

Research on the Impact of Green Finance on Ecological Industrial Structure

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Abstract: At the 19th Congress in 2019, it was clearly pointed out that the Chinese economy has shifted from a high-speed growth stage to a high-quality development stage, and high-quality economic development has become the primary goal of economic development. In September 2020, the "dual carbon" goal was clearly proposed at the United Nations General Assembly. This clearly requires us to change our development concept, and green finance, as a new economic growth point, can help promote the development of green industries, improve the ecological level of industrial structure, and promote the transformation of the economy towards high-quality green development. This article constructs a green finance indicator system from five dimensions: green credit, green investment, green insurance, green bonds, and carbon finance, and analyzes the current development status of these four indicators in China; To measure the ecological level of China's industrial structure from the three dimensions of industrial structure rationalization, industrial structure upgrading and industrial structure sustainability, the entropy method was used to calculate the green finance and industrial structure ecological development index of 30 provinces (except Xizang, Hong Kong, Macao and Taiwan) from 2005 to 2020. Construct a panel data model using multiple mixed regression to examine the impact of green finance on the ecologicalization of industrial structure.

Keywords: Green finance; Ecological transformation of industrial structure; Multiple mixed regression

1. Introduction

Since the reform and opening up in 1978, China's economic construction has achieved remarkable results, from a per capita income of only a few tens of US dollars to a current per capita gross domestic product exceeding 12000 US dollars; In 1978, the gross domestic product was only 367.87 billion US dollars, while in 2022, the gross domestic product had reached 121.02 trillion yuan, and in 2010, China's GDP surpassed Japan to become the world's second largest economy. However, behind the rapid economic development in our country, serious economic problems have also emerged. The rapid development of industry requires a large amount of energy consumption as a basis, which also leads to excessive emissions of pollutants. If environmental issues are not addressed seriously, it will in turn constrain China's economic development and bring obstacles to its sustainable development. Therefore, finding a balance between economic development and environmental protection is an urgent issue that needs to be addressed.

As the core of the economic system, industry not only affects the utilization and efficiency level of various production factors in the economic system, but also directly determines the type and scale of pollution emissions in the economic operation process. The ecological transformation of industrial structure is a systematic evolution from traditional industrial structure to environmental protection industry, mainly manifested in the relative shrinkage of polluting industries and the continuous expansion of environmental protection industries. The ecological transformation of industrial structure is not only a process of improving the efficiency and level of industrial structure, but also a result of the upgrading of industrial structure. Promoting the ecological development of industrial structure is an important measure to break the bottleneck of resource and environmental constraints in economic development and achieve sustainable development. In recent years, green finance has played an increasingly important role in promoting the ecological transformation of industrial structure. Green finance is a financial activity in which the financial industry prioritizes and favors the environmental protection industry in terms of loan policies, targets, conditions, types, and methods, with priority given to credit allocation, investment volume, terms, and interest rates. As a financial tool for environmental protection, green finance plays an important role in promoting the ecological transformation of industrial structure by

restricting capital inflows into polluting industries and providing financial support for environmental protection industries.

2. Literature review

2.1 Green finance

For a long time, the academic community at home and abroad has not yet formed a unified definition of the connotation of green finance. Foreign scholars pay more attention to climate change, natural resource conservation, and sustainable economic development in their research on the connotation of green finance.

Salazar (1998) believes that green finance can connect the environmental and financial industries, guide the flow of funds into and out of the environmental protection industry, and thus achieve sustainable economic development ^[1]. Scholtens et al. (2007) argue that in the context of continuous innovation and development in the financial industry, green finance, as an important innovative tool, can help solve environmental pollution and greenhouse effect, promote coordinated development between environment and society ^[2]. Yu et al. (2021) propose that green finance can enable the green industry to obtain more social capital, promote green investment, stimulate green development momentum, and reduce polluting investment as an important financial tool. Domestic scholars are more focused on promoting sustainable economic development through the guidance of funds through green finance ^[3]. He Jiankui et al. (2006) believe that green finance is based on the purpose of environmental protection, ensuring coordinated development between economic sustainability and environmental protection by promoting the rational allocation of resources in financial operations ^[4]. Ma Jun (2015) believes that a green finance system should be constructed from four aspects: the construction of green investment institutions, fiscal and financial policy support, financial infrastructure construction, and legal infrastructure construction to guide financial funds towards green investment projects ^[5]. Yu Lan (2016) pointed out that green finance is to accelerate the innovation of green financial tools and protect the environment by guiding funds to support environmental protection through sound systems ^[6]. He Qian (2021) believes that the connotation and goals of green finance will be more diverse. Its connotation should be integrated from a single green financial tool to the level of ecological protection, and its purpose should not only be to adapt to changes in natural weather, but also to optimize industrial structure and achieve high-quality economic development ^[7].

2.2 Ecological transformation of industrial structure

The ecological transformation of industrial structure is different from the ecological transformation of annual industries. It refers to the construction of an efficient and harmonious industrial structure according to the principles of ecological economy and ecological laws, so that multiple production systems or links can achieve efficient output and sustainable utilization of resources and environment through system coupling and multi-level utilization of material and energy. Lv Mingyuan is one of the scholars in China who has published a lot of literature on the ecological transformation of industrial structure. Lv Mingyuan et al. (2016) pointed out that the ecological transformation of industrial structure refers to the process of traditional industrial structure evolving towards an ecological industrial structure, that is, constructing an efficient, harmonious, green, and sustainable industrial structure according to the principles of industrial ecological economy and ecological laws, making the hierarchical utilization between multiple industrial systems or links more fully utilized, Closer material connections enable efficient output and sustainable economic and social development ^[8]. Except for Lv Mingyuan, Hu Wentao et al. (2023) believe that the ecological transformation of industrial structure directly reflects the degree of clean production in the economic system. In a broad sense, it includes efficiency improvement and resource conservation brought about by industrial structure upgrading and coordination. In a narrow sense, it refers to the environmental efficiency of industrial structure, measured by the total amount of pollution emissions per unit of GDP ^[9]; Xiang Qiulan and Cai Shaohong et al. (2023) believe that ecological industrial structure refers to obtaining maximum output with minimal input, and achieving zero or low emissions throughout the production process. It has three characteristics: green industrial production, low-carbon energy structure, and intensive resource utilization, which can achieve high-quality economic development, resource conservation, and environmental protection. In summary, this article believes that the ecological transformation of industrial structure is the transformation of industrial structure from traditional to ecological. In this process, ecological factors are reasonably allocated among industries, ecological factor productivity and growth rate are improved, and the ratio of green industries

continues to increase, achieving coordinated development of economic growth and environmental protection ^[10].

2.3 Green finance and ecological industrial structure

Research by foreign scholars on the relationship between green finance and ecological industrial structure suggests that the prerequisite for sustainable economic development is to adjust the industrial structure, strive to promote the transformation of traditional industries, and support technological innovation in traditional industries. At the same time, we will vigorously develop environmentally friendly industries, minimize resource waste, and achieve sustainable economic development. When the concept of sustainable development is deeply rooted in people's hearts, it will promote further optimization and upgrading of industrial structure. Fangmin (2011) believes that financial resources should be vigorously promoted to flow into green industries, and the development of green industries is conducive to the upgrading of industrial structure towards greening ^[11]. Labatt et al. (2002) argue that the purpose of developing green finance is to deeply implement environmental protection concepts and achieve high-quality economic development ^[12]. Wang et al. (2019) pointed out that green finance can inhibit investment in energy intensive industries, strengthen investment in technology intensive industries, and ultimately achieve the goal of industrial structure adjustment. Most of the relevant literature in China is limited to theoretical analysis ^[13]. Wang Kangshi et al. (2019) indicate that green investment can provide support for economic growth, generate new growth points, and accumulate necessary potential for economic development by promoting the development of green industries ^[14]. Li Yu et al. (2020) emphasized that green finance not only actively guides the flow of funds among industries from the market perspective, but also promotes the transformation of economic structure from the perspective of resource and income distribution and incentive mechanism. Some scholars have also explored the impact of green finance on the ecologicalization of industrial structure from an empirical perspective ^[15]. Chen Weiguang et al. (2011) empirically studied the impact mechanism of green finance on the ecologicalization of industrial structure, pointing out that green finance achieves industrial greening and ecologicalization by guiding the flow of funds ^[16]. Gao Jinjie et al. (2021) used a systematic GMM model to empirically examine the impact of green finance on the ecological transformation of China's industrial structure. The results showed that green finance promotes the ecological transformation of industrial structure by differentiating its impact on environmental protection and pollution industries ^[17].

3. Model setting and variable selection

3.1 Explained variable: Ecological industrial structure

This article draws on the research of Lv Mingyuan and Sun Xianzhen et al. (2018). The ecological transformation of industrial structure is a process of evolution from traditional to ecological industrial structure, and it is a process of industrial structure towards advanced, rational, and sustainable development. Its goal is to achieve coordinated development of economy, resources, and environment. Based on this, the ecological level of industrial structure is measured by selecting advanced industrial structure, rational industrial structure, and sustainable industrial structure. The upgrading of industrial structure mainly considers the optimization of industrial structure at the economic level, the rationalization of industrial structure mainly considers the optimization of industrial structure at the social level, and the sustainability of industrial structure mainly considers the optimization of industrial structure at the environmental level. The advanced industrial structure is measured by the ratio of the added value of the tertiary industry to the added value of the secondary industry, the rationalization of the industrial structure is measured by the Theil index, and the sustainability of the industrial structure is measured by the entropy method for five tertiary indicators.

3.2 Explanatory variable: Green finance

Based on the documents released by the People's Bank of China and the current development characteristics of green finance in China, this article believes that green finance is a series of financial activities carried out to address climate change, improve resource allocation, protect the ecological environment, and seek efficient resource utilization and industrial green transformation. A green finance (GF) indicator system has been constructed from five dimensions - green credit, green investment, green insurance, green bonds, and carbon finance

4. Empirical result analysis

4.1. Descriptive statistics

Table 1: Descriptive statistics

VARIABLES	N	mean	sd	min	max
Iso	480	0.824	0.215	0.505	2.026
Gf	480	0.288	0.141	0.0380	0.879
Eco	480	9.237	0.494	8.091	10.76
Open	480	0.282	0.328	0.00714	1.668
Ur	480	0.552	0.140	0.269	0.896
Th	480	9.473	1.662	4.369	13.47

According to the Descriptive statistics (Table 1), the maximum value of the ecological level of industrial structure is 2.026, the minimum value is 0.505, the maximum value of green finance is 0.879, and the minimum value is 0.038. There is a large gap in the ecological level of industrial structure and the development level of green finance among provinces, which may be due to the large regional differences and economic development levels among provinces and cities.

4.2. Empirical analysis

Multiple mixed regression was used to test and analyze the model, and the regression results are shown in Table 2:

Table 2: Regression results

	Iso
Gf	0.302***
	(0.074)
Eco	0.029*
	(0.018)
Open	-0.203***
	(0.033)
Ur	0.792***
	(0.103)
Th	-0.028***
	(0.007)
cons	0.348**
	(0.175)
N	480.000
r2	0.241

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The regression results show that the regression coefficient of green finance is 0.302, which is significantly positive at the 1% level. This indicates that after controlling for other explanatory variables, for every 1% increase in green finance level, the average ecological level of industrial structure increases by 0.302%. So with the promotion of green finance activities, the ecological level of industrial structure will also significantly improve.

5. Conclusions

The government should implement a differentiation strategy to promote the coordinated development of green finance and industrial structure optimization and adjustment in various regions. Based on the actual situation of each region, a green finance development model with regional characteristics should be constructed to promote the development of local green industries. Each province and city should fully leverage their local geographical and resource advantages. For example, the rapid economic development in the eastern coastal region should make high-quality economic development a future goal, continue to strengthen industrial structure deepening, and drive industries to develop towards high-end industries such as new concept industries, high-tech industries, and emerging industries; The economy of the central and western regions is not as rapidly developing as that of the eastern regions. When developing green

finance, we cannot blindly pursue the scale expansion of green credit, green investment, etc. We should establish an economic circle centered on the central and western provinces and build a green finance system that matches the needs of advanced and rational industrial structure. Governments, financial institutions, and enterprises in various regions should coordinate and cooperate to better promote the optimization and adjustment of industrial structure.

The spatial differentiation between the development of green finance and industrial structure adjustment mainly comes from the differences between provinces within the region. Therefore, attention should be paid to the issue of uneven development of green finance and industrial structure adjustment among provinces. In the eastern region, green finance has developed rapidly and has a high degree of compatibility with industrial structure. It should play a guiding role in driving the common development of surrounding areas and guiding the flow of resources in other provinces. For the relatively backward central and western regions, we cannot blindly pursue economic development and accept the transfer of external high polluting industries. On the basis of vigorously promoting agricultural modernization, we should quickly transfer surplus labor in the primary industry to the secondary and tertiary industries and focus more on the coordination between green finance and industrial structure. Only through mutual adaptation and coordinated development can we make maximum contributions to sustainable economic development. There are differences in resource endowments among different regions, and these differences should be utilized reasonably. Combining with the characteristics of local industrial structure, green finance should be used to promote the adjustment of industrial structure in the province towards rationalization, advancement, and sustainability.

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