

Carbon Finance, ESG Performance and Corporate Green Transformation and Upgrading

-- Survey evidence from 484 manufacturing enterprises in Zhejiang Province

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Abstract: Promoting green transformation and upgrading of manufacturing enterprises is an important way to solve the global energy crisis and climate change, and achieve the goal of carbon peak and carbon neutrality. Based on the multi-stage probability sampling survey of manufacturing enterprises in the National Green Reform and Innovation Experimental Zone of Zhejiang Province, this paper collects first-hand micro enterprise data, and then examines the impact and transmission mechanism of carbon finance on the green transformation and upgrading of manufacturing enterprises from the perspective of enterprise ESG performance. Empirical research part, in this paper, the integrated use of multivariate linear model and instrumental variable method analysis found that carbon finance effectively promote the manufacturing enterprise green transition and upgrade; Heterogeneity analysis shows that the more developed the regional economy is, the larger the enterprise scale is and the lower the enterprise technology level is, the greater the promotion effect of carbon finance on the green transformation and upgrading of manufacturing enterprises is. Further, the mediating effect model and structural equation model were used to identify the transmission mechanism, and it was found that carbon finance promoted the green transformation of manufacturing enterprises by improving corporate social governance and environmental governance. Carbon finance promotes the upgrading of manufacturing enterprises by improving corporate governance and environmental governance. The findings of this paper provide empirical evidence and practical implications for improving the ESG performance of enterprises through financial means, thus promoting the green transformation and upgrading of manufacturing enterprises.

Keywords: Carbon finance, ESG performance, Green transformation, Enterprise upgrading, Influence effect, Transmission mechanism.

1. Introduction and Literature Review

Embroidery is a famous intangible cultural heritage in ChIn the face of complex challenges such as global climate change and energy crisis, achieving green transformation and high-quality development has become a global issue (Tang Y et al., 2024). In this context, the Chinese government put forward the financial support to the development of green low carbon high quality special strategy, has been clear about the promote social comprehensive green transformation and upgrading of carbon up to the peak, carbon neutral roadmap. At the same time, on the journey towards the "dual carbon" strategy, as the most basic cell of social economy, enterprises undertake the social responsibility for the sustainable development of economy, environment and society (Archie B.Carroll, 2021). Among them, ESG is regarded as an important action guide, and the economic benefits obtained through "greening" and the social benefits of environmental responsibility in the field of social and ecological security are regarded as potential driving forces (An, 2021), to obtain a healthy growth environment, substantial competitive advantages and development potential (Xie, 2022). Carbon finance is the product of financial innovation in the development of low-carbon economy (Chu, 2010). As an important pillar under the framework of green and low-carbon transformation strategy, it can play a key role in achieving the goal of carbon emission reduction through the application of financial tools and strategies (Yan, 2024).

With the continuous and steady development of China's

carbon market and the increasingly active carbon trading, the academic discussion on carbon finance is also deepening. At present, the specific significance of carbon finance in the academic circle can be divided into broad sense and narrow sense. The broad sense of carbon finance refers to investment and financing behaviors that can alleviate environmental and climate problems (Zhengzhong W, 2022), while the narrow sense of carbon finance focuses on options or futures related to carbon emission rights (Liu Zhuowei, 2023). As the core subject of social green development, accelerating green transformation and upgrading in a dynamic environment is the only way for enterprises to debug and solve their own survival and development problems (XingF, 2024). Although people generally associate the two concepts of transformation and upgrading, there are some differences between them (Gong Q, 2023). Pay more attention to green transformation is the enterprise from the traditional mode of production to high pollution and high energy consumption of low carbon, environmental protection, sustainable production mode transformation process, and upgrade emphasis is the enterprise innovation ability, technology improvement, learning pursued and the allocation of resources to improve (Liu Mengmeng, 2025). Low degree of the current domestic carbon market financialization of overall (Yao Dengbao etc., 2024), and the existing discussion of carbon finance, mainly concentrated in the carbon market construction as well as the influence on regional carbon emissions, little effect on enterprise low carbon development and transformation and upgrading of quantitative research, based on micro data transmission mechanism of enterprise level identification test

is scarce. In view of this, this article aims to from carbon financial drive enterprise green on the path of transformation and upgrading, to deeply research in the field. Specific research questions include: under the background of "dual carbon", does carbon finance effectively promote the green transformation and upgrading of enterprises? What is the relevant path mechanism? What are the differences in the application of carbon finance in different industries and scales of enterprises, and what are the optimization and improvement paths?

The marginal contribution of this paper is mainly reflected in the following three aspects: (1) Anchoring the leading role of carbon finance in the process of enterprise transformation, opening a new perspective to study the relationship between carbon finance and enterprise green transformation and upgrading, and injecting new theoretical vitality and in-depth analysis into transition economics. (2) use the micro perspective, the carbon financial measure as a relatively subjective variables, penetration, participation, interactive degrees as measure, to quantify the level of carbon financial processing, the empirical test effect of carbon financial green transformation and upgrading of the enterprise. Thirdly, through the empirical analysis, it is concluded that the transmission paths of corporate environmental governance, social governance and corporate governance can affect the carbon finance to drive the green transformation and upgrading of enterprises to varying degrees. It has important policy value to understand the policy effect of the national Green Finance Reform and Innovation Pilot Zone, improve the policy design to improve the level of enterprise green transformation and upgrading and promote the development of "dual carbon".

2. Theoretical Analysis and Hypothesis Derivation

Carbon finance is an important engine to promote the development of low-carbon economy and energy structure transformation (Ren et al., 2025). On the one hand, carbon finance provides capital supply for the development of enterprises and achieves financial integration (Yao X, 2024); Carbon finance, on the other hand, the enterprise of "green" into the investment and financing decisions, carbon finance to tilt in the field of green low carbon, cause pollution of the financial resources flow from polluting enterprises to the enterprise, increased the difficulty of polluting enterprises to obtain financial resources, the use of its functions of financing constraints (xiao-xiao zhou, etc., 2023). In order to obtain environmental qualification recognition from authoritative authorities and obtain more green credit, enterprises carry out green transformation and transformation (Zhou et al., 2022), and improve their own performance (Wang et al., 2023). Therefore, the research hypothesis is put forward as follows:

H1: Carbon finance plays a direct positive role in the green transformation of enterprises

Corporate environmental governance mainly examines the impact of enterprises on the environment and their contribution to environmental protection. Hong et al. (2024) concluded that carbon finance influences corporate environmental governance through two paths: financial instruments and market. That is, through carbon forward, carbon futures, carbon options and carbon swaps and other economic and financial means to guide capital flow to clean and environmental protection projects, further guide

enterprises to take the initiative to reduce carbon emissions to obtain economic benefits. Under the regulation of carbon financial market mechanism, enterprises can be encouraged to improve their ability of environmental governance, reduce the emission of pollutants, and help achieve the purpose of environmental protection (Chen S, 2024). At the same time, from the perspective of long-term development, carbon finance will guide funds to carbon emission reduction and sustainable development projects, creating conditions for enterprises to achieve green production (Chen et al., 2023). Therefore, the research hypothesis is put forward as follows:

H1a: Environmental governance is the transmission path of carbon finance to promote corporate green transformation

Enterprise positive social responsibility in the process of economic development, the attention to interact with the community, employees and suppliers and other stakeholders (Chen J, 2023). There is a certain crowding-out effect in the transformation and technological innovation investment of enterprises with high energy consumption (Wang et al., 2022). And development of carbon finance is a good way to ease the financing constraints of crowding out, help enterprises to find and social common FaZhanDian, improve the ability of social governance, sustainable development. From the perspective of fulfilling social responsibility, enterprises take on the social responsibility and mission of leading economic and social development by responding to social policies (Qi, 2023). Based on this, carbon finance not only serves the economy, but also plays a certain role in strengthening social supervision and facilitating the green transformation of enterprises. Therefore, the research hypothesis is put forward as follows:

H1b: Social governance is the transmission path of carbon finance to promote corporate green transformation

The establishment and operation of internal organizational structure, power distribution, decision-making mechanism and supervision mechanism are the core of corporate governance (Marcellin M, 2023). In order to meet the needs of relevant departments' supervision and their own sustainable development, enterprises will invest in improving resource utilization efficiency, reducing pollutant emissions and improving internal governance after receiving green finance support (Cao et al., 2024).

In this process, carbon finance promotes the expansion of corporate ESG from governance structure to economic governance tools and means, among which governance structure is the key to corporate sustainable development (Yu et al., 2022). The formation of corporate carbon finance risk management experience also needs to be realized in the process of green transformation (Wu, 2024). Therefore, the research hypothesis is put forward as follows:

H1c: Corporate governance is the transmission path of carbon finance to promote corporate green transformation

Enterprises respond to the changing external environment and customer needs through innovation and upgrading (Wang, 2021). Under the green development mode, three major priorities are put forward for enterprises: high production efficiency, energy saving and green expansion. Zhu et al. (2022) proposed that the introduction of carbon finance can promote corporate innovation. Faced with the requirements of carbon emission restrictions, enterprises need to find more efficient and low-carbon production methods. This will give rise to new technological and innovative solutions, and

promote the upgrading and reform of enterprises in technology R&D, product design and management (Du et al., 2019). At the same time, Jing C et al. (2021) argued that financial services need to adapt to different stages of enterprises, and there is a dynamic coordination relationship between them. Therefore, the research hypothesis is put forward as follows:

H2: Carbon finance plays a direct positive role in corporate upgrading

By strengthening ESG environmental governance, carbon finance can effectively promote enterprises to achieve upgrading. Song et al. (2021) pointed out that financial development provides investment and financing assistance for units tackling clean and environmental protection technologies, which can produce a structural effect of reducing carbon emissions and solve regional environmental pollution problems. Using the economic bar to push up the financing cost of high-polluting enterprises, it forces high-polluting enterprises to upgrade and transform, to achieve environmental pollution control (Leyuan Y, 2023). From an empirical perspective, it is found that carbon finance can encourage enterprises to carry out green innovation, and promote the adoption and development of green technology (Wen Yang, 2023). Therefore, the research hypothesis is put forward as follows:

H2a: Environmental governance is the transmission path of carbon finance to promote enterprise upgrading

Carbon finance supports enterprises to attach importance to environmental protection and fulfill their social responsibilities. From the perspective of society, according to Porter's competitive advantage theory, it will be a win-win strategy for enterprises to seek their own interests while balancing social interests. Under the operation mechanism of carbon financial market, actively participating in low-carbon upgrading can enhance the social image and reputation of enterprises and attract the favor of consumers and investors (Li et al., 2023). Carbon finance can optimize the allocation of resources, ease the financing constraints of enterprises, provide funds for the upgrading of green industrial structure, support enterprises to fulfill social responsibilities and improve corporate social governance (Zhang, 2023). Therefore, the research hypothesis is put forward as follows:

H2b: Social governance is the transmission path of carbon finance to promote enterprise upgrading

Good corporate governance helps companies better respond to environmental challenges and achieve low-carbon development and corporate upgrading. In the process of corporate financing, investment and financing parties are in different transaction positions, and the lack of corresponding disclosure channels and supervision will cause information dislocation, which will have a negative impact on investors (Tawfiq T, 2024). With the support of green finance, enterprises can send signals of green development and emphasis on environmental protection to the outside world. Since external investors lack information on corporate governance and development level, this signal can attract investors' attention to invest in corporate development (Wen, 2023). In addition, the development of carbon finance will also have a significant impact on the total factor productivity of enterprises, helping enterprises to improve the level of corporate governance and realize the upgrading of enterprises (Hu Yizhuo, 2022).

H2c: Corporate governance is the transmission path through which carbon finance promotes corporate upgrading

3. Research Design

Traditional embroidery art still has wide application value in contemporary fashion design. For modern fashion design, it still has a very strong sound. First, we need to break the integrity of the design. Traditional embroidery art is often lack of abstractness, and the pattern image is very complete, but it has the characteristics of rigidity. It is not conducive to the long-term promotion of traditional ideas, and modern fashion design in the process of integration must break through the limitations of traditional embroidery, the integrity of the continuous to be broken, in order to innovate. For fashion designers, we can divide the patterns properly and pick up the relevant comData sources

This paper introduces the design effect deff to determine the sample of relevant enterprises distributed in the survey area. The sample size is based on simple random sampling, the confidence interval is 95%, and the marginal error E is generally not more than 0.1. In this paper, the value of E is 0.06. Since the population proportion is unknown, the maximum value of (1-P) is 0.5, 1.96, then the sample size is: $PPZ_{\alpha/2} =$

$$n_0 = \frac{t^2 p(1-p)/r^2}{1 + \frac{1}{N} \left(\frac{t^2 p(1-p)}{d^2} - 1 \right)}$$

Considering that the efficiency of multi-stage sampling is lower than that of simple random sampling, the design effect of this paper is a relatively high value of 1.2, so the sample size is:

$$n_1 = n_0 \times Deff = 462$$

Considering the validity of the questionnaires distributed and the limitations of the funds, whose recovery rate is generally 90%, the actual number of questionnaires distributed is 514. =According to the proportion of enterprises in different regions, the corresponding sample size was calculated to determine the corresponding number of questionnaires distributed in different regions. The specific distribution method was np/P*N. Finally, 530 questionnaires were distributed, and 484 valid questionnaires were collected, with an effective rate of 91.2%, which better met the international requirements for questionnaire efficiency.

3.1. Description of Variables

3.1.1. Explanatory variable - Carbon finance

By referring to the scale of inclusive finance of the Central Bank of China and the processing method of Shen and Liao (2020), this paper discusses the penetration, utility and interaction of carbon finance: (1) penetration: companies' perception, system understanding, frequency of use and recommendation intention of carbon finance; (2) Utility: the company's carbon emission monitoring, carbon emission management, carbon emission optimization and carbon market participation; (3) Interaction degree: corporate carbon finance ecology, publicity activities, cooperation opportunities and corporate interaction.

3.1.2. Explained variable: green transformation

Referring to the research of Wu Fei and Li Wei (2022) on the core words of corporate green transformation, this paper takes green system transformation, green action transformation and green guarantee transformation as

dependent variables for calculation: (1) Green system transformation: the changes implemented by enterprises in business philosophy, strategic planning, production process, products and services; (2) Green action transformation: the actions taken by enterprises in operation mode, resource utilization, environmental protection measures and development practice; (3) Green guarantee transformation: the guarantee undertaken by enterprises in management system, strategic model, management regulations and corporate culture.

3.1.3. Explained variable: enterprise upgrading

This paper mainly refers to the classification method of enterprise upgrading by Yu Donghua (2018), and measures enterprise upgrading from three aspects: enterprise structure, performance level and product value: (1) enterprise structure: the composition and distribution of employees in the enterprise environmental department; (2) Performance level: the quantitative evaluation of a company's achievement of its green strategic goals and operational efficiency within a certain period of time; (3) Product value: the degree to which consumers recognize the quality, function, design and service attributes of their green products.

3.1.4. Mediating variable: ESG performance

This paper refers to the discussion of Yuan Ronli et al. (2022) on ESG research, draws on the 35 key ESG issues of enterprises in the three categories of environment, society and company in the index system of MSCI's ESG rating model,

$$\begin{cases} G_Transformation = \partial_1 \cdot C_Finance + \sum_{\sigma=2}^n Control \cdot a_{\sigma} + \varepsilon \\ E_Upgrade = \gamma_1 \cdot C_Finance + \sum_{\sigma=2}^n Control \cdot \gamma_{\sigma} + \varepsilon \end{cases}$$

Note: is green transformation, is enterprise upgrading, is carbon finance, and Control is the control variable. $G_Transformation$ $E_Upgrade$ $C_Finance$

After the data is standardized, after excluding the interference of all control variables such as enterprise region, enterprise size and industry type, carbon finance has a significant role in promoting the green transformation and upgrading of enterprises

3.3. Endogeneity Analysis

In the above verification, the factors affecting enterprise transformation and upgrading were controlled as much as possible, but theoretically, there are still other variables that cannot be solved or observed to have an impact on enterprise green transformation and upgrading, resulting in omitted variable bias; At the same time, enterprises may obtain financial support by participating in the carbon financial market for green transformation measures such as

and finds that the governance capacity of enterprises is mainly reflected in three dimensions: environmental governance, social governance and corporate governance. The behavior of water conservation, waste discharge, clean energy use and recycling in the process of production and operation; (2) Social governance: the implementation effect of the enterprise in product quality and safety, social welfare, employee welfare and health, and supply chain management; (3) Corporate governance: the company's organizational structure, business performance, information disclosure, risk management.

3.1.5. Control variables

In order to exclude other factors affecting the green transformation and upgrading of enterprises, this paper takes enterprise characteristics as control variables to avoid interference in the empirical analysis based on the existing literature. The specific indicators designed in this paper include enterprise region, enterprise size, organizational form and industry type, to enhance the scientific and accurate research conclusions

3.2. Analysis of Regression Results

This paper uses multiple regression model to explore the impact of carbon finance on green transformation and enterprise upgrading, and the specific regression equation constructed is as follows:

environmental protection technology innovation and energy efficiency improvement. In addition, since the carbon financial market usually gives more attention and support to enterprises with environmental protection and sustainable development, the green transformation and upgrading of enterprises may also increase their participation in the carbon financial market. As a result, the explanatory variable and the explained variable are mutually dependent, resulting in endogeneity problems.

In addition, participation in the use of carbon finance is the result of enterprises' independent choice, which has certain endogeneity. Therefore, in order to alleviate the endogeneity problem to the greatest extent, this paper adopts the instrumental variable method to solve the endogeneity problem. The more a company knows about carbon finance, the stronger its willingness to participate in carbon finance. However, whether it knows about carbon finance does not directly affect its green transformation and upgrading.

Table 1. Estimation results of instrumental variables

Variables	2SLS			
	Stage 1	Stage 2	Stage 1	Stage 2
	C_Finance	Green Transition	C_Finance	Enterprise upgrade
PEN	0.126 *** (0.11)		0.126 *** (0.11)	
C_Finance		0.521 *** (0.04)		0.497 *** (0.06)
Control variables	Control	Control	Control	Control
F-statistic	28.72 ***		28.72 ***	
Wald statistic	45.32 ***		39.67 ***	
Observation index	484		484	

Table 1 presents the regression results using instrumental

variables. The regression results show that after fully

considering the endogenous bias of the model, the understanding of carbon finance is selected as the instrumental variable in this paper, which is reliable to some extent, and there is no weak instrumental variable problem. Therefore, the null hypothesis H1 and H2 are valid.

3.4. Heterogeneity Analysis

3.4.1. Regional heterogeneity

There is a strong correlation between carbon finance and the degree of green development and the level of economic development. Geographical location has an important impact on the transformation and upgrading of enterprises. The level of economic development, the degree of industrial agglomeration and the degree of government policy support in different regions determine the convenience of enterprises in terms of business environment, market contact and resource access. According to the model results, carbon finance has a significant promotion effect on promoting the green transformation and upgrading of enterprises in some regions. Specifically, carbon finance has played the biggest role in promoting the green transformation and upgrading of enterprises in Kecheng District, while for enterprises in Changshan County, the promotion effect of carbon finance is not significant.

3.4.2. Heterogeneity of scale

The research of Ye and Wu (2010) proved that in the transitional economy scenario, large enterprises will increase

investment in environmental management in order to gain social reputation and social performance compared with small and micro enterprises. The results show that carbon finance has heterogeneous effects on promoting the green transformation of enterprises of different sizes. Among them, large and medium-sized enterprises have the most significant promotion effect.

3.4.3. Industry heterogeneity

Low-tech manufacturing is labor-intensive. It has weak innovation ability and R&D investment, often uses traditional processes and old equipment, and has high carbon emissions and energy consumption. According to the model results, carbon finance has heterogeneous effects on promoting green transformation and upgrading of low -, medium - and high-tech manufacturing enterprises. Specifically, the promotion effect of carbon finance on low-technology manufacturing enterprises is the most significant. However, for high-tech enterprises, the promotion effect of carbon finance is not significant.

4. Analysis of Impact Mechanism

4.1. Mediating Mechanism Analysis

In terms of the impact of carbon finance on green transformation, this paper builds three paths based on three mediating variables, and the mediating effect data of each transmission path are shown in Table 2.

Table 2. Test results of the transmission mechanism of green transition

Variables	Benchmark	Environmental governance		Social governance		Corporate governance	
	green Transformation	Environmental governance	Green transformation	Social governance	Green transformation	Corporate governance	Green transformation
Carbon finance	0.549 ** (14.164)	0.515 ** (12.451)	0.260 ** (5.715)	0.495 ** (12.709)	0.260 ** (5.715)	0.547 ** (13.786)	0.260 ** (5.715)
Mediating variable			0.172 ** (4.266)		0.188 ** (4.413)		0.196 ** (4.547)
Control variables	Control	Control	Control	Control	Control	Control	Control
R²	0.284	0.235	0.242	0.273	0.405	0.284	0.235
Total effect	0.549 **						
Mediating effect value	0.089		0.093		0.107		
Direct effect	0.260 **		0.260 **		0.260 **		

Table 3. Test results of the transmission mechanism of enterprise upgrading

Variables	Benchmark	Environmental governance		Social governance		Corporate governance	
	Business Upgrading	Environmental governance	Enterprise upgrading	Social governance	Enterprise upgrading	Corporate Governance	Corporate upgrading
Carbon finance	0.294 ** (6.410)	0.515 ** (12.451)	0.294 ** (6.410)	0.495 ** (12.709)	0.294 ** (6.410)	0.547 ** (13.786)	0.294 ** (6.410)
Mediating variable			0.198 ** (4.879)		0.175 ** (4.072)		0.153 ** (3.536)
Control variables	Control	Control over	Control	Control	Control	Control	Control
R²	0.296	0.233	0.240	0.272	0.401	0.296	0.233
Total effect	0.567 **						
Mediating effect value	0.102		0.087		0.084		
Direct effect	0.294 **		0.294 **		0.294 **		

According to the mediating effect results, carbon finance has a significant positive impact on promoting the green transformation of enterprises. In terms of social governance and environmental governance, carbon finance plays a significant role in promoting the green transformation of enterprises.

In terms of the impact of carbon finance on enterprise upgrading, this paper builds three paths based on the three mediating variables, and the mediating effect data of each transmission path are shown in Table 3.

According to the results of mediating effect, carbon finance has a significant positive impact on promoting enterprise

enterprise upgrading. From different perspectives, in terms of corporate governance and environmental governance, carbon finance has a significant role in promoting enterprise upgrading, while its impact on social governance is relatively limited. Therefore, enterprises should further deepen the social application of carbon finance in corporate sustainable development.

4.2. Robustness Test

Since the traditional statistical analysis method cannot properly deal with the six latent variables of carbon finance, environmental governance, social governance, corporate

governance, green transformation and enterprise upgrading studied in this paper, while the structural equation model can well deal with these latent variables and their indicators at the same time, this paper selects the structural equation model for robustness test, and the structural equation theoretical model

4.3. Confirmatory Factor Analysis (CFA) Was Used

Confirmatory factor analysis was performed on 6 latent variables and 22 observed variables, and the structural validity test. All the model fitting indexes met the standards.

Table 4. Goodness-of-fit index table of confirmatory factor model

	χ^2/df	GFI	RMSEA	RMR	CFI	NFI	NNFI
value	2.55	0.91	0.06	0.04	0.96	0.94	0.95
Standard	<3	>0.9	<0.10	<0.05	>0.9	>0.9	>0.9
Fit results	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal

The factor loads of all latent variables corresponding to each topic in the model are more than 0.7, which indicates that each latent variable corresponding to the topic has a good representativeness. In addition, the average variance variation AVE of each latent variable was greater than 0.5, and the combined reliability CR was greater than 0.75, indicating that the convergent validity was ideal.

4.4. Confirmatory Factor Analysis Was Performed

AMOS was used to analyze the data and solve the structural equation model, and the results were verified. At the same time, the packaging dimension also includes the corresponding topic scope. The following table shows the fitting results of the relationship between latent variables and explicit variables.

Table 5. Fitting results of structural equation model

	χ^2/df	TLI	NFI	CFI	RMSEA	SRMR
Model value	3.367	0.919	0.907	0.914	0.074	0.0638
Standard value	< 5	> 0.9	> 0.9	> 0.9	< 0.08	< 0.08
Fitting results	Ideal	Ideal	Proximity	Ideal	Ideal	Ideal

Table 6. Path and mediating effect analysis table

The path				Effect size	Boost SE	Bias-Corrected 95%CI		Test Results	
			Lower			Upper			
Carbon Finance	0.64*** →	Society Governance	0.12*** →	green Transformation	0.5271	0.029	0.0508	0.1238	Significant
Carbon finance	0.62*** →	The Company Governance	0.11 →	green Transformation	0.0682	0.026	-0.0172	0.1192	Don't significant
Carbon finance	0.67*** →	Environment Governance	0.19*** →	green Transformation	0.4964	0.034	0.0340	0.1684	Significant
Carbon finance	0.62*** →	Society Governance	0.09 →	Corporate upgrading	0.0558	0.028	-0.0009	0.1107	Don't significant
Carbon finance	0.63*** →	The Company Governance	0.16*** →	Corporate upgrading	0.3462	0.034	0.0185	0.1432	Significant
Carbon finance	0.66*** →	Environment Governance	0.14*** →	Corporate upgrading	0.3688	0.031	0.0168	0.1458	Significant

Table 5 shows that all indicators are good, indicating that the overall reliability of the model is high, and it can well reflect the practical problems, that is, the above hypotheses can be effectively supported. So far, we have completed the fitting results of the relationship between latent variables and explicit variables, and the fitting results of the relationship between latent variables are shown in Table 6.

5. Analysis of Results

Carbon finance has a significant positive impact on promoting the green transformation and upgrading of

enterprises. From different perspectives, in social governance, corporate governance, environmental governance and other aspects, carbon finance has a significant role in promoting the green transformation and upgrading of enterprises. This shows that carbon finance plays an important role in the process of sustainable development of enterprises, to promote the development of enterprises in a more environmentally friendly and sustainable direction.

However, in terms of enterprise upgrading, the impact of carbon finance on social governance is not significant, and in terms of green transformation, the impact of carbon finance

on corporate governance is not significant. This shows that in the process of enterprise upgrading, the role of carbon finance in social governance is relatively limited, and in the process of green transformation, the role of carbon finance in

corporate governance is relatively limited. Enterprises need to further explore other factors or take other measures to achieve better results.

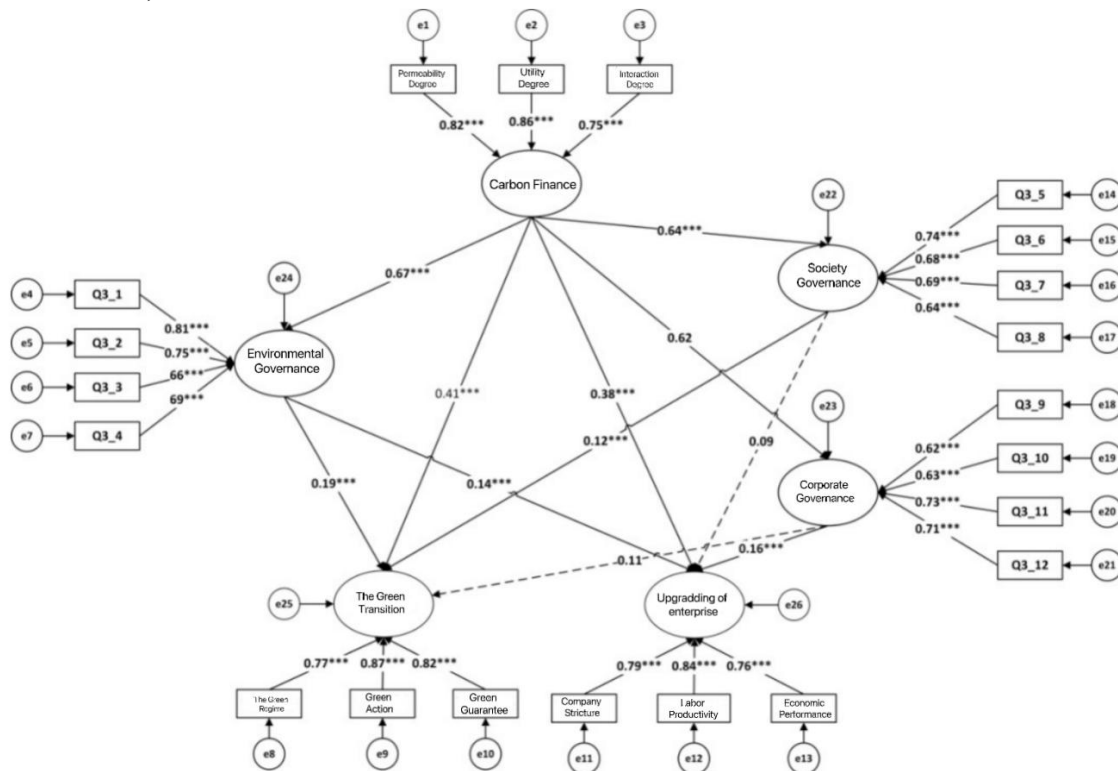


Figure 1. Schematic diagram of the results of structural equation theory model

6. Conclusion

6.1. We Will Optimize the Carbon Finance Ecosystem and Continue to Stimulate New Drivers of Enterprise Transformation and Upgrading

Carbon finance will provide important support for China's high-quality economic development. Compared with traditional finance, carbon finance is more flexible, targeted and adaptable, and can meet the financial needs of economic and energy structure transformation, especially the transformation of key traditional "carbon intensive" sectors, in a larger scope and on a larger scale, and support the transition of carbon intensive and high environmental impact economic activities to low and zero carbon along a clear path. The government can consider granting preferential tax policies to enterprises that issue carbon transition bonds, such as exempting bond interest income tax or preferential corporate income tax policies, to further reduce financing costs and enhance the motivation of transformation and upgrading of enterprises.

6.2. Differentiated Policies Should Be Formulated to Promote the Coordinated Development of Carbon Finance Regions

In order to promote the coordinated development of carbon finance regions, a number of strategies need to be adopted. First, differentiated policies should be formulated according to the characteristics of different regions, considering factors such as carbon emission reduction potential, industrial structure and economic development level, and providing more support and incentives, including reducing carbon

trading costs and setting up special funds for carbon finance. Secondly, a carbon finance cooperation mechanism should be established to strengthen information sharing, coordination and cooperation among local governments, and promote experience sharing and cooperation and exchange. Finally, we should build a carbon trading platform and a carbon credit system to provide enterprises and investors with services such as carbon trading and carbon asset appraisal, and formulate carbon trading rules and systems that are in line with the actual situation in the region.

6.3. We Will Strengthen the Efficiency of ESG Governance and Promote the Green Transformation and Upgrading of Enterprises

As a powerful engine for enterprises to achieve green transformation and upgrading, ESG governance provides strong support for sustainable development. In order to improve their ability to fulfill social responsibilities and sustainable development benefits, enterprises need to establish a sound ESG management system to ensure that their social responsibilities are fully fulfilled; Strengthen employee benefits and training to enhance employee engagement and sense of belonging, while focusing on diversity and inclusion; Actively participate in social welfare undertakings, give back to society and promote social progress; Promote the sustainable development of the supply chain, pay attention to the social responsibility performance of partners, and promote the sustainability of the whole supply chain; Strengthen communication and cooperation with stakeholders, build relationships of mutual trust, and jointly solve social and environmental problems

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