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The Impact of Green Finance on the Competitiveness of China's Green Product Exports

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Abstract

Against the backdrop of the global green and low-carbon transition and the deepening advancement of the "dual carbon" goals, green finance serves as a crucial tool for guiding resource allocation. It holds significant importance for shaping China's new competitive edge in green trade. This study employs a province-year-product triple fixed-effects model based on panel data covering 31 provinces and 174 categories of green products in China from 2015 to 2022. It analyzes the impact and mechanism of green finance on the export competitiveness of China's green products. The findings reveal that the development of green finance significantly enhances the export competitiveness of green products, a conclusion that remains robust after undergoing a series of rigorous stability tests. Heterogeneity analysis indicates that the promotional effect of green finance is more pronounced in regions with higher levels of foreign direct investment and economic development. To further enhance the export competitiveness of green products, efforts should focus on continually improving green financial infrastructure and refining policies to guide foreign investment, thereby maximizing the effectiveness of green finance policies.

Keywords

Green finance; Green products; Export competitiveness

1. Introduction

Under the new development paradigm, actively promoting the green transformation of trade has become a powerful driving force and an inherent requirement for advancing Chinese-style modernization (Han Jian et al., 2024). In recent years, China's exports of green products have generally shown steady growth. According to the United Nations Commodity Trade Statistics Database (UN COMTRADE), China's green product exports surged from $495.79 billion to $691.64 billion between 2013 and 2022, achieving an average annual growth rate of 3.8%. By 2022, China had surged to become the world's largest exporter of green products, accounting for 16% of global exports in this category and representing 19.2% of China's total merchandise exports. Against a backdrop of deepening global consensus on climate change

and environmental issues, the international low-carbon governance system is undergoing systemic restructuring. Carbon pricing mechanisms, primarily through Emissions Trading Schemes (ETS) and carbon taxes, are being adopted by an increasing number of economies. Meanwhile, the scope and binding strength of environmental provisions in free trade agreements continue to expand. Within this trend, green products have emerged as the most promising category in the global trade landscape.

Green finance, as a key policy tool guiding resource allocation, has become a vital link connecting the "dual carbon" goals with trade competitiveness. In this process, guided by ESG principles, green finance provides targeted support for clean technology R&D and industrial upgrading, directly influencing corporate green production efficiency and the technological content of export products. However, existing research predominantly focuses on the environmental effects of green finance, with insufficient attention paid to its micro-level transmission mechanisms and regional heterogeneity in influencing the export competitiveness of green products. Therefore, this paper aims to explore the transmission channels through which green finance influences the export competitiveness of China's green products, providing theoretical foundations and practical references for optimizing green financial policy tools and promoting high-quality trade transformation.

2. Literature Review

Research on green finance has been explored by scholars from multiple perspectives, including sustainable development, technological innovation, and industrial structure. From a sustainable development perspective, green finance bridges the financial and environmental sectors, aligning with national sustainability strategies (He Qian, 2021). Regarding technological innovation, most studies confirm that green finance significantly promotes green technological innovation (Han Kezhen, 2020) and drives industrial green transformation (Zhu Xiangdong et al., 2021). From an industrial structure perspective, green finance not only drives the growth of the environmental protection industry but also significantly facilitates the ecological transformation of industrial structures (Gao, J.J. & Zhang, W.W., 2021). Regarding measurement methodologies, academia primarily employs two approaches: single-indicator measurement and comprehensive indicator systems. Single-indicator methods often utilize metrics such as total environmentally friendly investment (OECD, 2006) or green credit scale. Comprehensive indicator systems construct evaluation frameworks across multiple dimensions. For instance, Zeng Xuewen et al. (2014) developed a five-dimensional system encompassing green credit and green securities, while Shao Xuefeng and Fang Tianshu (2021) employed the entropy weight method to establish an eight-indicator evaluation system, providing methodological foundations for green finance measurement.

For measuring export competitiveness, Revealed Comparative Advantage (RCA) has

become a mainstream indicator due to its ability to eliminate the impact of economic scale (Balassa, 1965). Scholars have employed this metric to conduct in-depth analyses of China's manufacturing competitiveness (Wei Hao et al., 2005; Zhang Yu and Yan Bing, 2016) . Furthermore, research has expanded dimensions by examining trade network structures (Barrat et al., 2004) and product characteristics such as technological sophistication (Hausmann et al., 2007). However, systematic studies on the export competitiveness of green products remain relatively scarce. Existing analyses are often confined to specific regions or products (Wang et al., 2020), with limited exploration of the impact mechanisms of non-trade factors like green finance.

A review of existing literature reveals that while both green finance and green export competitiveness have yielded substantial findings individually, studies directly integrating the two remain scarce. Existing research primarily focuses on the impact of green finance on overall export trade (Yu, Mao Mao, and Ma, Yan Yan, 2022; Jin, Xiangyi et al., 2022), without delving into its specific mechanisms for enhancing green product export competitiveness. Particularly regarding transmission channels, green finance may exert influence through multiple pathways—such as attracting FDI (Helpman et al., 2004) and stimulating green consumption—yet the precise manifestations and interrelationships of these effects remain under-examined.

To address these research gaps, this paper expands upon existing literature through three key contributions: First, drawing on financing constraint theory and sustainable development theory, it systematically examines the direct impact of green finance on China's green product export competitiveness. This approach broadens the research perspective by integrating green finance with international trade, enriching the understanding of factors influencing green product export competitiveness. Second, through a heterogeneity analysis of the interaction terms between green finance, economic development levels, and foreign direct investment, this study refines the differentiated effects of green finance on enhancing green product export competitiveness across varying contexts. Third, grounded in the practical context of China as a large developing country, this study employs provincial panel data and a multidimensional fixed-effects model for empirical testing. This approach not only provides empirical support for theoretical analysis but also offers targeted policy implications for advancing the green transformation of China's export trade and optimizing its green financial system.

3. Theoretical analysis and research hypotheses

3.1. The Direct Impact of Green Finance on the Export Competitiveness of Green Products

First, as argued by Wang Yao and Xu Nan (2016), green finance establishes a systematic incentive mechanism through differentiated credit policies, special-purpose bonds, and innovative insurance products. This mechanism precise-

ly allocates scarce financial resources away from "brown" industries with strong environmental negative externalities toward green environmental industries and green manufacturing with positive externalities. This targeted capital supply directly alleviates the financing constraints commonly faced by green product manufacturers, particularly small and medium-sized technology enterprises. Enterprises can thus secure valuable capital to introduce advanced production equipment, undertake process upgrades, and enhance product quality, thereby establishing competitive advantages in international markets based on cost efficiency and product differentiation. This mechanism aligns with the core tenet of the "Porter Hypothesis" (Porter & van der Linde, 1995), which posits that appropriate environmental regulations—manifested here as green finance policies—can stimulate innovation compensation effects, ultimately boosting corporate competitiveness.

Second, green finance exerts powerful signaling and reputation-building effects. A robust and active green financial system sends a clear signal to market participants that the government is unwavering in its commitment to sustainable development strategies. Enterprises proactively integrate environmental performance into their strategic core to establish a responsible image among stakeholders and sustain access to preferential financing through green channels. This reputation-based incentive drives enterprises to actively pursue green transformation and technological innovation, thereby forming a self-reinforcing virtuous cycle: "policy-driven → financial support → corporate response → enhanced competitiveness."

However, the expansion of green finance may also be accompanied by potential market frictions and crowding-out effects. Most green projects feature high upfront investment, long payback periods, and significant technological uncertainty, creating substantial tension with traditional finance's pursuit of short-term stable returns. Aghion et al. (2019), examining green innovation financing, note that financial institutions must allocate additional resources for project screening, risk assessment, and post-loan management when funding green initiatives, thereby increasing the financial system's operational costs and complexity. More critically, under relatively stable total financial resources, excessive allocation to green industries may squeeze credit for traditional sectors—particularly enterprises with untapped efficiency potential—creating structural crowding-out effects. While such resource reallocation benefits long-term economic restructuring, it may inflict short-term pain on overall industrial productivity.

In summary, green finance directly empowers green product exporters through its core mechanisms of capital allocation and signal transmission. Its essence lies in the financial system serving the national green development strategy by systematically reorganizing production factors within a market-based framework. Based on this, this paper proposes.

Hypothesis 1: Green finance can significantly enhance the export competitiveness of China's green products.

3.2. The Heterogeneous Impact of Green Finance on the Export Competitiveness of Green Products

The effectiveness of green finance implementation may also vary significantly across regions due to differing developmental conditions. Foreign direct investment (FDI) introduces advanced technologies, management expertise, and international market networks to host countries. In regions with higher concentrations of foreign direct investment (FDI), green finance is more likely to complement FDI, thereby amplifying its role in enhancing the export competitiveness of green products. Concurrently, the level of economic development determines a region's industrial foundation and technological absorption capacity. In regions with higher economic development, green finance is more likely to translate into enhanced export competitiveness through technological innovation and industrial upgrading. Conversely, in less developed areas, its impact may be constrained.

Based on the above analysis, this paper proposes the following research hypotheses:

Hypothesis 2: Foreign direct investment strengthens the promotional effect of green finance on the export competitiveness of green products.

Hypothesis 3: The higher the level of economic development, the more pronounced the promotional effect of green finance.

4. Model Setting and Variable Explanation

4.1. Model Construction

This paper constructs the following three-level fixed-effects panel regression model to examine the impact of green finance on the export competitiveness of green products:

$$\ln(\text{rca\_clean}_{ipt} = \alpha_i + \gamma_t + \delta_p + \beta_1 \cdot \text{green\_finance\_index}_{ipt} + \beta_2 \cdot \text{control\_variables}_{ipt} + \varepsilon_{ipt} \quad (1)$$

The formula specifies:

$\ln(\text{rca\_clean}_{ipt})$ denotes the export competitiveness of the pth green product for the ith province in year t (logarithm of the RCA index); $\text{green\_finance\_index}_{ipt}$ measures the regional level of green finance development; $\text{control\_variables}_{ipt}$ represents a set of control variables; α_i、γ_t、δ_p denote the province, year, and product fixed effects, respectively, controlling for unobservable time-invariant or region (product)-specific factors; $\varepsilon_{ipt}$is the error term, accounting for other unaccounted-for random factors or province-year-level disturbances in the model.

4.2. Variable Selection

4.2.1. Explained variable

The paper uses the export competitiveness of green products as the dependent var-

iable, measured by the logarithmic form of the Revealed Comparative Advantage (RCA) index for green products. Given the lack of a unified international definition for "green products," identification primarily relies on environmental product lists published by international organizations and institutions. Representative lists include environmental product catalogs proposed by the Asia-Pacific Economic Co-operation (APEC), the Organization for Economic Cooperation and Development (OECD), and the World Trade Organization (WTO). These lists aim to promote trade liberalization for environmental goods and advance green economic development.

Specifically, the OECD conducted comparative research on multiple environmental product lists, consolidating them into a single catalog of 255 HS 6-digit coded products. These are categorized into 10 functional groups:①Air pollution control,②Soil and water remediation,③Clean or energy-saving technologies and products,④Environmental monitoring and assessment equipment,⑤Environmentally Friendly Products Defined by End-Use or Disposal Characteristics,⑥Heating and Energy Management Equipment,⑦Solid and Hazardous Waste Management and Recycling Systems,⑧Renewable Energy Equipment,⑨Noise Control Products,⑩Wastewater Management and Drinking Water Treatment Equipment. This paper builds upon the OECD product list, incorporating adjustments and selections based on the trade characteristics of green products and data availability.

Specifically, considering the green attributes of products and their stability in trade data, the following three categories were excluded: The "noise reduction" and "wastewater management and drinking water treatment" categories in the list contain a large number of steel products. Since such products are often used for non-green purposes in practical applications, leading to certain ambiguity in their definition, they were excluded. Certain HS products were excluded due to frequent classification standard adjustments across different years, resulting in significant fluctuations in their export data over time. This volatility hindered continuous panel data analysis. Exports of heavy rail transit equipment are dominated by a handful of enterprises, exhibiting high concentration. Export records are limited to a few provinces like Hunan, Liaoning, and Sichuan, with severe gaps in some years. Despite their energy-saving and environmental attributes, their structural contribution to China's green exports is limited, so they were excluded from the analysis.

Ultimately, this study selected 174 green products, uniformly classified based on the six-digit HS 2007 codes, and constructed a three-level panel dataset of Province × Year × Product. To quantify the export competitiveness of green products, this study employs the Revealed Comparative Advantage (RCA) index proposed by Balassa (1965) as the measurement metric (1). The RCA values are log-transformed to mitigate data skewness and enhance model fitting stability. The RCA formula is:

$$\mathrm{RCA}_{i,j,t} = \frac{X_{i,j,t}/X_{i,\cdot,t}}{X_{\cdot,j,t}/X_{\cdot,\cdot,t}} \qquad (2)$$

where $X_{i,j,t}$ denotes the export value of green product j from province i in year t, $X_{i,\cdot,t}$ represents the total export value of all green products from province i in year t,

$X_{\cdot,j,t}$ indicates the national total export value of green product j in year t, and $X_{\cdot,\cdot,t}$ signifies the national total export value of all green products in year t.

Therefore, the dependent variable used in this study is the logarithm of the green product RCA index, denoted as ln（$\text{rca\_clean}_{\text{ipt}}$）, reflecting each province's relative export competitive advantage for specific green products across different years.

4.2.2. Core Explanatory Variable

The core explanatory variable in this paper is green finance, which refers to financial services provided to sectors such as environmental protection, energy conservation, and clean energy to enhance resource utilization efficiency and improve environmental governance. This aims to redirect resources from high-pollution, high-energy-consumption industries toward advanced technology-driven clean industrial sectors. Currently, China's green finance primarily encompasses green credit, green securities, green insurance, and green investment. Regarding its measurement, academia predominantly employs two approaches: one utilizes a single indicator to measure green finance, while the other constructs a comprehensive indicator system for this purpose. This paper draws upon Huang Wen and Liu Yang (2022), who selected one tertiary indicator from each of the four dimensions—green investment, green insurance, green securities, and green credit—to measure China's green finance development level from 2015 to 2022 using the entropy weight method. The measurement is primarily conducted through the green finance index . This index comprehensively evaluates the regional development levels of financial instruments such as green credit, green securities, and green investment, serving as a key indicator for assessing the advancement of local green finance.

4.2.3. Controlled variable

The control variables in this study include: environmental regulation intensity, degree of openness to foreign investment, infrastructure level, innovation capability level, and consumption capacity. The measurement methods for these variables and descriptive statistics are presented in Table 1.

Table 1. variables and their composition methods

Variable Type	Variable Name	Variable Symbol	Variable Definition
Explained variable	ln_rca_clean	Ln(RCA)	RCA indicators with logarithmic transformation
Core Explanatory Variable	green_finance_index	GFI	Sub-indicators selected and constructed using entropy method
Controlled variable	env_regulation	Env_Reg	Industrial pollution control investment as a percentage of industrial value added
	Openness	Openness	(Total goods imports and exports * USD/CNY exchange rate) as a percentage of regional GDP
	infrastructure_level	Infrastructure	Logarithmic transformation of highway mileage
	innovation_level	Innovation	Logarithmic transformation of domestic invention patent applications accepted
	consumption_level	GDP_pc	Total retail sales of consumer goods relative to

			regional GDP

4.3. Data Sources and Descriptive Statistics

The green finance data in this paper is sourced from authoritative websites of institutions such as the National Bureau of Statistics, the Ministry of Science and Technology, and the People's Bank of China, as well as various authoritative statistical yearbooks. These include national and provincial statistical yearbooks, environmental status bulletins, and specialized statistical yearbooks such as the China Science and Technology Statistical Yearbook, China Energy Statistical Yearbook, China Financial Yearbook, China Agricultural Statistical Yearbook, China Industrial Statistical Yearbook, and China Tertiary Industry Statistical Yearbook. Green product export data was obtained by matching the OECD list with 6-digit customs codes from the 2007 China Customs Trade Database to retrieve provincial green product export values for 2015–2022. For certain products—such as those listed below— In certain years or provinces, exports of specific products were genuinely absent due to policy changes or economic development factors. To maintain data integrity, exports for such products in those provinces and years were recorded as zero. This process yielded 43,152 data points, with all measurements expressed in Renminbi (RMB). Control variable data primarily originates from the China Statistical Yearbook. Descriptive statistics of the sample are presented in Table 2.

Table 2. Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Ln(RCA)	43152	-1.623	2.255	-12.691	7.178
GFI	43152	0.425	0.222	0.001	1
Env_Reg	43152	0.002	0.002	0	0.021
Openness	43152	0.239	0.234	0.008	1.038
Infrastructure	43152	11.741	0.839	9.466	12.913
Innovation	43152	9.795	1.478	4.852	12.399
GDP_pc	43152	0.386	0.074	0.183	0.538

5. Empirical Results and Analysis

5.1. Baseline Regression Results

To examine the impact of green finance on the export competitiveness of China's green products, this study first conducted a baseline regression (Model 1) under a provincial × year × product triple fixed-effects model. This model included only the core explanatory variable—the green finance index—without introducing control variables. Subsequently, control variables such as environmental regulation intensity, degree of openness, infrastructure level, innovation level, and consumption level were added to Model 1 to test the robustness of the results. The regression results are presented in Table 3.

Model 1 shows that the regression coefficient for the green finance index is 0.575, significantly positive at the 1% significance level, indicating that green finance de-

velopment significantly enhances the export competitiveness of green products. After introducing control variables, the regression coefficient for the green finance index slightly decreased to 0.501 but remained positive at the 1% significance level, indicating that the promotional effect of green finance remains robust after controlling for other economic and institutional factors.

Moreover, as shown in Table 3 (Column 2), the regression coefficients for environmental regulation intensity, degree of openness, infrastructure level, innovation level, and consumption level are all positive and mostly statistically significant. This indicates that these factors also play a positive role in enhancing the export competitiveness of green products. Overall, the results of both the benchmark regression and the regression with control variables consistently validate the study's hypothesis H1: green finance can effectively enhance the international competitiveness of China's green products.

Table 3. Regression result of baseline

Variable	(1)	(2)
GFI	0.575**	0.501**
	(0.182)	(0.176)
Openness		0.864**
		(0.268)
Innovation		0.108*
		(0.044)
Infrastructure		0.473*
		(0.187)
GDP_pc		0.787**
		(0.300)
Env_Reg		33.268***
		(6.091)
_cons	-1.868***	-9.023***
	（0.077）	(2.123)
Province	YES	YES
Year	YES	YES
Product	YES	YES
N	43152	43152
R^2	0.280	0.281
“***p<0.01”，“**p<0.05”，“*p<0.10”		

5.2. Robustness Test

The benchmark regression results indicate that green finance development exerts a significant positive impact on green product exports. To further test the robustness of this conclusion, this paper will conduct multi-dimensional verification by replacing the explanatory variables, the dependent variable, and lagging green finance development by 1-2 periods.

5.2.1. Replacing Explanatory Variables

Following Liu Huake(2021), this study replaces the core explanatory variable—the green finance index—with green credit for re-estimation. Column (1) of Table 4 presents regression results after incorporating control variables including environmental regulations, openness to foreign trade, infrastructure level, innovation

level, and consumption level. The regression coefficient for green credit is 3.859, with a marginal significance approaching 10% (p=0.057). The direction remains consistent, still indicating a positive effect. This suggests that after controlling for other economic and institutional factors, the promotional effect of green credit on the comparative advantage of green product exports persists.

Overall, these robustness test results align with the benchmark regression conclusions: the targeted allocation of financial resources to green sectors can enhance the comparative advantage of regional green industries. Furthermore, these findings remain robust even after replacing the green finance measurement indicators.

5.2.2. Changing the Dependent Variable

To further validate the robustness of the baseline regression results, this study replaces the explanatory variable from the logarithm of the green product RCA index to the logarithm of green product export value (ln_export_value). According to the regression results in Column (2) of Table 4, the coefficient of the core explanatory variable, the green finance index , is 0.594, which is significantly positive at the 1% significance level. This indicates that the improvement in the level of green finance development can also significantly promote the growth of green product export value. This result aligns with the direction and significance of the benchmark regression, further validating the robustness of the study's conclusions. Additionally, the intensity of environmental regulation and openness to foreign trade continue to have a significant positive impact on green product exports. Conversely, the coefficients for the infrastructure level, innovation level, and consumption level are insignificant, indicating their limited influence on export value within the current model. In summary, the robustness test results support the findings of the benchmark regression.

5.2.3. The core explanatory variable is lagged by two periods

The regression results in column (3) of Table 4 show that the coefficient of the two-period lagged green finance index (gf_lag2) is 0.609 ($p < 0.001$), indicating that the two-period lagged green finance index has a significant positive impact on the export competitiveness of green products. This suggests that the lagged effects of green finance policies have a positive influence in the medium term, contributing to the enhanced export competitiveness of green products.

Through testing for lagged effects, we confirm that the impact of green finance policies exhibits temporal lags, with their effects gradually manifesting over time. The significance and directionality of the lagged terms provide strong support for our research hypotheses.

Table 4. Robustness Test Results for Independent Variables, Dependent Variables, and Lagged Explanatory Variables

Variable	（1）	（2）	（3）
GFI		0.594**	

		（2.860）	
green_credit	3.859		
	(2.014)		
gf_lag2			0.609***
			(2.79)
Openness	0.892**	3.694**	0.248
	（0.269）	(13.13)	(0.850)
Innovation	0.107*	0.094*	-0.003
	（0.044）	(1.93)	(-0.05)
Infrastructure	0.461*	-0.021	0.169
	（0.187）	(-0.09)	(0.85)
GDP_pc	0.785**	0.077	0.790*
	(0.301)	(0.23)	(1.91)
Env_Reg	33.67***	75.930***	-28.743***
	(6.115)	(10.06)	(-2.93)
_cons	-8.862***	13.783***	-4.177*
	（2.126）	(5.26)	(-1.79)
Province	YES	YES	YES
Year	YES	YES	YES
Product	YES	YES	YES
N	43152	36754	32364
R^2	0.281	0.658	0.291
“***p<0.01”，“**p<0.05”，“*p<0.10”			

5.3. Heterogeneity analysis

5.3.1. Testing the Interaction Term Between Green Finance and Foreign Direct Investment

The first column of Table 5 indicates that the promotional effect of green finance on green product export competitiveness is more pronounced in regions with higher levels of foreign investment development: the coefficient for the interaction term green_finance_index×FDI is 13.748 (p = 0.002). Estimates indicate that the marginal effect of green finance on ln(RCA) is 0.326 + 13.748×FDI. This suggests that for most positive FDI levels in the sample, green finance exerts a significant positive boost on green export competitiveness, with this effect substantially intensifying as FDI increases. This result indicates that foreign capital inflows complement green finance through technology spillovers, management expertise, and international market channels, thereby amplifying the effect of green finance in promoting green exports.

5.3.2. Testing the Interaction Term Between Green Finance and Economic Development Level

We further examine the moderating effect of economic development level on the impact of green finance. Estimation results indicate that the interaction coefficient between green finance and economic development level is 0.4066 (SE = 0.1751, p = 0.021), significant at the 5% level. This suggests that the economic development level significantly amplifies the effect of green finance on the export competitiveness of

green products. The benchmark term for green finance is −4.1032 (SE = 1.9976, p = 0.041), suggesting that at very low development levels, the immediate effect of green finance may be negative. Specifically, when economic development indicators exceed approximately 10.09, the marginal effect of green finance on export competitiveness shifts from negative to positive. This reveals a pronounced dependency in green finance's promotional effect on export competitiveness: at the "lower end" of development, mere financial investment may struggle to translate into export competitiveness in the short term due to insufficient supporting conditions; in more developed regions, green finance can more effectively promote green exports through capital supply, technological upgrading, and market expansion.

Table 5. Heterogeneity Test Results

Variable	（1）	（2）
GFI	0.326	-4.103*
	（0.181）	（1.998）
gfXfdi	13.748**	
	(4.265)	
gfXeconomic_develo~t		0.407*
		（0.175）
Control variables	Control	Control
_cons	-10.321***	-10.405**
	（2.122）	(3.152)
Province	YES	YES
Year	YES	YES
Product	YES	YES
N	43152	43152
R^2	0.281	0.281
"***p<0.01"，"**p<0.05"，"*p<0.10		

6. Conclusion and Policy

6.1. Research Conclusions

This study employs a province-year-product tri-level fixed-effects panel model based on export data for 174 categories of green products across China's 31 provinces from 2015 to 2022. It systematically examines the impact of green finance development on the export competitiveness of China's green products, conducting in-depth analysis through robustness tests and heterogeneity studies. Key findings are as follows: The study reveals that the green finance index exerts a significant positive effect on the log-transformed RCA index of green product export competitiveness, indicating that green finance effectively enhances the competitive edge of green products in international markets. This conclusion remains robust after controlling for a series of variables, confirming that green finance has become a significant driver of green product export competitiveness. Results persist even when substituting core variables or changing the dependent variable, further validating the robustness of green finance's role in enhancing export competitiveness.

Heterogeneity analysis reveals that the promotional effect of green finance on green product export competitiveness varies significantly across different levels of foreign direct investment and stages of economic development.

6.2. Policy Recommendations

Based on the above research findings, this paper proposes the following policy implications: First, continuously improve the green finance system to enhance the international competitiveness of green products. Efforts should be made to further refine the institutional framework for green finance, expand the range of green financial instruments, and improve evaluation and incentive mechanisms for green finance. This will promote the concentration of financial resources in green industries, thereby strengthening the core competitiveness of green product exports. Second, emphasize the coordinated advancement of green finance policies and foreign opening-up policies. In regions with high concentrations of foreign investment, green finance can more effectively complement foreign capital, amplifying its role in promoting green exports. Therefore, while guiding foreign investment toward green industries, governments should strengthen the supply of green financial instruments and enhance financial support for high-quality foreign investment projects. Third, green finance policies should fully consider regional economic development disparities, avoiding a one-size-fits-all approach. In regions with lower economic development levels, efforts should simultaneously improve industrial foundations, technical support, and institutional environments to enhance enterprises' capacity to absorb and transform green financial resources. Conversely, in more developed regions, green finance can further strengthen its guiding role in technological innovation and export upgrading.

Overall, advancing the high-quality development of green finance requires implementing differentiated policy designs at the regional level to better serve the sustained enhancement of green product export competitiveness.

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