emerged. As a key component of sustainable development, green finance has attracted attention worldwide. China, as one of the world's largest developing countries, faces unique economic and environmental challenges. This study aims to explore the impact of green finance on sustainable development in China through empirical research, aiming to fill the research gap in this field. The research findings indicate that China's green finance products and services have played a positive role in sustainable development. The promotion of green finance is related to the growth of the renewable energy industry, reduction in carbon emissions, and investment in ecological conservation. Specifically, the development of green finance promotes the growth of the Chinese economy, the transformation and upgrading of the industrial structure, and guides a low-carbon economy through energy conservation and emission reduction, thereby promoting economic sustainability. Therefore, it is necessary to actively cultivate the strength of green finance, vigorously promote the green transformation and upgrading of the regional industrial structure, and implement measures such as carbon finance to promote the development of a low-carbon economy nationwide, in order to promote the sustainable development of the Chinese economy.

Keywords

Green Finance, Sustainable Development, Low-Carbon Economy, China

1. Introduction

On a global scale, the challenges we face have extended beyond mere economic development and resource utilization. The escalating prominence of issues such as climate change, ecological degradation, and resource depletion has become a stark reality before us. The increasing urgency of these problems necessitates a fundamental restructuring of our industries to better adapt to this new environmental reality (Pan et al., 2023). Consequently, the emergence of green finance has come to the fore, aiming to channel funds towards environmental protection and sustainable development, thereby propelling the healthy development of green industries and optimizing the overall industrial structure. This trend is not just an internal adjustment within the financial sector but a crucial part of the reshaping of the entire socio-economic structure (He et al., 2023).

However, driving the financial industry towards green finance solely due to the severity of environmental issues is still insufficient. The negative impacts of environmental pollution on economic sustainability have become increasingly apparent, compelling the financial sector, as a core element of the economy, to accelerate its transformation and actively participate in the process of sustainable economic development (Harahap et al., 2023). This transformation is not merely a superficial change but an awakening of the financial industry's sense of responsibility. The rise of green finance expands the financial sector's responsibilities beyond mere fund allocation, fostering sustainable development of the entire economic system while providing funds to the real economy (Chaudhry & Husain, 2023).

In this context, the direction of the financial industry towards "green finance" is becoming increasingly evident. This transformation is not just the effort of a single institution but a shared goal of the entire financial system (Rashid & Ullah, 2023). By guiding funds towards environmental protection and sustainable development, the financial industry can not only provide more financial support to society but also consider environmental, social, and corporate governance (ESG) factors in investment decision-making, thereby promoting a more sustainable economic development (Afzal et al., 2022). This green finance-led economic development model can not only bring about an increase in economic benefits but also create a healthier and more sustainable development environment for the entire society (Danilov, 2022).

Based on these trends, we can conclude that green finance is not just a means of addressing environmental issues but also an important avenue for promoting sustainable economic development. Its rise enables us to better tackle the challenges posed by global climate change, making our economic system more resilient and adaptable to the demands of the global ecological environment (Johan, 2022). Therefore, the development of green finance is not just an adjustment within the financial industry but a reconstruction of the entire socio-economic structure. With the deepening of the concept of green finance, we believe we can collectively meet the challenges of a more sustainable future development (Li et

al., 2022).

2. Model Construction, Indicator Selection, and Data Explanation

2.1. Model Construction

The article collects panel data from 30 provinces (excluding Hong Kong, Macau, Taiwan, and Tibet) in China from 2016 to 2022 as samples to verify the hypotheses proposed earlier (Ziolo, 2020). The constructed models are as follows:

1) Economic growth effect model

$$\begin{aligned} \text{economy}_{it} = & \alpha_i + \beta \ln(\text{industry}_{it}) + \gamma \ln(\text{CO2}_{it}) + \delta \ln(\text{gf}_{it}) \\ & + \sum_{j=1}^4 \alpha_j \ln(\text{control}_{ij}) + c + \mu_{it} \end{aligned} \quad (1)$$

2) Industrial transformation effect model

$$\text{industry}_{it} = \alpha_i + \gamma \cdot \text{gf}_{it} + \alpha_j \cdot \text{control}_{it} + c + \mu_{it} \quad (2)$$

3) Low-carbon environmental protection effect model

$$\text{CO2}_{it} = \alpha_i + \beta_1 \cdot \text{gf}_{it} + \beta_2 \cdot \text{control}_{it} + \sum_{j=1}^4 \alpha_j \cdot X_{ijt} + \mu_{it} + c \quad (3)$$

Wherein, i represents the province, t represents time, economy indicates the economic scale, industry indicates the index of industrial structure upgrading, CO_2 represents carbon emission intensity, and β , γ , δ , represents the coefficient values for the three effects respectively. gf represents the green finance development index, “control” represents four control variables, α_j represents the coefficients of the control variables, “ c ” represents the constant term, α_i represents unobserved individual effects, and μ_{it} represents the random disturbance term.

2.2. Selection of Indicators

This article uses economic scale, industrial structure upgrading index, and carbon emission intensity as dependent variables, corresponding to the effects of economic growth, industrial transformation, and energy conservation and emission reduction (Lee, 2020). The green finance development index is used as an independent variable, while fixed asset investment scale, local government scale, degree of nationalization, and urbanization rate are used as control variables. Specifically:

- Economic scale. Many studies often use per capita Gross Domestic Product (GDP) as a standard to assess the scale and development level of an economy. However, in this article, we chose a different measure, specifically the natural logarithm of per capita real GDP calculated based on the year 2016 as a baseline. This choice aims for a more accurate reflection of economic scale. By using this indicator, we eliminate the impact of inflation on economic data, allowing for a more accurate measurement of the economic scale in different regions. This enables us to draw more precise conclusions about the comparative analysis of economic development in different regions (Cen & He,

2018).

- Industrial structure upgrading index. The Porter-Clark theorem reveals the evolutionary law of industrial structure, namely the transition from the primary industry to the secondary and tertiary industries. This article adopts the method used in studies by Ren Li and others to construct the industrial structure upgrading index, which measures the proportion of different industries in regional Gross Domestic Product (GDP). The formula for calculating the industrial structure upgrading index is $O + 2T + 3R$, where O represents the weight of the primary industry, T represents the weight of the secondary industry, and R represents the weight of the tertiary industry. This formula considers the different contributions of each industry and reflects their relative importance in regional GDP. This comprehensive index allows us to more accurately grasp the trend of changes in industrial structure, providing robust data support for industrial policy formulation (Wan et al., 2018).
- Carbon emission intensity. This article introduces a key method for measuring carbon emissions, typically using the carbon emission coefficients of three major energy sources multiplied by energy consumption for calculation. A modified method proposed by Zhu Jing and others converts energy consumption into units of ten thousand tons of standard coal and uses weighted sums with average carbon emission coefficients. Based on this, the natural logarithm of per capita carbon emissions is used as a new indicator to measure regional carbon emission intensity. Therefore, this study provides a comprehensive method for estimating carbon emissions and uses the natural logarithm of per capita carbon emissions as a measure of regional carbon emission intensity, aiding a more accurate assessment of carbon emissions in different regions (Zou, 2014).
- Green finance development index. This article refers to the methods used in studies by Li Xiaoxi and others to evaluate the level of green finance development. Researchers constructed an evaluation index system for the green finance development index, aiming to comprehensively and objectively assess the level of green finance development. This evaluation index system includes primary and secondary indicators to ensure the comprehensiveness and accuracy of the assessment. Specifically, the primary indicators cover four main areas: green credit, green securities, green insurance, and carbon finance (Chen, 2012). These primary indicators are considered crucial for evaluating the level of green finance development, providing a solid foundation for the overall assessment. The secondary indicators further refine the content of the primary indicators, covering seven specific evaluation dimensions. The detailed content of the secondary indicators can be found in **Table 1**. In determining the weight allocation in the index system, the weights of the primary indicators are determined using expert scoring, ensuring that the respective importance of each area in the overall assessment is fully considered. The

Table 1. The evaluation index system of green finance development index.

Evaluation objectives	Primary indicators	Secondary indicators	Indicator weight/%
Green finance development index	green credit	The proportion of green credit balance to the loan balance of financial institutions	53
	green securities	The proportion of A-share market value of environmental protection enterprises to the total A-share market value of listed enterprises	27
	green insurance	The proportion of environmental pollution liability insurance income to property insurance income	12
	carbon finance	The proportion of clean development mechanism (CDM) projects to the total number of environmental protection projects	8

The indicator system consists of five indicators, among which the green investment indicator overlaps with the sub indicators of green credit in this article. Therefore, it is removed from the indicator system and removed Consolidation of weights and green credit indicators.

weight allocation for the secondary indicators uses a simple arithmetic average to ensure a fair and reasonable distribution of weights for each evaluation dimension.

- Control variables. Urbanization rate (urban) is represented by the proportion of the urban population to the total population in each region; fixed asset investment scale (invest) is represented by the proportion of social fixed asset investment to regional GDP; local government scale (gov) is represented by the proportion of local fiscal expenditure to regional GDP; the degree of nationalization (national) is represented by the proportion of the output value of state-owned industrial enterprises above a certain size to the output value of all industrial enterprises above a certain size in each region.

2.3. Data Source

In this study, the sample data we focused on spans from 2016 to 2022. These data were collected from various sources, including the official website of the China Banking Regulatory Commission, the National Research Network Industrial Statistics Database, Wind Database, and the China Insurance Yearbook. The diversity of these data sources ensures a comprehensive understanding of our research subjects. Our data research covers a wide range, including green credit, interest expenditures in high-energy-consuming industries, green securities, loan balances of financial institutions in various regions, green insurance, and public fiscal expenditures on environmental protection, among other crucial as-

pects.

The specific data involved in the study are also extensive, encompassing indicators such as regional gross domestic product (GDP), the value added of the three major industries, primary energy consumption, fixed asset investment, output of industrial enterprises above a certain scale, total population, and urban population, among others. Through a comprehensive analysis of these data, we gain an in-depth understanding of the development status in various aspects, providing a solid foundation for further research.

3. Empirical Result Analysis

This article uses Eviews 7.0 statistical software to process interprovincial panel data. The regression results of each model are shown in **Table 2**. Judging from the adjusted R2, the goodness of fit of each model is relatively high, indicating that each model can effectively explain the majority of the variations in economic scale, industrial structure upgrading index, and carbon emission intensity.

In terms of the economic growth effect model, all indicators pass the test at the 1% significance level. Specifically, the green finance development index, urbanization rate, and local government scale are significantly positive, while fixed

Table 2. National sample model estimation results.

Variable name	economic growth effect economy	Industrial transformation effect industry	Energy reduction effect co2
gf	0.4259*** (0.1747)	0.7693* (0.4423)	-0.5299* (0.2261)
urban	4.8459*** (0.7851)	-1.1492 (0.7316)	0.8792** (0.3741)
invest	-0.6874*** (0.1747)	0.5489*** (0.1747)	0.1237 (0.1747)
gov	2.2244*** (0.1747)	1.8009** (0.1747)	1.2531*** (0.1747)
national	-3.0704*** (0.1747)	1.4981*** (0.1747)	-0.0475 (0.1747)
c	-0.2319*** (0.0952)	1.7305*** (0.4614)	0.23234 (0.2359)
N	210	210	210
Adjusting R ²	0.8823	0.7804	0.9755
Hausman test	83.4319	38.5873	13.2286
P-value	0.0000	0.0000	0.0395

“*”, “**”, and “***” indicate significant at the 10%, 5%, and 1% levels, respectively. The numbers within “()” are standard errors.

asset investment and level of nationalization are significantly negative. This conclusion suggests that the economic growth effect of China's green finance on sustainable economic development is positive, meaning that the development of green finance promotes economic growth.

Regarding the industrial transformation effect model, the green finance development index shows a positive effect at the 10% significance level, and the local government scale is positive at the 5% significance level. The scale of fixed asset investment and the degree of nationalization are positive at the 1% significance level, while the urbanization rate has no significant impact on industrial transformation. This conclusion indicates that the industrial transformation effect of China's green finance on sustainable economic development is positive, meaning that the development of green finance promotes the transformation and upgrading of China's industrial structure, thereby driving sustainable economic development.

In terms of the energy conservation and emission reduction effect model, the green finance development index is negative at the 10% significance level, while the urbanization rate and local government scale are positive at the 5% and 1% significance levels, respectively. The impact of the scale of fixed asset investment and the degree of nationalization is not significant. This conclusion suggests that the energy conservation and emission reduction effect of China's green finance on sustainable economic development is positive, meaning that the development of green finance reduces carbon emissions and promotes sustainable economic development through a low-carbon economy.

In terms of the absolute value of the green finance development index, among the three effects, the industrial transformation effect is the largest, followed by the energy conservation and emission reduction effect, and the economic growth effect is the smallest. This aligns with the requirements of sustainable economic development, indicating that the development of green finance promotes the transition of China's economic growth from low-quality and extensive growth to high-quality and intensive growth. At the same time, it indirectly reflects that the current role of green finance in promoting China's economic growth needs further enhancement.

4. Conclusion and Recommendations

4.1. Conclusion

According to the research results of the economic growth effect model, the development of green finance has a positive effect on economic growth, although its impact is relatively small, it has reached a significance level of 1%. This means that green finance has played a certain role in promoting economic growth, although the scale of this role is relatively limited. At the same time, the data from the industrial transformation effect model reveals that the development of green finance has a significant positive impact on the transformation and upgrading of industrial structure, with a significance level even as high as 10%. This discovery

provides a solid basis for the important role of green finance in promoting industrial upgrading and structural optimization. However, the results of the energy-saving and emission reduction effect model show a worrying trend, indicating that the development of green finance has had a negative impact on energy-saving and emission reduction effects, and this impact is equally significant, reaching a level of 10%.

A comprehensive analysis of these three effects reveals that the industrial transformation effect is the most significant, followed by the energy-saving and emission reduction effect, while the economic growth effect is relatively small. These data results consistently indicate that the development of green finance has had a positive driving effect on the transformation of China's economic growth mode. Although its promoting effect on economic growth is limited, its negative impact on energy conservation and emission reduction needs to be taken seriously. This also means that the path of green finance development needs to pay more attention to overall ecological benefits to ensure effective resource utilization and sustainable environmental protection while promoting economic development.

Based on the above research data and analysis, it can be concluded that the development of green finance has played an important role in promoting the transformation of China's economic growth mode. Although its role in promoting economic growth is relatively small, it has a significant positive impact on the transformation and upgrading of industrial structure. However, its negative impact on energy conservation and emission reduction goals also needs to be given sufficient attention. Therefore, when formulating and implementing green finance development policies, it is necessary to pay more attention to the balance between environmental protection and economic development to ensure sustainable economic growth and maximize the positive role of green finance in achieving sustainable economic development goals.

Overall, this article starts from three perspectives: economic growth, industrial transformation, and energy conservation and emission reduction. We have constructed a theoretical analysis framework for the relationship between green finance and sustainable economic development. This study uses panel data from 30 provinces in China to empirically test the economic growth effect, industrial transformation effect, and energy-saving and emission reduction effect of green finance on sustainable economic development. The final conclusion can be drawn as follows:

- From a national perspective, the economic growth effect, industrial transformation effect, and energy conservation and emission reduction effect of green finance on sustainable economic development are all positive. In other words, the development of green finance promotes economic growth, facilitates the transformation and upgrading of the industrial structure, guides low-carbon economy through energy conservation and emission reduction, and thus drives sustainable economic development in China.

- Nationally, the magnitudes of the three effects are ranked as follows: industrial transformation effect > energy conservation and emission reduction effect > economic growth effect. This indicates that the development of green finance can promote the transformation of China's economic growth from low-quality and extensive growth to high-quality and intensive growth. This also indirectly reflects that the current role of green finance in promoting China's economic growth needs further enhancement.

4.2. Recommendation

One of the historical missions of the current government is to actively nurture a system with robust green financial capabilities and deepen the crucial role of green finance in promoting sustainable development. This requires taking a series of powerful measures to propel the comprehensive development of the green finance ecosystem. Firstly, the establishment of policy-oriented green financial institutions is of utmost importance. Such institutions will serve as the backbone driving the stable development of the green finance market, providing reliable funding sources and support for green projects and businesses through financial support and policy guidance. Secondly, to ensure the healthy operation of the green finance market, efforts must be made to accelerate the development of green intermediaries, enhance their professional service levels, and better connect the demand and supply of funds to facilitate effective fund allocation. Simultaneously, strengthening the development of a skilled workforce is also an indispensable aspect. Cultivating a high-quality, specialized workforce in green finance can not only drive innovation in green finance but also elevate the overall industry's professional standards and service quality.

On the other hand, intensifying policy support and promoting the green upgrading of regional industrial structures are urgent tasks. Targeted transformation measures should be implemented for traditional high-pollution industries, guiding them towards green and clean directions. Additionally, differentiated financial service policies for environmental protection and energy-saving projects should be formulated to provide financial and policy support for relevant industries, promoting the vigorous development of the green industry.

In the process of achieving a nationwide balance in green economic development, carbon finance plays a pivotal role. Therefore, there should be an acceleration in the development of low-carbon industries and technologies to ensure the comprehensive development of the country's green economy. Simultaneously, to promote the healthy development of the national carbon trading market, it is necessary to establish a sound institutional framework, improve relevant policies, enhance market transparency and standardization, and encourage active participation of enterprises and institutions in carbon trading to propel the rapid development of a low-carbon economy. Furthermore, to foster the theoretical and practical development of carbon finance, the government should encourage green finance innovation, support relevant theoretical research, and provide

more policy support and financial guarantees for promising carbon finance projects. This will inject new vitality into the development of carbon finance and promote its broader application in advancing low-carbon economic development.

In conclusion, actively nurturing green financial capabilities, increasing policy support, and leveraging carbon finance to drive low-carbon economic development are crucial measures for achieving balanced nationwide green economic development. Only through the government's strong guidance and support can the critical role of green finance in sustainable economic development be realized, propelling the economy towards a greener, environmentally friendly, and sustainable direction.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- Afzal, A., Rasoulinezhad, E., & Malik, Z. (2022). Green Finance and Sustainable Development in Europe. *Economic Research-Ekonomska Istraživanja*, *35*, 5150-5163. <https://doi.org/10.1080/1331677X.2021.2024081>
- Cen, T., & He, R. (2018). Fintech, Green Finance and Sustainable Development. In *Proceedings of the 2018 International Conference on Management, Economics, Education, Arts and Humanities (MEEAH 2018)* (pp. 222-225). Atlantis Press. <https://doi.org/10.2991/meeah-18.2018.40>
- Chaudhry, N. I., & Hussain, M. (2023). Nexus of Renewable Energy, Green Financing, and Sustainable Development Goals: An Empirical Investigation. *Environmental Science and Pollution Research International*, *30*, 58480-58492. <https://doi.org/10.1007/s11356-023-26653-7>
- Chen, H. X. (2012). Transition of Land Finance and Sustainable Development: A Theoretical Analysis. *Advanced Materials Research*, *616-618*, 1267-1271. <https://doi.org/10.4028/www.scientific.net/AMR.616-618.1267>
- Danilov, Yu. A. (2022). Coalitions for Sustainable Finance and Sustainable Development. *Herald of the Russian Academy of Sciences*, *92*, S91-S99. <https://doi.org/10.1134/S1019331622080032>
- Harahap, B., Risfandy, T., & Putri, I. N. (2023). Islamic Law, Islamic Finance, and Sustainable Development Goals: A Systematic Literature Review. *Sustainability*, *15*, Article 6626. <https://doi.org/10.3390/su15086626>
- He, J., Iqbal, W., & Su, F. (2023). Nexus between Renewable Energy Investment, Green Finance, and Sustainable Development: Role of Industrial Structure and Technical Innovations. *Renewable Energy*, *210*, 715-724. <https://doi.org/10.1016/j.renene.2023.04.010>
- Johan, S. (2022). Complementary or Substitute: Sharia Financing, Green Financing, and Sustainable Development Goals? *International Journal of Sustainable Development and Planning*, *17*, 487-495.
- Lee, J. W. (2020). Green Finance and Sustainable Development Goals: The Case of China. *The Journal of Asian Finance, Economics and Business (JAFEB)*, *7*, 577-586.

<https://doi.org/10.13106/jafeb.2020.vol7.no7.577>

- Li, G., Zhang, R., Feng, S., & Wang, Y. (2022). Digital Finance and Sustainable Development: Evidence from Environmental Inequality in China. *Business Strategy and the Environment*, 31, 3574-3594. <https://doi.org/10.1002/bse.3105>
- Pan, C., Yu, J., Huang, Y., & Altuntas, S. (2023). The Dynamic Relationship between Resources, Finances, and Sustainable Development: An In-Depth Analysis. *Resources Policy*, 86, Article 104074. <https://doi.org/10.1016/j.resourpol.2023.104074>
- Rashid, F., & Ullah, A. (2023). Practices of Green Financing and Sustainable Development: Scope and Complexity. *International Journal of Sustainable and Green Energy*, 12, 6-12. <https://doi.org/10.11648/j.ijrse.20231201.12>
- Wan, M., Zhu, W. & Zhang, S. (2018). The Relationship between Low-Carbon Finance and Sustainable Development: A Case Study of Industrial Bank of China. *International Journal of Sustainable Energy and Environmental Research*, 7, 24-34. <https://doi.org/10.18488/journal.13.2018.71.24.34>
- Ziolo, M. (2020). *Finance and Sustainable Development: Designing Sustainable Financial Systems*. Taylor and Francis.
- Zou, L. (2014). *China's Rise: Development-Oriented Finance and Sustainable Development*. World Scientific. <https://doi.org/10.1142/9133>