

Market-oriented Reform Promotes the Development of Green Finance: Effects and Mechanisms

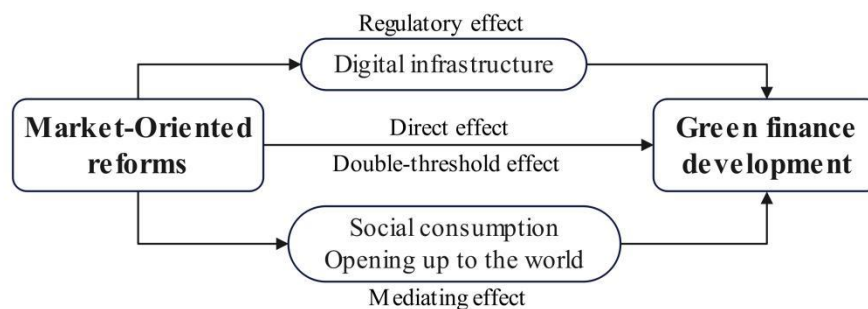
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Graphical abstract



Abstract

Under the 'dual carbon' goals, there is an urgent need for an in-depth analysis of the institutional drivers of green finance development. Using China's provincial panel data from 2000 to 2023, this study systematically examines the impact of market-oriented reforms on the development of green finance. The findings suggest that market-oriented reforms can significantly promote the development of green finance, a conclusion that remains valid after multiple robustness tests. Heterogeneity analysis reveals that this effect is more pronounced in eastern and north-eastern regions, as well as in provinces with lower levels of marketisation. Mechanism tests demonstrate that market-oriented reforms indirectly empower green finance through two pathways: driving social consumption upgrades and enhancing openness to the outside world. Meanwhile, digital infrastructure plays a positive moderating role in this process. Further threshold analysis shows that the effects of market-oriented reforms have a dual-threshold characteristic: their catalytic effect is significantly amplified only when the level of marketisation exceeds a critical threshold, after which it increases marginally. This study provides empirical support and policy insights for the coordinated advancement of market-oriented reforms and the development of a green finance system.

Keywords: Marketization; Green finance; Consumption level; Opening up; Digital infrastructure

1. Introduction

Driven by the synergistic advancement of the 'Dual Carbon' goals and the sustainable development strategy, green finance has attracted significant attention regarding its development trajectory as the core hub for directing resources towards low-carbon sectors. In recent years, China's green finance sector has experienced explosive growth. According to data from the People's Bank of China, the outstanding balance of green loans in both domestic and foreign currencies was 30.08 trillion yuan at the end of 2023. This represented year-on-year growth of 36.5%, or an increase of 8.48 trillion yuan compared to the beginning of the year. Wind statistics show that a total of 802 green bonds were issued during the year, valued at 1.118 trillion yuan in total. In 2023, the trading volume and value of carbon emission allowances (CEAs) reached 212 million metric tonnes and 14.444 billion yuan respectively, marking substantial year-on-year increases of 317% and 416% respectively. China has established the world's largest green credit and green bond markets. However, behind this rapid expansion, structural contradictions are becoming increasingly apparent. On the one hand, instances of 'greenwashing' are frequent, with some green financial products failing to live up to their claims due to vague performance-linked transition targets and inadequate information disclosure. On the other hand, there are discrepancies between local and industry green standards, and corporate environmental disclosure rates remain low. This leads to misallocation of green capital due to insufficient data authenticity and comparability. These issues stem from the fact that green finance development relies heavily on administrative impetus and policy guidance, while a market-based pricing mechanism has yet to truly take shape. As global climate risks intensify, the physical and policy risks faced by enterprises significantly influence their financial asset allocation behaviour (Ding et al., 2025). Meanwhile, increased disclosure of net-zero transition risks widens bond credit spreads, raising the cost of green financing (Sun et al., 2025). These empirical findings suggest that climate-related risks are being transmitted through financial markets to corporate financing, further exacerbating the paradox between 'market-driven' and 'government-led' approaches to the development of green finance. While administrative measures have driven expansion in scale, a system lacking endogenous market momentum struggles to achieve sustainable development of a high quality.

In fact, market-oriented reforms generate an inherent demand for green finance by reshaping the pricing of factors and competition mechanisms. From a practical perspective, however, China's market-oriented reform process remains uneven. According to the 2023 Market-Oriented Reform Index, only 11 provinces saw an increase in their scores. Changes in key dimensions, such as 'the relationship between government and the market', 'the development of the non-state-owned economy', and 'the level of development of factor markets', remain unsatisfactory. Significant disparities in the level of market-oriented reform persist across regions. This imbalance provides a natural basis for studying the relationship between market-oriented reforms and the development of green finance. However, the complex transmission mechanisms and non-linear relationships between the two remain an unsolved 'black box'. Against the backdrop of rapid expansion in the scale

of green finance and insufficient endogenous momentum, coupled with the deepening of market-oriented reforms and pronounced regional disparities, there is an urgent need for a systematic examination of the effects and mechanisms of market-oriented reforms on the development of green finance, from both theoretical and practical perspectives.

This paper has two key theoretical aspects. Firstly, it overcomes the limitations of traditional research that focuses solely on external policy drivers by revealing the direct institutional dividends of market-oriented reforms in driving the development of green finance from the perspectives of resource allocation and price signal correction. Secondly, it establishes a dual-mediated pathway involving 'consumption upgrading' and 'opening up', elucidating how reforms indirectly empower green finance by stimulating domestic demand and introducing international standards. This deepens our understanding of the transmission mechanisms of institutional change. In practical terms, given the profound transformation of the financial landscape by digital technology (Wang and Ren, 2025), this study incorporates digital infrastructure into its analytical framework. It explores how digital infrastructure enhances the efficiency of market-oriented reforms in resource allocation. This provides a basis for decision-making in addressing information asymmetry and insufficient coverage in green finance practices.

The innovative aspects of this paper are primarily reflected in the following. Firstly, in terms of the research perspective, it moves beyond traditional fintech-oriented approaches to establish a comprehensive logical chain encompassing 'institutional reform–market response–green finance', demonstrating the dual threshold effect of the level of marketisation as an 'institutional converter'. This expands the scope of institutional economics in the field of green finance. Secondly, in terms of mechanism exploration, it innovatively integrates social consumption upgrading and opening-up into a unified intermediary framework. It also introduces digital infrastructure as a key contextual variable and reveals the pattern of synergistic evolution through which the deep integration of market-oriented reforms and digital technologies drives green financial development.

2. Literature review

2.1. Factors influencing green finance

Existing literature suggests that the factors influencing the development of green finance can be categorised into three main themes: technological empowerment, the institutional environment and socio-economic foundations.

At the technological empowerment level, research consistently confirms that digital technology is a key driver of green finance development. Fintech significantly boosts green credit growth by enhancing the risk management and operational capabilities of financial institutions (Wan et al., 2023). Its specific mechanisms include improving financial efficiency and fostering green innovation (Xu et al., 2025), while blockchain technology reduces credit risks and regulatory complexity by establishing novel governance frameworks (Jin and Zhao, 2019). Furthermore, spatially-based studies reveal that the impact of fintech on green finance exhibits spatial spillover effects

(Wang et al., 2023a).

At the institutional and policy level, both formal and informal institutions play a crucial role. Public environmental oversight, as an informal, bottom-up constraint, optimises the allocation of green resources from the supply side and drives green transformation among enterprises from the demand side. This fosters the development of green finance (Zhuang et al., 2025). Public environmental concern indirectly promotes the development of green finance by strengthening government environmental regulations (Liu and Yuan, 2024). In terms of formal policies, the synergy between low-carbon city initiatives and intellectual property demonstration city policies creates high-quality green patent signals which effectively stimulate green finance (Cheng and Tang, 2024).

At the fundamental socio-economic level, the level of economic development, financial deepening and innovation capacity serve as crucial supporting factors. Studies indicate that regional GDP, financial relevance ratios and levels of technological innovation have a significant positive impact on the development of green finance in provinces along the Belt and Road (Qiao et al., 2021). Furthermore, higher levels of openness, urbanisation and social consumption provide favourable external conditions for the effective realisation of digital technologies or policy outcomes (Qin et al., 2023).

2.2 Impacts of Market-Oriented Reforms

As a profound institutional transformation, market-oriented reform has multidimensional and complex effects on economic activities. Extensive research confirms that the marketisation process significantly enhances efficiency by optimising resource allocation. For example, Lu and Wang (2022) discovered that land market reforms notably improved the efficiency with which industrial land was utilised by identifying higher-quality enterprises. Similarly, Yue et al. (2023) demonstrated that developing product and factor markets alleviates financing constraints and stimulates competitive effects, robustly driving innovation in manufacturing firms. Zhou and Li (2021) also confirmed that market-oriented reforms substantially improve energy efficiency in the manufacturing sector.

Market-oriented reforms have profoundly reshaped the allocation patterns and value realisation of production factors. Qian's (2025) research shows that de-administratization reform in the labour market has reduced the misallocation of human capital and enabled greater talent mobility. Yue et al. (2026) found that marketisation significantly increased the domestic value-added rate of export enterprises by raising their cost-plus margins and optimising the allocation of intermediate goods. However, these reforms have also brought structural adjustment pains. Wang and Zhang's (2025) model shows that, although reducing entry barriers for private enterprises and financial constraints stimulated growth, this initially exacerbated wealth inequality due to higher savings rates among entrepreneurs - a trend that only subsided after the economy surpassed the inflection point of the Kuznets curve.

Moreover, the effects of marketisation are neither singular nor universal; they are

often constrained by other institutional factors. For example, the positive impact of marketisation on land efficiency is reduced in enterprises with strong government-enterprise relationships (Lu and Wang, 2022). Furthermore, market reforms in developed coastal regions have a more significant impact on curbing industrial land expansion and enhancing efficiency than in inland areas (Pu and Zhang, 2022). Concurrently, Li et al.'s (2019) study shows that marketisation gives micro-level entities more operational flexibility, which could increase the energy rebound effect, revealing another aspect of marketisation's effectiveness.

2.3. The relationship between market-oriented reforms and the development of green finance

The rise of green finance stems from a re-evaluation of traditional financial models that neglect ecological costs. Market-oriented reforms have played an increasingly critical role in this evolution. Existing research focusing on dimensions such as institutional competition, market structure and factor pricing has revealed the complex logic by which market forces are reshaping the landscape of green finance. The incentive effects of green credit policies are not independent, but highly dependent on the maturity of the market-oriented environment. In regions where information flows smoothly and price signals are responsive, the resource allocation function of credit is significantly enhanced and the marginal utility of policies is amplified, indicating that marketisation is the key moderating variable through which policy effectiveness is realised (Yao and Xu, 2023). From a banking systems perspective, increased competition, as measured by the HHI index, can significantly drive regional green finance development. This is achieved by enhancing banks' capacity to evaluate green projects and their willingness to provide credit, while lowering entry barriers to attract green entities to the market (Xiang and Ma, 2025). Market-based tools facilitate price discovery and risk transfer through mechanisms such as emissions trading and environmental derivatives. This internalises ecological and environmental externalities, improving the availability and liquidity of funding for green projects. However, there is a structural contradiction between the long-term nature of ecological conservation and financial capital's preference for short-term liquidity (Wang and Zhi, 2016). Furthermore, micro-level evidence indicates that market competition encourages firms to adopt green finance and product-oriented green innovation because these can generate financial returns more quickly and reduce firms' demand for a transition risk premium. Consequently, product-oriented green innovation exerts a more direct driving effect than deep ecological technological innovation (Ben Belgacem et al., 2026). In summary, competitive market structures facilitate the adoption of green finance and product-oriented green innovation by improving the information environment, optimising credit allocation and attracting green actors to enter the market.

2.4. Literature review

Although existing research has provided a solid basis for understanding the development of green finance, there is scope for further research in three key areas.

Firstly, while most studies focus on technological enablement or external policy incentives, few reveal the endogenous logic driving green finance by starting from the institutional core of market-oriented reform. Secondly, a unified intermediary framework is still lacking to examine how market-oriented reform indirectly influences green finance through intermediate channels, such as consumption upgrading and opening up to the outside world. Thirdly, insufficient attention has been paid to the contextual effects of digital infrastructure in the transmission of reforms, and to the non-linear threshold characteristics of the level of marketisation itself.

The marginal contributions of this paper are as follows: First, moving beyond the traditional 'policy-response' paradigm, we present a comprehensive 'institutional reform-market response-green finance' chain, verify the dual threshold effects of market-oriented reform as an institutional converter and reveal its law of increasing marginal returns. Second, by incorporating social consumption upgrades and opening up innovatively into the dual intermediary pathway, and by introducing digital infrastructure as a moderating variable, we characterise the synergistic empowerment mechanism resulting from the deep integration of institutional reform and digital technology. Third, based on regional heterogeneity and threshold grouping, we provide an empirical basis for differentiated policy design across different marketisation stages, thereby expanding the application of institutional economics in the field of green finance.

3. Theoretical analysis

3.1. The direct effects of market-oriented reforms on the development of green finance

Market-oriented reforms focus on enabling price and competition mechanisms to play a decisive role in resource allocation. This provides an intrinsic and direct driving force for the development of green finance. Firstly, such reforms optimise resource allocation directly, establishing a market foundation for green finance. By correcting price distortions in factor markets, reforms ensure that resource prices accurately reflect market supply and demand dynamics, as well as resource scarcity (Hu and Du, 2025). This compels traditional, energy-intensive, and polluting enterprises to either pursue green transformation or exit the market due to rising costs. It also creates a more equitable competitive environment for green industries and projects. Secondly, market-oriented reforms correct price signals by internalising environmental externalities into corporate costs. In a well-functioning market economy, clear property rights systems and mechanisms for internalising environmental costs transform environmental impacts such as carbon emissions from free externalities into tangible economic costs. This directly generates substantial market demand for green technologies, products and financial services, transforming sustainable development from passive corporate social responsibility into proactive competitive advantage. Finally, the fair competitive environment fostered by market reforms incentivises companies to gain a competitive edge through green innovation. Market-driven strategies compel businesses to closely monitor customer trends and competitor

activities. As public awareness of green consumption grows, so does market demand for green products. In order to meet these demands and gain a competitive edge, companies will proactively increase their investment in green R&D and pursue technological innovation. This endogenous innovation drive, which is rooted in market mechanisms, is more effective and enduring than relying solely on government subsidies or administrative mandates. It provides a continuous stream of high-quality investment projects and asset opportunities for green finance. Accordingly, this paper proposes the following hypothesis:

Hypothesis 1: Market-oriented reforms can significantly promote the development of green finance.

3.2. The mediating effect of social consumption

Market-oriented reforms impact the supply side of green finance directly and indirectly, the latter occurring through the stimulation of social consumption upgrades. The expansion and optimisation of the structure of household consumption provide a foundation of demand and market space for green finance.

Firstly, market-oriented reforms have significantly increased the level of household consumption upgrades and generated positive spatial spillover effects (Zhao and Zhang, 2025). This upgrading of consumption manifests as a shift towards service-oriented and environmentally friendly consumption patterns, with increased demand for low-carbon products such as energy-efficient appliances, new energy vehicles and green buildings. This has increased demand for supporting financial products such as green loans and green bonds, compelling financial institutions to innovate in green financial services. Secondly, interest rate liberalisation has increased real deposit rates, improving households' expectations regarding property income and future disposable income and thus boosting current consumption growth. Rising incomes and improved consumer confidence encourage households to spend more on green durable goods, while intensified financial competition driven by interest rate liberalisation prompts banks to develop specialised green consumer credit products and reduce financing costs for green consumption. Finally, greater marketisation has mitigated the negative impact of child and elderly dependency ratios on consumption, optimising household consumption structures. Improvements to social security systems have led to a decrease in household precautionary savings and an increase in consumption propensity, particularly in developmental expenditure such as education, healthcare and culture - areas that are closely aligned with green principles. The green transformation of household consumption patterns further directs financial resources towards low-carbon sectors. In summary, market-oriented reforms have a mediating effect on social consumption via the chain of consumption upgrading → green demand → financial supply. For this reason, this paper puts forward a second hypothesis.

Hypothesis 2: market-oriented reforms drive the development of green finance by boosting social consumption.

3.3. The mediating effect of opening up to the outside world

Market-oriented reforms directly drive the development of green finance and also have an indirect mediating effect by enhancing openness levels. Firstly, market-oriented reforms lay the groundwork for increased openness. The marketisation process, centred on developing the non-state sector and refining market systems, effectively facilitates the free flow of goods and factors, significantly boosting a region's economic openness. In the context of green finance, market-driven price discovery mechanisms and the principle of competitive neutrality more accurately reflect the environmental externalities of green projects. This attracts international capital seeking long-term, sustainable returns, while also establishing an institutional framework for opening up. Secondly, high levels of openness are critical drivers of green finance development. While foreign direct investment has heterogeneous effects on total factor productivity, increased trade and technological spillovers can significantly enhance efficiency. In the context of green finance, this means that 'bringing in' enables the adoption of advanced international green investment concepts, environmental risk management technologies and standardised green financial products, while 'going global' broadens the international market reach of green industries and compels domestic green finance standards to align with international norms. Ultimately, market-oriented reforms facilitate the efficient integration of domestic and foreign green capital and technologies through enhanced openness, creating a virtuous cycle of 'deepened reforms → upgraded openness → thriving green finance'. Based on these insights, this paper proposes a third hypothesis. Hypothesis 3: Market-oriented reforms promote the development of green finance by encouraging openness.

3.4. The positive regulatory effects of digital infrastructure

The effectiveness of market-oriented reforms in promoting the development of green finance hinges on robust digital infrastructure. As a core component of "new infrastructure," digital infrastructure positively influences the relationship between market-oriented reforms and green finance development across at least three key dimensions.

First, digital infrastructure amplifies the disclosure effects of market-oriented reforms. One of the main obstacles to green financial activities is information asymmetry. The effectiveness of the disclosure mechanisms required by market-oriented reforms depends directly on the efficiency and breadth of information dissemination. Digital infrastructure enables the transmission and diffusion of information, enhancing transparency and allowing external investors to promptly and accurately obtain corporate profile information. Consequently, corporate environmental responsibility information and green project data can transcend temporal and spatial constraints and be delivered to investors at minimal cost. This strengthens the effectiveness of market-oriented reform policies and provides a robust informational foundation for green asset pricing and investment decisions.

Second, digital infrastructure provides the technological foundation for financial innovation driven by market-oriented reforms. These reforms encourage innovation in

financial instruments through deregulation, and digital inclusive finance is a prime example of this process. Robust development of digital infrastructure is essential for advancing digital inclusive finance because it significantly enhances coverage, accessibility, and digitization levels. With comprehensive facilities such as 5G, big data, and cloud computing, financial institutions can reduce their reliance on traditional physical branches. They can also more accurately identify the financial needs of green industries and develop green financial products with lower entry barriers. This effectively transforms the institutional dividends generated by market-oriented reforms into financial momentum for green industry development.

Third, developing digital infrastructure expands the reach of green financial services and enhances the inclusiveness of market-oriented reforms. A quasi-natural experiment study based on the "Universal Telecommunications Service Project" found that implementing digital infrastructure in remote rural areas significantly improves household access to information and financial literacy, thereby promoting financial inclusion. Similarly, extending digital infrastructure to regions with weak traditional financial services enables broader economic entities to participate in the green finance system, lowers participation barriers, and ensures that the benefits of market-oriented green finance reforms reach the "long-tail population." Accordingly, this paper proposes the fourth hypothesis.

Hypothesis 4: Digital infrastructure can positively moderate the impact of market-oriented reforms on green finance development.

3.5. The threshold effect of the level of marketization

The catalytic effect of market-oriented reforms on green finance is not linear. Rather, it exhibits distinct threshold characteristics. In other words, reform measures can only effectively unlock the development potential of green finance when the degree of marketization exceeds a specific critical level. Before this point is reached, institutional provisions struggle to translate into substantial market expansion.

This nonlinear relationship stems from the interactive constraints between the quasi-public nature of green finance and market-based conditions. At low marketization levels, issues such as distorted factor prices, unclear property rights, and externalized environmental costs are particularly pronounced. Despite the introduction of green credit guidelines or environmental disclosure requirements, financial resources tend to flow into high-carbon sectors offering clear short-term returns. This occurs because price signals fail to adequately reflect the positive externalities of green projects and the negative externalities of brown assets. Meanwhile, environments with low marketization levels typically involve strong administrative intervention inertia. Financial institutions engage in green activities primarily due to compliance pressures rather than intrinsic incentives. This leads to green finance development easily falling into a low-level equilibrium characterized by "scale without efficiency."

Fundamental transformations occur when the marketization process transcends institutional barriers. Product and factor markets mature, enabling core parameters such as interest rates, energy prices, and emission rights pricing to reflect resource

scarcity and environmental constraints more accurately. This allows for the effective valuation of green projects' risk-return profiles, empowering financial institutions to identify long-term value in green assets within commercial sustainability frameworks. On the other hand, intensified market competition and stricter soft budget constraints compel institutions to shift from expanding in scale to specialized differentiation, making green finance a proactive driver of profit growth. Simultaneously, improvements in legal frameworks, information transparency, and contract enforcement efficiency reduce the costs and uncertainties of green investments, ensuring the implementation of reform policies. Thus, marketization serves as both an external condition for reform effectiveness and an "institutional converter," integrating environmental positive externalities with capital profitability. Only by overcoming this threshold can market-oriented reforms evolve from mere incentive mechanisms into the core driver of green finance's endogenous development, achieving comprehensive advancements in scale, quality, and efficiency. Based on the above analysis, this paper proposes the fifth hypothesis.

Hypothesis 5: Market-oriented reforms have a nonlinear impact on the promotion of green finance.

4. Research design

4.1. Model construction

(1) Benchmark model. In order to examine the impact of market-oriented reforms on the development of green finance and avoid the influence of provincial and temporal variations on the estimation results, this paper adopts Pham et al.'s (2025) methodology to construct a two-way fixed-effects model for benchmark regression. The model specification is shown in Equation (1).

$$GF_{it} = \alpha_0 + \alpha_1 mar_{it} + \alpha_2 X_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (1)$$

In this model, GF represents the dependent variable, measuring the level of green finance development across provinces, while mar serves as the core explanatory variable, indicating the degree of marketisation in each province. The X denotes a set of control variables, i stands for cities and t denotes time. The study covers the period from 2000 to 2023. The μ_i and ν_t represent provincial and year-specific fixed effects, respectively. The ε_{it} is the disturbance term.

(2) Mediation effect testing model. In order to further examine whether the level of social consumption and the degree of openness to the outside world play a mediating role, this paper employs the stepwise regression method developed by Baron and Kenny (1986), adding Models (2) and (3) to Equation (1) for verification.

$$Med_{it} = \beta_0 + \beta_1 mar_{it} + \beta_2 X_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (2)$$

$$GF_{it} = \gamma_0 + \gamma_1 mar_{it} + \gamma_2 med_{it} + \gamma_3 X_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (3)$$

Here, Med serves as the mediating variable, representing the level of social consumption (*con*) and openness (*open*), respectively. The remaining variables align

with equation (1). The estimation results show that α_1 represents the total effect of market-oriented reforms on green finance development, and that γ_1 represents their net effect. The β_1 and γ_2 quantify the mediating effects of these variables in the process by which market-oriented reforms influence green finance development.

(3) Moderation effect testing model. In order to further examine whether digital infrastructure moderates the effect of market-oriented reforms on the development of green finance, this paper presents a moderation model based on the methodology of Hussain and Zhang (2025), as illustrated by Equation (4).

$$GF_{it} = \delta_0 + \delta_1 mar_{it} + \delta_2 DI_{it} + \delta_3 mar_{it} \times DI_{it} + \delta_4 X_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (4)$$

Here, DI represents the digital infrastructure level in province i in year t , while $mar \times DI$ denotes the interaction term between the level of marketisation and the level of digital infrastructure. The moderating effect examines the direction of δ_3 : a significantly positive δ_3 coefficient indicates a positive moderating effect of digital infrastructure in the benchmark model, whereas a significantly negative δ_3 coefficient suggests a negative moderating effect.

(4) Threshold effect testing model. As the impact of market-oriented reforms on the development of green finance may be non-linear, this paper uses the method of constructing threshold effect models proposed by Hansen (1999) and Teng et al. (2024). This method is used to develop a threshold effect model with the level of marketisation as the threshold variable, as shown in Equation (5).

$$GF_{it} = \lambda_0 + \lambda_1 mar_{it} \times I(mar_{it} < \varphi_1) + \lambda_2 mar_{it} \times (mar_{it} \geq \varphi_1) + \lambda_3 X_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (5)$$

In equation (5), $I(\bullet)$ denotes the indicator function, taking the value 1 when the variable falls within the interval enclosed by parentheses and 0 otherwise. Φ represents the threshold value of the threshold variable. The remaining symbols are defined as in Equation (1).

4.2. Variable description

4.2.1. Dependent variable: Green finance (GF)

A comprehensive evaluation system for green finance development is constructed across seven dimensions (green credit, green investment, green insurance, green bonds, green support, green funds and green equity) based on the methodology of Zhao and Cui (2025). The proportion of environmental protection project loans in total credit volume is used as an indicator of green credit. The ratio of environmental pollution control investments to GDP as an indicator of green investment. The share of environmental pollution liability insurance revenue in total insurance income as an indicator of green insurance. The proportion of green bond issuance volume relative to total bond issuance as an indicator of green bonds. The share of fiscal environmental protection expenditures in general budget spending as an indicator of green support. The market capitalisation ratio of green funds as an indicator of green funds, and the aggregate transaction value of carbon trading, energy use rights trading, and emission rights trading divided by total equity market transactions as an indicator of green equity. Based on these sample data and employing the entropy method, a

Green Finance Index is constructed to measure the level of green finance development.

4.2.2. The core explanatory variable

Market-oriented reform (*mar*). The 'China Provincial Market-Oriented Index Report (2021)' by National Economic Research Institute in Beijing provides an effective characterisation of market-oriented reform progress across provinces. Therefore, this paper measures the level of marketisation using a marketisation index. Data from before 2019 is drawn from the China Provincial Marketisation Index Report (2021), while data from 2019 onwards is extrapolated using the geometric mean of the growth rates over the past five years (Sun et al., 2023; Hu et al., 2026). This index is widely used in the study of China's market-oriented reforms and their advancement. According to the Beijing National Economic Research Institute's official website, the China Provincial Market-Oriented Index (abbreviated to 'Market-Oriented Index') is a system of indices that measures the relative degree of marketisation in each province nationwide. While it assesses relative progress rather than absolute levels of marketisation, the indices are designed to be broadly comparable both horizontally (between provinces) and vertically (across annual data for individual provinces). As market-oriented reforms are ongoing and many aspects have yet to be fully implemented, the process is ongoing. Vertically, the Market-Oriented Index effectively reflects the outcomes of deepening market reforms, and horizontally it indicates the relative intensity of such reforms. Therefore, this paper employs the Market-Oriented Index as a proxy variable for market-oriented reform. To denote the status of these reforms, the level of marketisation is used directly as the indicator for market-oriented reform variables throughout the subsequent analysis.

4.2.3. Mediating Variables

First, social consumption level (*con*). This paper follows the approach outlined by Li et al. (2025) and uses the level of social consumption as a mediating variable. The total retail sales of consumer goods serves as a key indicator reflecting the scale and development level of the consumer market. An increase in retail sales signifies elevated household consumption levels and improved quality of life, indicating consumption upgrading that facilitates industrial transformation. Both consumption upgrading and industrial upgrading exert significant impacts on green finance development. This study measures social consumption level using the ratio of retail sales to GDP. Second, degree of openness (*open*). Higher regional openness not only effectively attracts foreign green technology enterprises, thereby enhancing domestic demand for green financial services, but also promotes export of local products. Foreign consumers' preference for high-quality products drives domestic firms to strengthen technological innovation and develop premium green products, further expanding demand for green finance. This study uses the ratio of regional import-export trade volume to GDP to measure openness (Xie and Wang, 2022).

4.2.4. Regulatory variable

Digital Infrastructure Level (*DI*). According to China's "Classification of Strategic

Emerging Industries (2018)", new-type digital infrastructure includes the next-generation information network industry, as well as internet and cloud computing, big data services, artificial intelligence, and smart terminal industries. These are categorised under next-generation information technology and high-end equipment manufacturing. As emerging sectors within the modern economic system, most of these industries are still in their infancy, characterised by significant investment, lengthy return cycles and the open sharing of R&D results. Consequently, at this stage, governments are the primary force in providing financial support, stimulating corporate R&D efforts and advancing the construction of new-type digital infrastructure. Accordingly, this study uses the frequency with which new-type digital infrastructure is mentioned in provincial government work reports as an indicator of its level of development (Chao, et al., 2021; Liu, 2026). Similar to the Baidu Search Index, the frequency with which new-type digital infrastructure is referenced in government reports reflects regional demand, enabling status tracking and trend forecasting, and providing a partial reflection of the region's progress in this field (Sheng et al., 2020). The specific calculation methodology is as follows: First, provincial government work reports from 2000 to 2023 are collected and analysed to identify terms related to new-type digital infrastructure. Then, use Python software to tokenise the reports and count the total vocabulary and number of infrastructure-related terms, and subsequently calculate their respective proportions. Finally, due to the strong correlation between the number of information-related employees in each province and the development of new digital infrastructure, we analysed the frequency distribution of terms related to new digital infrastructure by calculating the proportion of employment in information transmission, software and IT services relative to the total employed population. The resulting product of these two metrics serves as an indicator of each province's progress in developing new digital infrastructure.

The list comprises 51 terms related to new digital infrastructure. 5G; mobile communications; information technology; the information economy; information infrastructure; big data; digitisation; the digital industry; cloud computing; the internet; the Internet of Things (IoT); artificial intelligence; robotics; intelligent manufacturing; smart equipment; the smart economy; smart factories; data centres; smart cities; cloud services; cloud technology; virtualisation; cloud applications; cloud platforms; blockchain; smart terminals; cloud computing; e-government; internet finance; mobile payments; digital transformation; e-commerce; online operations; e-commerce platforms; information services; autonomous driving; intelligent technologies; network technologies; software technologies; information technology; communication technologies; electronic technologies; computer technologies; network technologies; software; intelligent technologies; the information industry; software engineering; digital technologies; and data technologies.

4.2.5. Control variables

This paper selects the following five indicators as control variables, drawing on existing research (Wang et al., 2025).

Regional economic development level (*pgdp*). Economic development is a prerequisite and foundation for green finance development. It is only when a region has achieved a high level of economic development that residents' incomes and consumption can continue to rise. This leads to higher demands for living standards and environmental quality, thereby fostering regional demand for and growth in green finance. This study measures economic development using the logarithm of per capita GDP across provinces.

The degree of government intervention (*gov*). One means by which the government conducts macroeconomic regulation is fiscal expenditure. When the government uses fiscal expenditure tools appropriately to intervene in the market, it can enhance factor mobility and the efficiency of resource allocation, mitigate market failures effectively, strengthen positive economic externalities and promote high-quality regional economic development. However, excessive government intervention can lead to resource misallocation and hinder high-quality economic development. This paper measures the degree of government intervention using the ratio of government fiscal expenditure to GDP.

The scale of financial development (*fin*). An expanded financial development scale provides ample funding and a robust market foundation for green finance, driving the growth of products such as green loans and green bonds. Meanwhile, the resulting resource aggregation effect reduces financing costs for green projects and directs capital towards low-carbon and environmentally friendly sectors. The scale of financial development is measured by the proportion of added value from the financial industry to GDP in each province.

Population density (*pop*). The concentration of capital, technology, and talent in urban areas increases environmental pressure and stimulates demand for green products and services. It also expands the market and enhances the implementation of policies, all of which facilitate the innovation and deployment of green credit products, bonds, funds, and related offerings. Population density is measured as the ratio of a city's permanent resident population at the end of the year to its land area.

Urbanisation level (*urb*). An increase in urbanisation heightens the demand for financing and investment in green infrastructure and environmental protection facilities, creating application scenarios and market opportunities for green finance. Meanwhile, population and industrial concentration drive the green transition, prompting financial institutions to innovate green products. Urbanisation level is measured by the ratio of the registered urban population to the total permanent resident population within a region.

The names, abbreviations and calculation descriptions of these variables are shown in Table 1.

Table 1. Variable Description.

Type of variable	Variable Name	Variable abbreviation	Variable Calculation Explanation
Explained variable	Green finance	<i>GF</i>	Establish a metric system for calculation
Core Explanatory	General adoption of	<i>mar</i>	Marketization Index Measurement

Variable	the market principle		
Metavariable	Social consumption	<i>con</i>	The proportion of retail sales of consumer goods in GDP
	Open door to the outside world	<i>open</i>	The proportion of total import and export trade volume to GDP
Regulated variable	The Digital Foundation Society	<i>DI</i>	The proportion of word frequencies related to new digital infrastructure in the Government Work Report
Controlled variable	Economic Development	<i>pgdp</i>	Per capita GDP
	Government intervention	<i>gov</i>	The proportion of government fiscal expenditure to GDP
	Financial Scale	<i>fin</i>	The proportion of the added value of the financial industry to GDP
	Density of population	<i>pop</i>	The ratio of the permanent urban population to the urban land area
	Urbanization	<i>urb</i>	The proportion of the registered urban population to the total permanent resident population in the region

4.3. Data sources and descriptive statistics

Due to the availability of research data and consistent statistical methodologies, this study has selected the period from 2000 to 2023 as its timeframe. However, considering the significant data gaps in Hong Kong, Macao and Taiwan, these regions were excluded. The final selection of research subjects was therefore limited to 31 provincial-level administrative units within China. The empirical analysis primarily relies on data from China and regional statistical yearbooks. Original sources include the China Statistical Yearbook, the China Environmental Statistical Yearbook, and the statistical yearbooks of various Chinese provinces. Descriptive statistics for the main variables used in this study are presented in Table 2.

Table 2. Descriptive statistics of variables.

Stats	N	Min	Mean	p50	Max	SD
<i>GF</i>	744	0.0533	0.2750	0.2740	0.6640	0.1250
<i>mar</i>	744	-0.1610	7.1010	7.1790	13.3600	2.4050
<i>con</i>	744	0.1810	0.3730	0.3720	0.6100	0.0656
<i>open</i>	744	0.0076	0.2950	0.1370	1.7110	0.3490
<i>DI</i>	744	0	0.0463	0.0279	0.6400	0.0613
<i>pgdp</i>	744	7.9230	10.2600	10.4200	12.2100	0.8910
<i>gov</i>	744	0.0691	0.2460	0.2030	1.3540	0.1830
<i>fin</i>	744	0.0103	0.0584	0.0535	0.1980	0.0322
<i>pop</i>	744	5.2260	7.6500	7.7450	8.7490	0.6690
<i>urb</i>	744	0.2010	0.5310	0.5290	0.8960	0.1590

5. Empirical testing

5.1. Basic regression results

This study uses a fixed-effects model to estimate parameters, while also presenting random-effects model results as a control to enhance the robustness of the estimates. The baseline regression results are presented in Table 3. Columns (1) and (2) show the fixed-effects estimates and columns (3) and (4) show the random-effects estimates. Column (1) examines solely the relationship between market-oriented reforms and green finance development. The fixed-effects estimate in this column reveals a significantly positive coefficient at the 1% significance level. This indicates that market-oriented reforms substantially promote green finance development. Subsequently, control variables were introduced to test the stability of this effect, as shown in column (2). The regression results in columns (1) and (2) suggest that, while the absolute magnitude of the market-oriented reform coefficient decreases, reflecting a reduced impact on green finance development, the addition of control variables does not alter its sign or significance. This confirms the persistent positive influence of market-oriented reforms. Similarly, the random-effects model estimates confirm a significant causal relationship between market-oriented reforms and green finance development. Therefore, a robust causal relationship exists between market-oriented reforms and green finance development in China, thus validating Hypothesis 1.

Table 3. Basic regression results.

Variable	(1)	(2)	(3)	(4)
<i>mar</i>	0.0133*** (0.0017)	0.0109*** (0.0017)	0.0369*** (0.0012)	0.0333*** (0.0036)
<i>pgdp</i>		-0.0305*** (0.0105)		-0.0037 (0.0118)
<i>gov</i>		-0.1540*** (0.0185)		-0.0319 (0.0292)
<i>fin</i>		0.2880** (0.111)		0.6910*** (0.1560)
<i>pop</i>		-0.0143*** (0.00227)		0.0274*** (0.0051)
<i>urb</i>		-0.1580*** (0.0440)		-0.0632 (0.0470)
Constant	0.1680*** (0.0115)	0.6650*** (0.0885)	0.0129 (0.0092)	-0.1320* (0.0753)
Individual effect	Yes	Yes	NO	NO
Time effect	Yes	Yes	NO	NO
Observations	744	744	744	744
R-squared	0.9631	0.9726	0.5005	0.5271

Note: (1) ***, ** and * indicate that the estimated results are significant at the 1%, 5% and 10% levels, respectively; (2) Given potential heteroscedasticity, all regressions use robust standard errors.

5.2. Robustness test

5.2.1. Substitution of the dependent variable

Green credit refers to credit services provided by financial institutions to support green industries, such as those involved in environmental protection, energy conservation, emission reduction and renewable energy. These services have three primary functions: optimising resource allocation, mitigating environmental risks and guiding corporate behaviour. This study uses the secondary indicator 'green credit' from the green finance index system as a substitute for green finance in regression analysis using Model (1). The results are presented in Column (1) of Table 4. The coefficient measuring the impact of market-oriented reforms on green credit is 0.0014, which is significant at the 1% confidence level. This confirms the robustness of the previous findings.

5.2.2. The explanatory variable is lagged by one period

As the impact of market-oriented reforms on green finance development may exhibit a time lag, this study applies a one-period lag to the marketisation level. This examines how changes in market reforms affect green finance development in the subsequent period. As shown in Column (2), market-oriented reforms continue to have a positive and significant impact on green finance development. Testing the benchmark regression using this method confirms that the findings are consistent with those of previous studies, demonstrating that higher levels of marketisation promote green finance development.

5.2.3. Exclusion of special samples

China has four municipalities that are directly under the central government. These municipalities have significant advantages over other provinces in terms of resource endowment and policy support. This could potentially influence the conclusions of this study's research. Therefore, this paper reestimates using data that excludes these four municipalities, and the corresponding estimation results are presented in Column (3) of Table 4. As shown in Column (3), market-oriented reforms still promote green finance development at the 1% statistical significance level after excluding the municipalities, which is consistent with previous findings.

5.2.4. Exclusion of specific time periods

The outbreak of the COVID-19 pandemic significantly impacted economic growth, potentially compromising the robustness of the research findings. Consequently, the model was re-estimated after the sample data from 2020-2022 was excluded; the corresponding estimation results are presented in Column (4) of Table 4. This demonstrates that market-oriented reforms significantly boosted green finance development at the 1% statistical significance level after removing the pandemic period data, consistent with the baseline regression results.

Table 4. Results of robustness tests.

Variable	(1)	(2)	(3)	(4)
<i>mar</i>	0.0014*** (0.0004)	0.0105*** (0.0017)	0.0122*** (0.0018)	0.0082*** (0.0018)
Constant	0.1083*** (0.0189)	0.6612*** (0.0943)	0.7274*** (0.0907)	0.5991*** (0.0942)
Controlled	Yes	Yes	Yes	Yes
Individual Effect	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes
Observations	744	744	648	651
R-squared	0.9451	0.9737	0.9719	0.9748

Note: (1) ***, ** and * indicate that the estimated results are significant at the 1%, 5% and 10% levels, respectively; (2) Given potential heteroscedasticity, all regressions use robust standard errors.

5.3. Heterogeneity analysis

5.3.1. Regional heterogeneity test

This study examines the differential impacts of market-oriented reforms on green finance development based on regional heterogeneity. According to the 'Classification Method for Eastern, Central, Western, and Northeast Regions' issued by the National Bureau of Statistics of China, the samples were divided into four major regions-Eastern, Central, Western and Northeast -for heterogeneity testing. The results are presented in columns (1) to (4) of Table 5. Market-oriented reforms had a significant positive effect on green finance development in all four regions: Eastern, Central, Western and Northeast. However, these effects varied. In the eastern and northeastern regions, the impact was statistically significant at the 1% level, whereas in the central and western regions, it was only significant at the 5% level.

The eastern region has a developed economy, high levels of marketisation, a robust financial system and green industries that have achieved economies of scale. Market-oriented reforms can efficiently direct capital towards green sectors via mature capital markets, price signals and competitive mechanisms, yielding significant results. However, despite its established industrial base, the northeastern region still relies heavily on traditional, energy-intensive industries and is under significant pressure to improve environmental governance and undergo green transformation. Institutional breakthroughs resulting from market reforms, such as the clarification of property rights and factor pricing, directly dismantle systemic constraints, stimulating green upgrading demands in existing industries and producing pronounced marginal reform effects. This makes their impact statistically significant at the 1% level. The central region is currently in the middle stages of industrialisation and prioritises industrial relocation and economic growth. Green finance development in this region relies more on policy guidance than endogenous market forces. While market reforms produce positive results, their effectiveness is constrained by the path dependence of local governments on traditional industries and their relatively

inefficient allocation of financial resources, resulting in significance only at the 5% level. The western region has weak financial foundations and underdeveloped market mechanisms, and green projects often carry higher risks and lower returns there. Signals from market reforms are easily weakened by non-market factors such as outdated infrastructure and stringent ecological protection requirements. This leads to delayed responses from capital to price signals, meaning their impact is statistically significant only at the 5% level.

5.3.2. Test of heterogeneity of marketisation levels

Provinces with marketisation levels above the median were classified as high level, while the rest were classified as low level. The estimation results are presented in columns 5 and 6 of Table 5. These results suggest that the promoting effect of market-oriented reforms on green finance development is significant at the 10% level in the high-marketization group and at the 1% level in the low-marketization group. The promotion of green finance development by market-oriented reforms is more pronounced in provinces with lower marketisation levels. This difference stems from variations in institutional foundations, marginal effects and driving mechanisms.

Firstly, the marginal effect of institutional dividends decreases. Provinces with low levels of marketisation have long suffered from limited factor mobility, financial repression and administrative interference. However, market-oriented reforms can swiftly eliminate such systemic barriers, such as rationalising energy pricing and clarifying environmental property rights, to establish the foundational conditions for green finance. This makes their initial contributions particularly significant. In contrast, highly marketised provinces have well-established market mechanisms and advanced green finance development, meaning subsequent reform measures are largely incremental optimisations with weaker stimulus effects. Secondly, the driving mechanism shifts from 'policy-driven' to 'demand-driven'. In provinces with low marketisation, green finance relies heavily on administrative initiatives such as national-level 'Green Finance Reform and Innovation Pilot Zones', where reforms directly relax access requirements and attract capital, making them highly sensitive to policy. In highly marketised provinces, green finance naturally stems from industrial upgrading and spontaneous market demand. Corporate emission reductions primarily result from supply chain pressures and investor preferences rather than mere regulatory relaxation. This diminishes the explanatory power of minor adjustments to marketisation indices on green credit growth. Thirdly, developmental bottlenecks differ significantly. Low-marketisation provinces are still in the 'zero-to-one' phase of filling gaps, where eliminating excessive government intervention could unlock substantial potential. In contrast, high-marketisation provinces face deeper structural challenges, such as information asymmetry and the lack of mutual recognition of green standards. These challenges cannot be effectively addressed through general market reforms alone. Instead, they require more specialised financial instrument innovations, resulting in relatively weaker statistical significance.

Table 5. Heterogeneity test results.

Variable	(1) Eastern	(2) Central Region	(3) Western Region	(4) Northeast	(5) High marketization	(6) High marketization
<i>mar</i>	0.0075*** (0.0022)	0.0111** (0.0049)	0.0061** (0.0029)	0.0096*** (0.0033)	0.0041* (0.0022)	0.0152*** (0.0022)
Constant	0.5529*** (0.1342)	-0.0414 (0.1885)	-0.5141*** (0.1895)	1.4924*** (0.0942)	0.6179*** (0.0756)	0.7347*** (0.1451)
Controlled	Yes	Yes	Yes	Yes	Yes	Yes
Individual	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	240	144	288	72	360	384
R-squared	0.9807	0.9819	0.9729	0.9918	0.9826	0.9675

Note: (1) ***, ** and * indicate that the estimated results are significant at the 1%, 5% and 10% levels, respectively; (2) Given potential heteroscedasticity, all regressions use robust standard errors.

6. Further analysis

6.1. Mediation effect test

This paper argues that, based on the earlier theoretical analysis, market-oriented reforms may drive the development of green finance through two channels: enhancing social consumption levels and promoting openness to the outside world. This study attempts to conduct an empirical analysis of these potential mediating effects. In recent years, the traditional three-step mediation testing model has been met with scepticism and criticism from economists in China's domestic economics community. Building on the theoretical frameworks for channel testing proposed by Jiang (2022) and the empirical methodologies developed by Li et al. (2023a), this paper first examines whether the key explanatory variable - market-oriented reforms - has a significant impact on the mediating variables. Furthermore, to address potential inadequacies in the theoretical justification of the causal effects of the mediating variables on the dependent variable, we examine the relationship between these variables and the dependent variable empirically, providing robust evidence to support our findings.

This paper uses the bootstrap model to test for mediation effects. Columns (1) and (2) of Table 6 present the results concerning the mediation effect of social consumption levels. Firstly, column 1 shows that the estimated coefficient of the core explanatory variable on the mediator variable is significantly positive at the 5% level. This indicates that market-oriented reforms can increase social consumption levels. Secondly, column 2 reveals that the estimated coefficient of social consumption levels on green finance development is also significantly positive at the 5% level. This demonstrates that social consumption levels positively influence green finance development. These findings support Hypothesis 2, confirming that raising social consumption levels is a key way in which market-oriented reforms promote green finance development.

Columns (3) and (4) of Table 6 present the results regarding the mediating effects of opening up. First, column 3 shows that the estimated coefficient of the core explanatory variable on the mediating variable is significantly positive at the 10% level, indicating that market-oriented reforms can increase the degree of opening up. Secondly, Column (4) shows that the estimated coefficient of opening-up on green finance development is significantly positive at the 5% level, demonstrating its positive influence on green finance development. These results support Hypothesis 3, confirming that increasing the level of openness serves as a channel through which market-oriented reforms can drive green finance development.

6.2. Testing the adjustment effect

Based on the preceding theoretical analysis, digital infrastructure has a positive moderating effect on the impact of market-oriented reforms on the development of green finance. To mitigate collinearity issues, this study applied centralisation techniques to both the explanatory and moderating variables when constructing the interaction terms. The moderating effects are presented in Table 6. Column (6) of Table 6 shows the regression results incorporating the interaction term between the level of digital infrastructure and the level of marketisation based on Column (5). The coefficient of the interaction term is significantly positive, which is consistent with the direction of the main effect. This demonstrates that the development of digital infrastructure positively moderates the influence of market-oriented reforms on green finance development, further validating Hypothesis 4.

Table 6. Results of tests for mediating and moderating effects.

Variable	(1) <i>con</i>	(2)	(3) <i>open</i>	(4)	(5)	(6)
<i>sch</i>	0.0059** (0.0030)	0.0097*** (0.0017)	0.0122* (0.0063)	0.0098*** (0.0017)	0.0104*** (0.0016)	0.0102*** (0.0016)
<i>con</i>		0.0467** (0.0188)				
<i>open</i>				0.0159** (0.0078)		
<i>DI</i>					0.0710** (0.0290)	-0.0290 (0.0424)
<i>DI</i> × <i>sch</i>						0.0328*** (0.0112)
Constant	-0.3953*** (0.1444)	0.7759*** (0.0894)	-1.0906** (0.4357)	0.7748*** (0.0905)	0.6432*** (0.0880)	0.5961*** (0.0903)
Vontrolled	Yes	Yes	Yes	Yes	Yes	Yes
Individual	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	744	744	744	744	744	744
R-squared	0.5832	0.9722	0.9200	0.9721	0.9751	0.9754

Note: (1) ***, ** and * indicate that the estimated results are significant at the 1%, 5% and 10% levels, respectively; (2) Given potential heteroscedasticity, all regressions use robust standard errors.

6.3. Threshold effect

To verify the threshold effect of market-oriented reforms on the development of green finance, we first conducted single-, dual- and triple-threshold tests on the threshold model. We then repeated the sample draw 300 times using the method to assess the significance of the threshold effects. The results are presented in Table 7.

Table 7. Threshold Effect Test.

Number of thresholds	F-price	P- price	10% threshold value	5% critical value	1% threshold
Single threshold	132.67	0.0000	36.7754	44.7711	57.7943
Double Threshold	72.76	0.0000	34.1215	41.7947	52.9386
Triple Threshold	99.00	0.7800	193.3234	196.8975	223.9493

As shown in Table 7, when marketisation level is selected as the threshold variable, the F-value and P-value for the single-threshold test are 132.67 and 0.0000 respectively, indicating significance at the 1% level. Similarly, the F-value and P-value for the dual-threshold test are 72.76 and 0.0000 respectively, confirming significance at the 1% level once again. These results suggest that the impact of market-oriented reforms on green finance development is non-linear and that such reforms exhibit a dual-threshold effect.

Figure 1 shows the likelihood ratio function curve of the single-threshold model, which further validates the existence of the dual-threshold effect in market-oriented reforms.

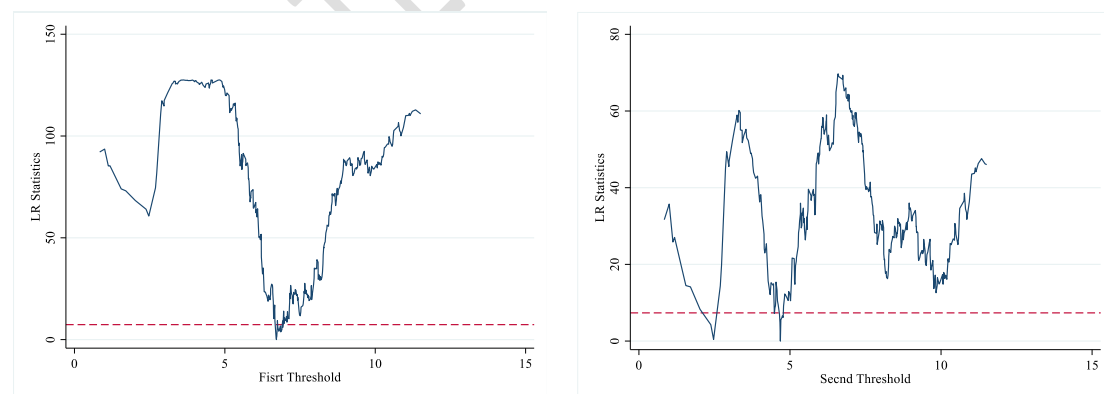


Figure 1. Likelihood ratio function plot based on the dual-threshold model.

Furthermore, after establishing the threshold variables for marketisation levels, a non-linear test was conducted using the panel threshold model. The results are presented in Table 8. The data indicate that, when the marketisation level falls below the first threshold value, its regression coefficient fails the significance test. When the marketisation level exceeds 4.6852 but remains below 6.7030, the regression

coefficient is 3.3700, passing the significance test at the 1% level. When the marketisation level surpasses 6.7030, the regression coefficient reaches 6.3476 and also passes the significance test at the 1% level. These findings demonstrate that, as marketisation levels exceed different thresholds, market-oriented reforms have an increasingly marginal positive effect on green finance development.

Table 8. Results of the threshold effect test.

Variable	<i>GF</i>
$sch \leq 4.6852$	0.1668 (2.0571)
$4.6852 < sch \leq 6.7030$	3.3700* (1.9807)
$sch > 6.7030$	6.3476*** (1.8423)
Constant	-5.5142*** (1.1043)
Controlled variable	Yes
Individual Effect	Yes
Time effect	Yes
Observations	744
R-squared	0.8714

Note: (1) ***, * indicate that the estimation results are significant at the 1%, 10% levels, respectively; (2) Given the potential for heteroscedasticity, all regressions use robust standard errors.

7. Discussion

The empirical tests described above lead this paper to conclude that market-oriented reforms significantly promote the development of green finance. This finding contributes to an important dialogue with, and expands upon, the existing literature. The paper's marginal contributions are primarily reflected in four areas: the research perspective, the core findings, the mechanisms of action and the non-linear characteristics.

7.1. Expanding the Research Perspective: Moving from Policy Effects to Institutional Change

Existing research on the determinants of green finance has focused primarily on three areas: the enabling role of fintech, environmental regulations as a driving force, and socioeconomic foundations as a supporting factor. However, most of these studies treat the level of marketisation as a background or control variable, lacking a systematic examination of it as a core driving force. This paper moves beyond traditional research paradigms centred on fintech and environmental policy by placing market-oriented reform at the heart of the analysis and constructing a complete logical chain of 'institutional reform - market response - green finance'. In this sense, the

paper addresses the call by Li et al. (2024) for the “coordinated advancement of the synergistic relationship between market-oriented financial reform and green finance policies”, elevating market-oriented reform from a peripheral variable in green finance research to a core explanatory variable.

7.2. Consistency of Key Findings: The Green Dividends of Market-Oriented Reforms

The conclusions of this paper are consistent with existing research on the environmental impact of market-oriented reforms. For example, Chen et al. (2021) argue that such reforms provide institutional support for green economic development by optimising resource allocation and improving energy efficiency. Han et al. (2021) found that correcting distortions in factor markets contributes to reducing emissions. Gao and Yuan (2022) confirmed that eliminating distortions in capital and energy markets can unlock significant potential for green development. While these studies confirm the green dividends of market-oriented reforms from the perspective of environmental performance, this paper extends this logic to the field of green finance. The results indicate that market-oriented reforms directly improve environmental performance and indirectly promote green finance development by reshaping the pattern of financial resource allocation. Notably, this study finds that the promotional effect of market-oriented reforms on green finance is more pronounced in eastern and north-eastern regions, as well as in less marketised provinces. This finding of heterogeneity contrasts interestingly with existing research. This difference may stem from the distinct research subjects: while Pu and Zhang (2022) focus on incremental efficiency gains, this paper focuses on creating institutions from scratch. Together, they reveal the differentiated characteristics of the effects of market-oriented reforms across different stages of development.

7.3. Deepening the Mechanism Pathways: New evidence on mediating and moderating effects

In terms of the mechanism of action, this paper is the first to incorporate social consumption and openness into a unified framework for mediation, examining the impact of market-oriented reforms on green finance while introducing digital infrastructure as a key moderating variable. This expanded mechanism design enhances our understanding of transmission pathways.

In terms of mediation effects, the paper validates the transmission chain 'market-oriented reforms → upgrading of social consumption → development of green finance', which aligns with research showing that market-oriented reforms promote consumption upgrades and that interest rate liberalisation boosts consumption (Chen and Li, 2019). Meanwhile, the pathway 'market-oriented reforms → opening-up → development of green finance' is consistent with research showing that market-oriented reforms enhance openness (Jiang, 2019), and that openness leads to greater efficiency (Liu and Zhang, 2024). This paper's innovation lies in integrating these two pathways into a unified framework, revealing how market-oriented reforms empower the development of green finance through the dual channels of 'domestic demand-driven growth' and 'external regulatory pressure'.

In terms of moderating effects, the paper finds that digital infrastructure positively moderates the impact of market-oriented reforms on green finance. This finding is consistent with research showing that digital infrastructure promotes financial inclusion (Wang et al., 2023b), enhances information transparency (Chen and Li, 2024) and supports the development of digital inclusive finance (Chen et al., 2025). This paper's contribution lies in revealing digital infrastructure's role as an institutional amplifier: it independently influences green finance and, more importantly, strengthens the efficiency with which market-oriented reforms allocate resources.

7.4. Discovery of Nonlinear Characteristics: The Theoretical Contribution of the Threshold Effect

This study finds that the catalytic effect of market-oriented reforms on the development of green finance exhibits a significant dual-threshold characteristic. That is to say, the reform effect only becomes significantly greater once the level of marketisation crosses a critical threshold. This non-linear finding engages in an important theoretical dialogue with existing research. In the context of the environmental impacts of market-oriented reforms, Li et al. (2023b) found that the impact of land marketisation on ecological efficiency follows a U- or inverted U-shaped curve. The threshold effect findings in this paper share a similar theoretical logic, indicating that the effects of market-oriented reforms depend on the phased accumulation of institutional foundations. In the field of green finance, other studies have also identified a threshold effect relating to the degree of marketisation in the process by which green finance influences the development of renewable energy. The marginal contributions of this paper are as follows: First, the focus of the threshold effect analysis shifts from the impact of green finance to market-oriented reform itself. This reveals the critical characteristics of the level of marketisation as an institutional converter. Secondly, it identifies a dual threshold rather than a single one, indicating that the release of reform effects occurs in steps of 'crossing—release—acceleration', rather than increasing linearly.

8. Conclusion and Policy Implications

8.1. Conclusion

Drawing on panel data from 31 Chinese provinces spanning the years 2000 to 2023, this study adopts a unified framework that incorporates market-oriented reforms, social consumption, opening-up policies, and digital infrastructure. This approach allows for a comprehensive examination of the impact and transmission mechanisms of market-oriented reforms on the development of green finance. The main conclusions are as follows:

First, market-oriented reforms have a significant direct positive impact on green finance development, a finding that is robust and reliable. Benchmark regression analyses and multiple robustness tests both demonstrate that market-oriented reforms serve as an endogenous driver for green finance. Heterogeneity analysis further

reveals that the marginal boosting effect of reforms is more pronounced in eastern and northeastern regions, as well as in provinces with lower marketisation levels, manifesting as timely institutional dividends. Secondly, social consumption upgrading and opening up constitute crucial channels through which market-oriented reforms indirectly empower green finance.

Market-oriented reforms elevate household consumption levels and expand demand for green products, establishing a transmission chain of 'consumption upgrading - green demand - financial supply'. At the same time, by facilitating cross-border flows of factors and introducing international green concepts and standards, they encourage domestic green finance to improve quality and efficiency, creating a virtuous cycle of 'deeper reforms - greater openness - development of green finance'. Thirdly, digital infrastructure positively moderates the way in which market-oriented reforms drive green finance development. Robust digital infrastructure enhances the effectiveness of information disclosure, reduces information asymmetry and broadens the scope of financial services, enabling the institutional dividends from market reforms to drive green finance development across broader areas and deeper dimensions. Fourthly, the catalytic effect of market-oriented reforms on green finance exhibits distinct dual-threshold characteristics: when levels of marketisation fall below the first threshold, the effects of reform remain insignificant; once this threshold is surpassed, however, the driving effect becomes evident and shows increasing marginal trends as levels of marketisation exceed higher thresholds. This demonstrates that the degree of marketisation acts as an 'institutional converter' linking environmental positive externalities with capital's profit-seeking nature. Only by surpassing this critical threshold can green finance transition from exogenous impetus to endogenous development.

8.2. Policy implications

The following policy implications can be drawn based on the above conclusions:

Firstly, the foundation of green finance development should be strengthened through deep market-oriented reforms. It is essential to continuously eliminate distortions in factor markets and administrative monopolies, and to improve property rights systems and mechanisms for internalising environmental costs. This will ensure that price signals accurately reflect resource scarcity and environmental risks. In less market-developed regions of central and western China in particular, reforms to the market-based allocation of resources must be accelerated, prioritising the clarification of key mechanisms such as energy pricing and emission trading, in order to promptly overcome institutional barriers and unlock the potential for transformative reforms. Secondly, dual pathways should be established to link consumption upgrading with international openness. On the one hand, a green consumer market should be cultivated by refining product standards and certification systems. Tools such as consumption subsidies and green loan interest subsidies should be employed to lower barriers to green consumption and thereby stimulate financial supply from the demand side. On the other hand, actively align with international green finance standards to facilitate the cross-border flow of green capital and introduce advanced green

investment concepts and risk management technologies through trade and investment liberalisation, thereby driving institutional innovation.

Thirdly, accelerate the development of digital infrastructure to enhance the efficiency of reform-driven resource allocation. Prioritise the deep integration of 5G, big data and blockchain technologies in green finance. Establish environmental information-sharing platforms and address the challenges of information asymmetry in identifying, valuing and regulating green assets. At the same time, extend digital inclusive finance to rural and remote areas to improve accessibility for 'long-tail' populations and strengthen the inclusiveness of market-oriented reforms. Fourthly, implement differentiated green finance strategies tailored to different stages of market development. In regions that have not yet crossed the threshold, policies should focus on establishing fundamental institutional frameworks, such as clarifying environmental rights ownership and strengthening budgetary constraints. In highly market-oriented regions, greater reliance should be placed on product innovation, mutual standard recognition and market competition to shift green finance from scale expansion towards improving quality and efficiency, thereby ensuring the sustained realisation of reform dividends.

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