

Research On the Influence of Green Finance on The Optimization and Upgrading of Industrial Structure

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Abstract. Currently, sustainable development has emerged as the prevailing agreement at the national level and serves as the overarching principle driving the social and economic progress of all nations. The optimisation and modification of industrial structure is the central focus of China's green finance development, which plays a crucial role in attaining sustainable development. This study examines the relationship between "green finance" and the "upgrading and optimisation of industrial structure". It considers "technological progress" as a mediator and "openness level, government intervention, human resources, environmental supervision, and urbanisation rate" as control variables. The study aims to investigate the impact mechanism and degree of green finance on the optimisation and upgrading of industrial structure. This study presents specific recommendations based on the findings of the empirical analysis. The aim is to provide guidance for the government in formulating policies and regulations, making institutional decisions, and improving China's industrial structure. These recommendations also aim to promote sustainable and high-quality economic development.

Keywords: Green finance; optimization and upgrading of the industrial structure; technological progress.

1. Introduction

Since the onset of the 21st century, humanity has been confronted with a grave existential challenge stemming from excessive energy use and the substantial release of pollutants resulting from the Industrial Revolution. In light of these conditions, global attention has increasingly focused on the crucial matters of ecological and environmental preservation, as well as the pursuit of sustainable development. Sustainable development is a protracted undertaking that necessitates collaborative endeavours from governments, corporations, and the general populace of every nation worldwide. In the contemporary context of economic development, the "financial industry" plays a crucial role. China has achieved significant economic development since the implementation of reform and opening policies. However, this progress has been accompanied with the emergence of environmental issues. The previous economic development model in China has led to increased resource consumption, worsened environmental degradation, and hindered the progress of China's new economic normal. In order to attain long-lasting economic expansion, the Party Central Committee has proposed the imperative of green development, with a primary focus on actively advancing the establishment of ecological civilization [1]. The structure of industry plays a fundamental role in economic development, since it directly influences the utilisation of production components and resources, as well as the output benefits within the economic system. China's current industrial structure is not well-suited for green development. Specifically, the traditional industrial sector, which has a significant negative impact on the environment, has been consuming a large portion of financial resources. This further exacerbates the burden on the environment. Therefore, it is necessary to optimise and upgrade the industrial structure in order to achieve green development in China [2]. Simultaneously, green finance has emerged as a significant catalyst for enhancing and modernising the industrial framework. Green finance can direct capital towards environmentally friendly sectors by reallocating credit funds and adjusting financing leverage. This enhances the market competitiveness of green enterprises while increasing the financing costs for polluting industries. Consequently, it compels the transformation of high-pollution and high-energy-consuming sectors,

thereby promoting the optimisation and upgrading of the industrial structure [3]. Recently, there has been significant progress in the development and enhancement of the green finance system. As a result, both domestic and international scholars have expanded their research and discussion on topics related to "green finance". Consequently, there is now a substantial body of published articles on this subject. Currently, the academic community is highly interested in the influence of green finance on industrial structure. However, existing research primarily examines the qualitative aspects of this relationship at a theoretical level, with a relative lack of literature on quantitative analysis from an empirical perspective.

This study aims to examine the influence of "green finance" on the "optimisation and upgrading of industrial structure" by incorporating "technical progress" as a mediation variable. A double fixed model is constructed, and empirical analysis is conducted using Stata17.0 to explore the impact of green finance on the optimisation and upgrading of industrial structure. The findings of this study will help address the dearth of quantitative research in this field and expand the novel concepts of green finance, which in turn will impact the optimisation and enhancement of industrial structure. Additionally, it will contribute to a better understanding of the interplay between these two factors.

2. literature Review

2.1.Literature review of green finance

(1) The connotation of green finance

Green finance, which emerged in 1998, encompasses economic activities aimed at effectively allocating resources, addressing environmental issues, and responding to climate change while adhering to market principles [4]. Green finance is defined differently by scholars based on various theoretical research foundations. HouLingling et al. define green finance as an investment and financing activity that combines ecological protection and sustainable economic development. It focuses on environmental benefits and uses capital financing and risk management to support eligible green industries and projects. Banks and other financial institutions provide the necessary funds for production and operation [5]. According to GuoYoujia et al., green finance can be interpreted in two ways. Firstly, from the perspective of enterprises, green finance refers to the financial industry incorporating environmental protection as a fundamental policy in investment and financing decisions, with the aim of promoting environmental conservation and sustainable development of the economy and society. Furthermore, it is crucial to prioritise the sustainable growth of the financial industry by enhancing legislation and regulations pertaining to green finance. This includes fostering collaboration between financial institutions and actively promoting the creation of green financial products, such as green credit, green securities, and green funds in the capital market [6].

(2) The development status of green finance in China

Yu Xiang employed the Entropy-Topsis technique to assess the extent of green financial advancement in 30 provinces, municipalities, and autonomous regions in China between 2011 and 2020. The findings indicate that the level of green financial development in these regions exhibited a general upward trend during this period, albeit with some fluctuations [7]. Evidence indicates that the notion of green financial development has garnered significant interest nationwide, with all regions of the country actively pursuing the adoption and implementation of green development principles. Chen Huiying utilised the division standards of the eastern, central, and western regions of China developed by Wang Lei and other scholars. She enhanced the indicators of the green financial system and employed the weighted average method to compute the comprehensive index of green finance development in 30 provinces and municipalities directly under the Central Government of China. Based on this analysis, she reached a conclusion. The development level of green finance in all regions of China exhibits a gradual decline from the east-central to the west. The east and central regions have a higher development level of green finance compared to the national average, whereas the western region falls below the national average [8]. These findings indicate that the progress of green finance in China is uneven, with clear disparities among regions. Li Xuelin et al. conducted a

study to assess the progress of green finance in China's provinces and the entire country between 2018 and 2020. The findings indicate that China's green finance development is hindered by insufficient promotion, significant regional disparities, and a lack of driving force [9].

2.2.Literature Review of the Industrial Structure

(1) The connotation of industrial structure and industrial structure optimization

The industrial structure in the economy encompasses the intricate and interrelated connections between different industrial sectors, factors of production, and their internal workings. Based on social production activities, the industrial structure can be categorised into three main sectors: the primary industry encompasses agriculture, forestry, animal husbandry, and fishery; the secondary industry includes mining and manufacturing; the tertiary industry encompasses the service sector, which includes wholesale and retail, transportation, storage and postal services, accommodation and catering, finance, and other services [10].

Industrial structure optimisation involves the strategic reallocation of production resources to promote industrial adjustment. This process of adjustment and optimisation involves the reconfiguration of production inputs, such as labour, technology, capital, and information, from sectors with low productivity to sectors with high productivity. The efficiency of optimising industrial structure can be measured by three major indicators: the amount of sophistication, rationalisation, and ecological impact of the industrial structure [11].

(2) The development status quo of China's industrial structure

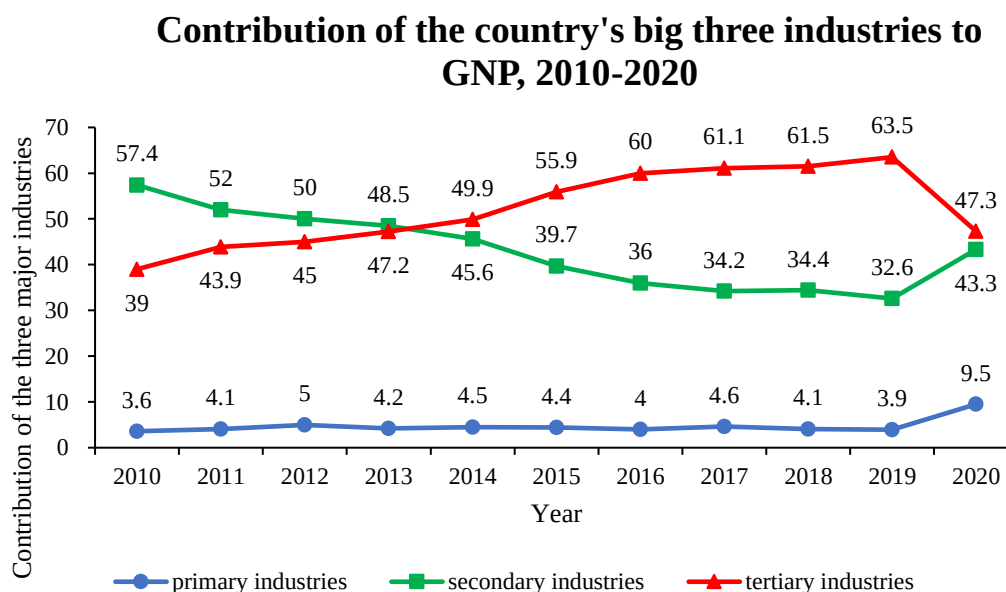


Fig 1. The contribution rate of the three major industries to GDP from 2010 to 2020

Figure 1 demonstrates that the contribution rate of China's primary sector remained relatively stable from 2010 to 2020, with no noteworthy changes. Between 2010 and 2019, the primary industry exhibited overall stability, with an average contribution rate of approximately 4%. However, in 2020, due to the impact of the pandemic, the contribution rate of the primary industry surged to 9.7%, marking the highest rate in a decade. Between 2010 and 2020, the secondary industry's overall contribution rate shown a consistent decline. Between 2010 and 2019, the proportion of the secondary industry's contribution steadily decreased from 57.40% to 32.60%. However, during the years of the pandemic, the contribution rate rose to 43.30%. Between 2010 and 2020, the tertiary industry's overall contribution rate exhibited a consistent rising trajectory. Between 2010 and 2019, the tertiary industry experienced a consistent increase in its contribution rate, rising from 39.00% to 63.50%. However, during the years of the pandemic, the contribution rate declined to 47.30%. In 2014, the tertiary industry had a higher contribution rate than the secondary industry, suggesting that the service

industry is playing a larger role in China's economy. Despite the significant negative impact of the pandemic on the tertiary industry in 2020, its contribution to the GDP surpassed the combined contribution of the primary and secondary industries by 2015. In 2015, the tertiary industry accounted for 55.90% of the GDP. Hence, the tertiary sector exhibits the highest contribution to the Gross Domestic Product (GDP) compared to the other two sectors. This prevailing pattern is expected to persist in the future.

2.3. Research that Green Finance Affects the Optimization of Industrial Structure

Currently, both domestic and international experts have put out their perspectives on the influence of green finance on the optimisation of industrial structure. Shahbaz et al. suggested that green finance can compel enterprises to abandon their current high-pollution and high-energy consumption development practices. Instead, they should increase their investments in green energy-saving projects, leading to the overall upgrading and transformation of society's industrial structure [12]. Anderson asserts that the introduction of innovative financial instruments can efficiently regulate projects that contribute to high pollution and excessive energy consumption. This, in turn, can direct financial resources towards environmentally friendly and energy-saving high-tech industries, thereby facilitating the enhancement and refinement of the industrial structure [13]. Li Shuo et al. conducted an empirical analysis to determine the level of coordination between green finance and industrial structure in Hebei Province. They found that green finance plays a significant role in promoting the optimisation and upgrading of the industrial structure. Furthermore, they observed that the positive impact of green finance on the coordinated development of the economy is becoming increasingly pronounced [14]. Yin Xiaoli conducts a thorough analysis of the relationship between financial development and industry structure upgrading in Jiangsu Province using the VAR model. The findings reveal a reciprocal and strengthening interaction between industrial structure upgrading and financial development in Jiangsu Province [15].

3. Research Design

3.1. Proposal of the Research Hypothesis

3.1.1 The Mechanism That Green Finance Affects the Optimization and Upgrading of Industrial Structure

(1) Capital formation mechanism

The fundamental focus of industrial structure modernization revolves around the issue of financing. Financial markets can accumulate surplus market capital through savings and subsequently allocate it to specific sectors or organisations to generate capital for industry development. Green finance supports environmentally friendly companies by providing financial support through instruments including green loans, green bonds, and green funds. It also helps guide how resources are distributed across businesses at a smaller scale to aid in corporate restructuring. Through the provision of financial support to environmentally friendly businesses and reducing their borrowing costs, enterprises can expedite their industrial growth and progress, thus enlarging their market share, enhancing their market competitiveness, and making a positive contribution to the creation of environmentally beneficial value.

(2) Capital management mechanism

Green finance plays a crucial role in reassessing the industrial structure and capital, hence influencing resource allocation within the industry. Green finance enhances imperfect markets by effectively allocating and optimising investment resources, hence adjusting the investment distribution within or across industries to mitigate environmental risks.

(3) Risk allocation mechanism

Industries that are now developing, such as environmental protection, energy conservation, and new energy, have significant size and pose substantial hazards. If firms assume greater risks

independently, their incentive to operate "green enterprises" will be diminished. The financial market operates by redistributing risk, allowing for the allocation of capital towards green businesses as a means to manage and mitigate risk in investment. Simultaneously, it can detect and assess its business and investment risks in order to contribute to the modernization of the industrial structure.

(4) Information transmission mechanism

The green finance system serves as a connection between green loans, equity, and finance. It plays a crucial role in reminding the market and signalling to firms the importance of investing in green sectors. Additionally, it takes into consideration the uncertainties surrounding the use of private money and helps lower the risk for investors in new environmental protection initiatives. According to this, the study assumes the following:

H1: Green finance can boost the optimization and upgrading of the industrial structure.

3.1.2 Technological progress mechanism

Technological advancements can significantly benefit the environment by facilitating the transition of industries towards more sustainable practices and promoting the improvement and modernization of industrial structures.

(1) technological progress can increase the resource utilization rate

Technological advancements can decrease the number of resources needed for production and raise the efficiency of resource utilisation in the secondary and tertiary sectors. This leads to resource conservation and cost reduction. Transitioning from "non-green" to "green" technology will result in decreased energy use in the secondary and tertiary industries, increased resource utilisation, and therefore reduced costs.

(2) Green finance can promote technological progress through risk diversification mechanisms

Green finance may facilitate and foster technical advancement through various means, including the consolidation of finances, nurturing talent, and augmenting financial support for scientific progress. Simultaneously, it may mitigate risks and facilitate the advancement of environmentally friendly technology by identifying, assessing, managing, and avoiding dangers. This, in turn, significantly fosters the optimisation and enhancement of the relevant industrial framework.

(3) Green finance can promote technological progress through incentives and regulation

The green financial market serves the purposes of "pricing" and "information exchange", enabling the identification of relevant technology advancements, provision of green financial services to businesses, and promotion of innovation within organisations. Furthermore, well-established green finance markets can leverage their strengths to offer up-to-date information and efficiently oversee technology initiatives that have received investments, thereby fostered the enhancement and streamlined of industrial frameworks.

Based on this, the study makes the following assumption:

H2: Green finance can boost the optimization and upgrading of the industrial structure through technological progress.

3.2. Variable Selection

3.2.1 Explained variable

In this paper, the index of "optimization and upgrading of industrial Structure" (IS) is expressed by the ratio of the tertiary industry and the secondary industry.

3.2.2 Explanatory variables

This study chooses green credit, green investment, green insurance, and government support as the four dimensions to assess the level of development of green finance (GF) in all provinces of China. The selection is based on the results and limitations of previous research, as well as the principles of science, specificity, feasibility, and data accessibility.

Green credit is a significant component of fiscal policy. This study focuses on the availability of data and uses interest expenditure as a negative indicator. It selects the interest expenditure or gross

industrial output value of six energy-intensive industries and six high-energy-consuming industries as indicators to evaluate the credit index of green credit in a comprehensive manner.

Green investment evaluates environmental variables and assesses project investment based on the objectives of green development and sustainable development. This study utilises green investment measures that incorporate the proportion of environmental pollution control investment in gross domestic product (GDP) to assess the relative level of green financing and so indicate the financing capability of green projects.

Green insurance must take into account the relevant insurance policies and the environment. However, China's environmental pollution insurance was introduced very late, resulting in limited coverage. The agriculture sector is significantly influenced by environmental factors; therefore, farm insurance is intricately linked to green insurance. Thus, the extent of agricultural insurance can precisely indicate the magnitude of the equivalent green insurance. Thus, this study opts to utilise the ratio of agricultural insurance income to total agricultural output value as a metric for green insurance. Simultaneously, this study incorporated the positive indicator of "government support" to holistically assess the level of advancement in green insurance.

3.2.3 Mediation variable

This paper introduces "TECH" as the mediation variable and measures it by the ratio of R&D expenditure to GDP.

3.2.4 Control variable

In order to conduct a more precise analysis of the influence of green finance on the optimisation and upgrading of industrial structure, this study incorporates five control variables: level of openness (FDI), government intervention (GOV), human resources (HR), environmental supervision (ENVIR), and urbanisation rate (UR). The openness level (FDI) is quantified by the FDI to GDP ratio. Government intervention (GOV) is measured by the government expenditure to GDP ratio. Human resources (HR) are assessed by taking the logarithm of the number of college students at the end of the year. Environmental supervision (ENVIR) is determined by the logarithm of the comprehensive interest rate of industrial solid waste. The urbanisation rate (UR) is calculated by the proportion of urban population to the total population, as presented in table 1.

Table 1. A table of index construction and interpretation

Level 1 indicators	Level 2 indicators	Indicator definition/measure	Symbol
Optimization and upgrading of the industrial structure	/	Tertiary industries / secondary industries	IS
Green finance	Green credit	High energy consumption industry interest expenditure or total industrial output value	GF
	Green investment	Investment in environmental pollution control / GDP	
	Green Insurance	Agricultural insurance income / gross agricultural output value	
	Government support	The proportion of spending on environmental protection	
technological progress	/	Expenditure on R & D/GDP	TECH
openness level	/	Openness level/GDP	FDI
Government intervention	/	government expenditure/GDP	GOV
Human resources	/	the logarithm of the number of college students at the end of the year	HR
environmental supervision	/	the logarithm of the comprehensive interest rate of industrial solid waste	ENVIR
Urbanization rate	/	the proportion of the urban population to the total population	UR

3.3.The Source of the Data

This study analyses data collected from 31 provinces and cities in China spanning the years 2010 to 2020. The statistics primarily originate from the China Statistical Yearbook, China Financial Yearbook, and WIND database. This work uses linear interpolation to calculate missing values and utilises logarithmic processing of non-ratio variables to construct a corresponding model, aiming to mitigate any variations.

3.4.Construction of the Model

This study aims to examine the influence of green finance on the optimisation and enhancement of industrial structures. This study not only investigates the direct influence of green finance on industrial structure, but also examines the intermediary effect of "technological progress" in optimising and upgrading this impact. This study established three models: the benchmark model, the intermediary effect model, and the double fixed model.

3.4.1 Benchmark Model

This study establishes a benchmark regression model using "Optimisation and Upgrade of Industrial Structure (IS)" as the dependent variable and "Development Level of Green Finance (GF)" as the independent variable, while also considering relevant control factors:

$$\text{Formula1IS} = C + \beta_1 \text{GF} + \beta_1 X + v + u + \varepsilon \quad (1)$$

3.4.2 Intermediary effect model

Green finance has indirect but significant impacts on the optimisation and upgrading of the industrial structure. This study examines the intermediary effect model in relation to technical development (TECH). It establishes a regression model using "TECH" as the dependent variable and "Green Finance Development Level (GF)" as the independent variable:

$$\text{Formula2TECH} = C + \beta_1 \text{GF} + \beta_1 X + v + u + \varepsilon \quad (2)$$

3.4.3 Double fixed model

The comprehensive model of this study was established by adding the above model to the corresponding main model:

$$\text{Formula3IS} = C + \beta_1 \text{GF} + \beta_2 \text{TECH} + \beta_1 X + v + u + \varepsilon \quad (3)$$

IS signifies the process of improving and enhancing the industrial structure. GF denotes the degree of advancement in the field of green finance. TECH symbolises advancements in technology; C is a fixed value; X encompasses a range of control variables, such as the degree of openness, government intervention, human resources, environmental oversight, and the rate of urbanisation; v represents individual effect; u represents time effect; ε represents random error items.

4. Empirical analysis

4.1.Descriptive Statistical Analysis

Table 2. Descriptive statistical analysis of the variables

Variable	Sample number	Average value	Standard deviation	Minimum value	Maximum value
IS	310	0.114	0.0953	0.0454	0.691
GF	310	0.190	0.118	0.0550	0.839
TECH	310	0.0107	0.00625	0.000236	0.0324
FDI	310	0.304	0.821	0.00538	13.86
GOV	310	0.295	0.206	0.119	1.354
HR	310	4.219	0.758	1.792	5.118
ENVIR	310	8.326	1.364	1.703	10.14
UR	310	0.581	0.131	0.228	0.896

Table 2 reveals that the mean value of green financing in China is 0.190, with a standard deviation of 0.118. This suggests that there are variations in the degree of green finance. The mean value of the industrial structure's development level is 0.114. The value of the standard deviation is 0.0953. The highest possible value is 0.691. The minimum value is 0.0454, which suggests significant disparities in the development level of China's industrial structure. Hence, it is imperative to assess the influence of the maturity of green finance in various regions on the enhancement and advancement of industrial structure. Consequently, this study conducted a regional heterogeneity test in the empirical analysis section.

4.2.The Intermediary Effect Test

In this study, the corresponding intermediary effect was tested by stepwise regression, and the regression results are shown in Table 3.

Table 3. Results of the intermediary effect test

Variable	IS(1)	TECH(2)	IS(3)
GF	0.5524** (2.24)	2.122** (2.06)	0.5132** (2.29)
TECH	/	/	0.0185** (2.55)
FDI	0.0023* (1.70)	0.00023* (1.71)	0.0018 (1.67)
GOV	0.118*** (3.50)	0.0059*** (3.66)	0.129** (2.94)
HR	0.0184 (0.80)	0.0078** (3.32)	0.0047 (0.20)
ENVIR	0.0118*** (3.50)	0.0003 (0.88)	0.0123*** (3.70)
UR	-0.548*** (-6.94)	0.0780*** (9.69)	-0.412*** (-4.54)
_cons	0.932*** (9.74)	-0.0205* (-1.69)	0.897*** (9.42)
N	310	310	310
R2	0.98	0.95	0.98

Table 3 clearly demonstrates the substantial impact of green funding on the promotion of industrial structure optimisation and upgrading. Green financing plays a crucial role in advancing technological advancement. technical advancements have greatly contributed to the improvement and modernization of the industrial framework. The impact of technical progress in green finance has a substantial influence on the optimisation and upgrading of the industrial structure.

Next, the Sobel test was further performed, and the results are shown in Table 4.

Table 4. Results of the Sobel test

Indirect effect / P-value	Direct effect / P-value	Total effect /P-value	Intermediary effect / Total effect	Indigo effect / Direct effect	Total effect / direct effect
0.0393	0.5132	0.5524	0.0711	0.0765	1.0765

Table 4 provides more evidence supporting the existence and significance of the intermediary effect of technological progress. The Sobel test reveals the proportions of the overall effect, direct effect, indirect effect, and intermediary effects that correlate to each other. The Sobel test result shows that the intermediary impact accounts for 7.106% of the total effect. This means that 7.106% of the promotion effect of green finance on the industrial structure is attributed to technical progress.

4.3.Dynamic Panel Model Regression Analysis

This study uses Stata17.0 for panel data regression, and the results are shown in Table 5.

Table 5. The regression results of the dynamic panel model

Variable	IS
L.IS	0.695*** (2.60)
GF	0.044*** (23.57)
TECH	0.461*** (6.06)
FDI	0.005** (2.00)
GOV	0.017** (2.39)
HR	0.003** (2.03)
ENVIR	0.002* (1.66)
UR	0.006 (0.22)
_cons	0.004*** (2.88)
N	310

Table 5 clearly demonstrates that even after using the lag-back-level variable that represents the "optimisation and upgrading of industrial structure," the results remain statistically significant. Green financing contributes to the optimisation and upgrading of the industrial structure in different regions of China, while technical growth also plays a significant role in advancing this process. The inclusion of control variables reveals that higher levels of openness have a notable and favourable impact on the optimisation and advancement of the industrial structure. This suggests that embracing international trade can attract appropriate capital investments and facilitate the introduction of novel technologies, thereby fostering the optimisation and advancement of the industrial structure. The

government's support has a substantial and beneficial impact on the optimisation and upgrading of the industrial structure. This implies that the government can redistribute production resources through financial spending and direct the flow and allocation of production resources between various industries or departments within the industry. This ensures the efficient transformation of production resources and ultimately achieves the optimisation and upgrading of the industrial structure. The impact of human resources on the optimisation and upgrading of industrial structure is beneficial but limited. This highlights the need of high-quality education for talent and underscores the relevance of enhancing the training of exceptional individuals. The impact of environmental supervision on the industrial structure is only observed at a statistically significant level of 10%. This suggests that there is room for improvement in the effectiveness of environmental supervision, and that the strength and intensity of such supervision should be enhanced. The statistical analysis did not find a significant relationship between the rate of urbanisation and the optimisation and upgrading of the industrial structure. This suggests that the current level of urbanisation in China is not driving the optimisation and upgrading of the industrial structure. However, this is an area that can be focused on in the future.

4.4. Analysis of Heterogeneity

This study categorises China into three distinct regions: eastern, central, and western. It then examines and contrasts the influence of green finance on the industrial structure within each of these regions. The findings of this analysis are presented in Table 6.

Important: The eastern area comprises 11 provinces, which are Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan. These provinces are directly under the Central Government. The central region consists of eight provinces (cities), namely Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan. The western area comprises 12 provinces and cities, including Sichuan, Chongqing, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Guangxi, and Inner Mongolia.

Table 6. Results of the heterogeneity analysis

Variable	Eastern regions	Central regions	Western regions
L.IS	0.721*** (12.76)	0.813*** (18.88)	0.612*** (11.44)
GF	0.122*** (3.05)	0.101*** (3.84)	0.081** (2.23)
TECH	0.020* (2.11)	0.049*** (3.34)	0.052* (1.71)
FDI	0.291*** (42.13)	0.332** (2.51)	0.066*** (7.59)
GOV	0.010* (1.89)	0.018* (1.87)	0.194*** (4.42)
HR	0.622*** (37.27)	0.100*** (8.19)	0.003** (2.24)
ENVIR	0.344*** (38.85)	0.002* (1.69)	0.044*** (8.48)
UR	0.166*** (4.55)	0.162*** (6.98)	0.072*** (12.89)
N	110	80	120

Table 6 demonstrates that green finance is crucial in facilitating the improvement and advancement of the industrial structure, therefore confirming hypothesis H1. Nevertheless, the degree of advancement in green finance varies significantly across various locations. The eastern region's high level of development in green finance, human resources, environmental supervision, and urbanisation rate is crucial in promoting the optimisation and upgrading of the industrial structure. This indicates

that the eastern region has experienced rapid economic growth, possesses abundant human resources, has a high urbanisation rate, maintains a high degree of environmental supervision, and has a relatively balanced industrial structure. These favourable conditions provide a conducive environment for the application and promotion of green finance, enabling it to have a more impactful role. The central area ranks second, after the eastern region, in terms of fostering the optimisation and upgrading of industrial structure through the development of green finance. Technological progress and the level of openness to the outside world have the greatest influence on the optimisation and upgrading of the industrial structure. This suggests that the central region focuses on the advancement of science and technology and foreign trade, which are the strengths of the central region in improving and enhancing the industrial structure. Given the Western region's weak economic foundation and slow economic development, the impact of green finance in promoting the improvement and advancement of industrial structure is the least significant. This highlights the need for the Western region to actively utilise green finance to drive the development of its industrial structure.

4.5. Robustness Test

The regression results above confirm that green finance has a positive impact on the optimisation and upgrading of industrial structure, and also acts as an intermediate for technological growth. Subsequently, this study assessed the durability of the model by altering the measuring technique. This study uses the technique of manipulating the interpreted variables to assess the resilience of the model. This study suggests that green development is better aligned with the optimisation and upgrading of the industrial structure. Therefore, the relative importance of the tertiary sector might serve as an indicator of the corresponding green upgrading of the industrial structure. This article utilised the share of the tertiary industry in various provinces in China as the proxy indicator for conducting a robustness test. The outcomes of this test are presented in Table 7.

Table 7. Results of the robustness test

Variable	IS(1)	TECH(2)	IS(3)	IS(4)	TECH(5)	IS(6)
GF	0.5524** (2.24)	2.122** (2.06)	0.5132** (2.29)	0.5374** (2.35)	1.669** (2.48)	0.5062*** (2.93)
TECH	/	/	0.0185** (2.55)	/	/	0.0335** (2.48)
FDI	0.0023* (1.70)	0.00023* (1.71)	0.0018 (1.67)	0.0022* (1.73)	0.0202*** (2.88)	0.0026* (1.72)
GOV	0.118*** (3.50)	0.0059*** (3.66)	0.129** (2.94)	0.363*** (7.33)	0.0259*** (4.55)	0.373*** (7.58)
HR	0.0184 (0.80)	0.0078** (3.32)	0.0047 (0.20)	0.0264*** (3.72)	0.00681** (3.32)	0.109*** (4.18)
ENVIR	0.0118*** (3.50)	0.0003 (0.88)	0.0123*** (3.70)	0.0243*** (6.42)	0.0004 (0.88)	0.0248*** (6.61)
UR	-0.548*** (-6.94)	0.0780*** (9.69)	-0.412*** (-4.54)	0.202* (2.28)	0.0780*** (9.69)	0.332** (3.25)
_cons	0.932*** (9.74)	-0.0205* (-1.69)	0.897*** (9.42)	1.135*** (10.57)	0.0205* (2.10)	1.101*** (10.27)
N	310	310	310	310	310	310
R2	0.98	0.95	0.98	0.96	0.94	0.97

Table 7 shows that the robustness test results (4), (5), and (6) are compared with the regression results (1), (2), and (3) mentioned earlier. It can be observed that all the corresponding results remain unchanged and pass the significance test. This suggests that the model used in this study is robust and reliable.

5. Conclusion

5.1. Summary and Suggestions

Based on the empirical analysis, this study proposes the following recommendations to assist the government in formulating policies and regulations, implementing systems and decisions, and promoting the optimisation and upgrading of China's industrial structure for sustainable and high-quality economic development.

(1) Improve the laws and regulations related to green finance, and establish and improve the green finance policy system

The government should take a proactive role in creating and continuously enhancing rules and regulations pertaining to green finance. It should also use legislative measures to clearly define, outline, and establish goals for the development of green finance, in order to give legal assurances for its growth. Furthermore, it is crucial for the government to create and enhance a comprehensive green finance policy framework. This should involve implementing green finance development strategies, establishing regulations and standards for green finance, setting up a system to oversee green finance activities, and improving mechanisms for assessing, monitoring, and predicting risks associated with green finance. These measures will strengthen financial supervision and guidance, prevent disorder and the build-up of risks in the market, and ensure that the development of green finance is compliant and stable. In addition, the government can incentivize financial institutions to enhance their backing for environmentally friendly initiatives and lower the financing expenses associated with such projects by legislative directives. In addition, the government could proactively offer loan guarantees to support the growth of environmentally friendly businesses. Furthermore, the government should implement steps to increase the interest rates for these businesses, thereby enhancing their credit flow and facilitating greater investment in green industries.

(2) Increase the investment in technological innovation and promote the innovation and development of green finance

The government ought to augment its investment in green financial technology, enhance the research and development of cutting-edge technologies such as big data, cloud computing, and blockchain, prioritise the training and recruitment of green financial experts, and consistently enhance the expertise and business acumen of green finance professionals. During that period, it is advisable for the government to enhance its backing for the green sector, stimulate financial institutions and technology companies to enhance their innovation and research efforts, and foster green finance through tax benefits, fiscal subsidies, and other strategies. This will facilitate the enhancement of green financial products and services to cater to the varied market demands, ultimately enhancing the competitiveness of the green financial market.

(3) Establish an information-sharing mechanism related to green finance

Significant disparities exist in the amount of green finance development across different regions in China. Hence, it is imperative to enhance the interchange and sharing of information among regions, as well as to share experiences and developmental lessons. This will help to diminish the disparities between regions and foster collective development and advancement. The government has the ability to construct a green finance information platform and enhance the regional "development dialogue" with green finance in order to achieve the goals of information sharing and exchange. For instance, the eastern part of China has a comparatively advanced level of green finance development, while the western area lags behind. Therefore, the government can strategically combine the two regions to fulfil the objective of using the progress in the eastern region to stimulate the growth of the western region.

(4) Cultivate a culture related to green finance and enhance the social consensus on green finance

The government should proactively engage in promotional and educational initiatives regarding green finance, disseminating knowledge about green finance through diverse channels and mediums, enhancing public awareness and concern for green finance, and subsequently directing the public towards adopting the principles of green consumption and green investment. Furthermore, the

government should enhance green finance education and cultivate a cohort of professionals equipped with the expertise and competencies in green finance, thereby ensuring a robust talent pool to support the advancement of green finance. In addition, the government should proactively promote an environmentally friendly way of living and provide guidance to all sectors of society to engage in the advancement of green finance.

5.2. Summary

5.2.1 The shortcomings of the study

(1) The accuracy of the selected indicators may be insufficient

Currently, there is a lack of consistency in measuring the amount of development in green finance, and there is no unified approach or set of indicators for measurement. Furthermore, acquiring the index data necessary for assessing the level of progress in green finance is exceedingly challenging. Hence, this article may contain incomplete and disorganised flaws in the choice of indicators for assessing the level of growth in green finance and the selection of control variables. Furthermore, there exist other metrics to assess the optimisation and modernization of the industrial structure. However, this study just focuses on the ratio between the tertiary sector and the secondary industry, which somewhat limits the comprehensiveness of this study.

(2) The sample size is small, and some data are lagged

China's research on green finance commenced belatedly, and the publication of pertinent information is insufficiently comprehensive, resulting in a relatively restricted pool of samples available for gauging the extent of green finance development. Furthermore, this study considers environmental regulation and human resources as control variables. However, the available measurement data for both variables only goes up to 2020. Therefore, using panel data from 2010 to 2020 for this study may result in biased research findings due to data lag.

5.2.2 The future perspectives of the study

(1) Expand the new ideas of index selection

The assessment of green finance development can be thoroughly examined from various angles. For instance, the assessment of the optimisation and enhancement of the industrial structure can be evaluated by combining the tertiary industry/secondary industry with the advanced, rationalisation, and ecological industrial structure. Furthermore, it is important to analyse other mediation variables, such as the extent of modernization and the extent of the green concept, in order to gain a more comprehensive knowledge of how green finance impacts the optimisation and upgrading of industrial structure.

(2) Expand the sample size

As green finance and industrial structure continue to evolve, the relevant data will be regularly updated. This will lead to an increase in the number of measurement samples available for analysis. Future studies can therefore extend the research time and scope to conduct more comprehensive and detailed investigations. This will enable researchers to cover a wider range of samples and draw more precise conclusions.

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