



The Mitigating Effect, Mechanism of Action, and Optimization Path of Green Finance on Financing Constraints of Small and Medium-Sized Enterprises

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Abstract. In the context of "dual carbon" goals and high-quality economic development, green finance has become a key tool to support the low-carbon transformation of the real economy. However, small and medium-sized enterprises, which have long been constrained by information opacity and insufficient collateral, face further exacerbation of their "difficult, expensive, and slow financing" issues due to the high investment required for green transformation. Based on existing literature, this paper systematically reviews the mechanisms, practical dilemmas, and optimization paths of green finance in alleviating financing constraints for SMEs. The study finds that green finance can improve SMEs' financing constraints through four major mechanisms: direct alleviation mechanism, indirect transmission mechanism, synergistic enhancement mechanism, and constraint regulation mechanism. At the same time, green finance also optimizes capital allocation and reduces misallocation of financial resources through environmental access, information disclosure, and green-washing governance mechanisms. However, current green finance services for SMEs still face issues such as insufficient standard system adaptation, homogenization of financial products, weak corporate environmental information disclosure, imperfect risk compensation mechanisms, and uneven development across regions and industries. In the future, it is necessary to promote the deep integration of green finance with inclusive finance, digital finance, fiscal policy, and environmental regulation to build a green finance service system for SMEs that covers a wide range, has controllable risks, and provides effective incentives.

Keywords: Green Finance, Small and Medium-Sized Enterprises (SMEs), Financing Constraints, Green Credit, Green Inclusive Finance.

1 Introduction

Against the backdrop of global climate change, tightening resource constraints, and escalating pressure on ecological and environmental governance, green finance has gradually evolved from an auxiliary tool of environmental policies to an important financial institutional arrangement driving the green transformation of economic structure. After China proposed the goals of carbon peaking and carbon neutrality, the

role of the financial system in guiding capital flows to green industries, constraining high-pollution and high-emission projects, and promoting the low-carbon transformation of enterprises has become increasingly prominent. Policy instruments such as green credit, green bonds, green funds, green insurance, energy efficiency credit, and green finance reform and innovation pilot zones have been continuously developed, providing important financial support for the green transformation of the real economy. Green credit is the earliest developed financial product in China's green finance system with a relatively mature policy system. Its scale continues to expand, but there are still issues such as inconsistent standards, concentrated investment, relatively single audience, and insufficient incentives[1].

SMEs constitute a crucial component of the national economy and are key targets of inclusive finance. Not only are SMEs significant contributors to China's economic development and employment generation, but they are also a force to be reckoned with in the transition towards a green and low-carbon economy. However, in reality, green financial resources are still predominantly concentrated in large enterprises and major green projects, with relatively insufficient penetration into SMEs [2]. The vast number of micro, small, and medium-sized enterprises plays a crucial role in supporting employment and economic resilience, yet their pollution emissions and energy consumption issues cannot be overlooked. Due to significant financing constraints, SMEs often find it difficult to continuously invest in environmental protection, clean production, and green technology research and development [3].

Existing research primarily focuses on the macro-environmental effects and corporate innovation effects of green finance. Although some scholars have pointed out that green finance can promote corporate green transformation and pollution reduction by alleviating financing constraints, reducing operating costs, and incentivizing technological innovation [4,5], and further explored its synergistic relationship with inclusive finance [6], the existing literature mainly targets large enterprises, listed companies, or heavily polluting industries, with relatively little attention paid to the group of SMEs. There is a lack of systematic analysis on the transmission mechanism from "alleviation of financing constraints" to "green transformation". In view of this, this paper closely follows the logical thread of "green finance - financing constraints of SMEs - green and low-carbon transformation", integrates existing literature, and deeply analyzes its mechanism of action, practical obstacles, and optimization paths.

2 Mechanism

Green finance alleviates financing constraints for SMEs not through a single channel, but through multiple mechanisms such as direct financing support, indirect capability enhancement, diversified synergistic effects, and constrained and standardized governance. Combining existing literature and the main line of this study, the mechanism of action can be summarized into the following four aspects.

2.1 Direct Mitigation Mechanism

Targeted support and resource allocation optimization for green credit.

Green credit stands as the most direct and core pathway for green finance to alleviate financing constraints faced by SMEs. Financial institutions can leverage green standards to enhance SMEs' financing conditions through measures such as preferential interest rates, credit line tilting, and innovative guarantees, thereby directly broadening their green investment channels. Addressing the shortcomings of SMEs, which are characterized by "asset-light and lack of collateral," specialized products like energy efficiency credit have been developed in practice. These products do not solely rely on existing collateral but incorporate future energy-saving and carbon emission reduction benefits into credit extension considerations [1]. Energy efficiency credit can optimize bank resource allocation, enhance total factor productivity of enterprises, and facilitate their shift from passive environmental protection to proactive transformation [7]. In summary, green credit has established a virtuous cycle mechanism of "widening financing channels - reducing financing costs - increasing green investment" through supply-side tool innovation and policy design.

2.2 Indirect Transmission Mechanism

Innovation empowerment, signal enhancement, and green management improvement. The alleviation of financing constraints faced by small and medium-sized enterprises by green finance is not only reflected in the direct provision of funds, but also in the improvement of enterprises' long-term financing capabilities through three channels: innovation empowerment, signal transmission, and management enhancement. At the innovation level, financial support drives enterprises to increase investment in green research and development and technological transformation, forming a positive cycle of "financing support - green innovation - performance improvement - financing capability enhancement" [4]. At the signal level, enterprises use green certification and environmental information disclosure to transmit robust business signals to the market, replacing traditional collateral with verifiable green information, effectively reducing information asymmetry and financial institutions' risk control costs [8]. At the management level, external green credit constraints force enterprises to improve their environmental systems and internal governance, enhancing long-term operational stability through standardized management [9]. Therefore, the core of the indirect transmission mechanism lies in the fact that green finance does not merely address short-term funding gaps of enterprises, but continuously improves the creditworthiness and financing sustainability of SMEs through the construction of green innovation, green signal, and green management capabilities.

2.3 Synergistic Mechanism

Amplifying the effect of financing relief through diversified integration. The effectiveness of green finance in alleviating financing constraints for SMEs also depends on its synergistic effects with digital inclusive finance, inclusive finance, and policy instruments. Single green finance instruments often struggle to fully address the financing challenges faced by SMEs. Only by forming a synergy with inclusive finance, digital technology, and government policies can the coverage and precision of green finance be further expanded. Collaborating with digital inclusive finance and relying

on big data and AI technology to integrate unstructured data such as business operations, taxation, and pollution discharge, a dynamic green credit profile can be constructed, reducing dependence on traditional collateral while enhancing risk identification accuracy [3]. Integrating with the inclusive finance system, embedding green identification and differentiated pricing mechanisms on the basis of expanding service coverage, can precisely target enterprises with transformation potential, avoiding the indiscriminate expansion of inclusive finance that weakens environmental constraints [6,10]. Linking with policy instruments, utilizing public means such as green finance pilot zones, fiscal subsidies, and risk compensation, can hedge against the externalities and initial costs of green projects, reducing lending risks for financial institutions [2,11]. Therefore, the key to the synergistic mechanism lies in reducing information asymmetry, expanding financing coverage, sharing financial risks, and enhancing the precision and sustainability of green finance in serving SMEs through the diverse integration of "green finance + digital inclusive finance", "green finance + inclusive finance", and "green finance + policy instruments".

2.4 Constraint and Regulation Mechanism

Suppressing greenwashing and optimizing capital allocation. Green finance is not only a financing support tool but also serves as a constraint and regulatory function. Its core lies in preventing "greenwashing" risks by focusing on corporate environmental performance and capital usage. It targets speculative behaviors where companies may use green concepts to package ordinary projects and make false disclosures. Green finance can effectively reduce the tendency of companies to greenwash by alleviating financing constraints and enhancing management's environmental awareness, curbing resource misallocation, and protecting genuinely transforming small and medium-sized enterprises [12]. To ensure the effectiveness of this mechanism, a closed-loop regulatory system of "pre-loan access, in-loan tracking, and post-loan evaluation" needs to be established: that is, strengthening green qualification reviews before lending, monitoring whether funds are dedicated to energy-saving renovations and green research and development during lending, and continuously evaluating environmental performance and the quality of information disclosure after lending. This full-process constraint not only inhibits false green behaviors but also promotes companies to transform external financial pressure into internal green governance capabilities, elevating green finance from a mere fund supply tool to an institutional arrangement that combines financing support, environmental governance, and market discipline functions, thus achieving long-term stable financing relief.

3 Dilemma

Despite the significant theoretical effectiveness of green finance in supporting SMEs financing, it still faces three obstacles in practice: insufficient supply adaptation, weak corporate acceptance, and lagging policy support.

On the financial supply side, there are issues of inconsistent green finance standards and inadequate adaptation for SMEs. China's green credit recognition standards still

suffer from problems such as general categorization, inconsistent implementation across different banks, and certain indicators being more applicable to large commercial banks and large projects [1]. Green projects for SMEs are typically small-scale, scattered, and data-poor, making it difficult to fully recognize them according to the standards for large projects, leading to higher credit extension costs for banks. Secondly, green finance products are notably homogenous and still concentrated in areas such as infrastructure, clean energy, electricity, heat, and transportation, which inadequately covers SMEs' common small-scale, short-term, and high-frequency financing needs such as energy-saving renovations, equipment updates, green supply chains, pollution control, and green certification. Furthermore, financial institutions have limited motivation to serve SMEs. Green projects for SMEs involve small single amounts, high due diligence costs, and difficult risk identification. Without risk compensation and policy incentives, commercial banks are prone to directing green finance resources towards large enterprises and government-supported projects.

From the perspective of enterprise demand, SMEs themselves also face issues such as a weak green governance foundation, insufficient environmental information disclosure, weak collateral capacity, and higher risks of greenwashing. Many SMEs lack specialized ESG management departments, carbon accounting capabilities, and environmental information disclosure experience, making it difficult for them to fully demonstrate their green attributes and transformation achievements to financial institutions. Green transformation projects involve technology, equipment, energy-saving benefits, and carbon emission reduction benefits, but these green assets have weak liquidity and difficult value assessment in traditional collateral systems, making it difficult to replace traditional collateral such as real estate and land. Green finance has a positive effect on corporate pollution reduction and carbon emission reduction, but in the sample of SMEs, there may be issues of underreporting and incompleteness in emission data, which will affect the accurate identification and implementation efficiency of green finance policy effects [5].

From the perspective of policies and market environment, supporting mechanisms such as fiscal incentives, risk sharing, green certification, and carbon accounting still need to be improved. Green finance has obvious public policy attributes and externality characteristics, and it is difficult to achieve sufficient supply solely relying on commercial financial institutions. Policies in green finance pilot zones can significantly reduce carbon emissions of SMEs and promote their green and low-carbon development [2]. Government environmental subsidies can strengthen the policy effect, and the allocation of resources by financial institutions can also enhance the role of carbon reduction in the long run. Research on green finance reform and innovation pilot zones also shows that pilot policies can increase the long-term value of green enterprises, indicating that the synergy between government guidance and financial resource allocation is crucial to the effectiveness of green finance [11]. However, in non-pilot areas, central and western regions, and traditional industries among SMEs, there is still room for improvement in the coverage and service capabilities of green finance policies.

4 Optimization path

Based on the above analysis, optimizing green finance to facilitate SME financing should be promoted collaboratively from four levels: financial institutions, enterprises, government regulation, and market system.

Financial institutions should establish green identification and credit extension standards tailored to the characteristics of SMEs, incorporating indicators such as energy savings, emission reductions, green patents, environmental protection investments, carbon account records, supply chain cooperation, and green certifications into a comprehensive evaluation system, avoiding the simple application of standards for large projects. At the same time, more scenario-based, lightweight, and flexible green financial products should be developed, such as green credit loans, energy efficiency loans, green order loans, green supply chain loans, carbon asset pledge loans, and green bill financing. In terms of post-loan management, banks should establish a mechanism for tracking the use of funds and evaluating environmental performance to prevent fund misappropriation and greenwashing.

SMEs should proactively enhance their green governance and information disclosure capabilities. Enterprises should not view green finance solely as a low-cost financing channel, but should incorporate green development into their business strategies and establish an internal recording system for energy consumption, pollution emissions, environmental protection investment, carbon emission reduction data, and green research and development projects. Enterprises should proactively pursue green certification, environmental information disclosure, and green technological innovation to form a genuine, sustainable, and verifiable green competitiveness. Green culture can promote innovation in corporate green management [9], so SMEs should convert external green finance incentives into internal governance capabilities through green training, green supply chain cooperation, and the establishment of internal environmental management systems.

Governments and regulatory authorities should improve the green finance standard system, fiscal incentives, and risk-sharing mechanisms. For SMEs, a simplified, low-cost, and operable green certification mechanism should be established to reduce the upfront costs of green financing. Governments can reduce the risks and costs of financial institutions serving SMEs through fiscal subsidies, risk compensation, government guarantees, green reloans, and environmental protection subsidies. It is necessary to explore a green finance system that fits the characteristics of inclusive business entities and promote the deep integration of green finance and inclusive finance [2]. For polluting SMEs, policies should adopt a balanced approach of "constraint + support": on the one hand, increasing the cost of non-compliant financing, and on the other hand, providing subsidies for green technological transformation and financial support for transformation, to avoid enterprises losing their transformation capabilities due to simple credit contraction.

At the market system level, should accelerate the construction of green financial infrastructure. Firstly, establish a green credit database and carbon account system for small and medium-sized enterprises (SMEs), incorporating environmental protection records, carbon emission data, green patents, energy-saving benefits, administrative

penalties, and supply chain data into credit evaluation. Secondly, develop third-party green certification, carbon accounting, environmental auditing, and ESG evaluation services, and reduce the usage costs for SMEs through public platforms. Furthermore, should promote the development of green supply chain finance, leverage the information advantages among core enterprises, suppliers, and financial institutions, and expand trade credit and accounts receivable financing.

Overall, green finance will develop towards inclusivity, digitalization, transformation, and synergy in the future. Inclusivity means that green finance resources will further extend to SMEs, private enterprises, and transformation entities in traditional industries. Digitalization means reducing information asymmetry through data sharing, green credit profiling, and carbon accounts. Transformation means that green finance not only supports already green enterprises but also supports high-carbon SMEs to gradually transform. Synergy means that green finance must form a linkage with fiscal policy, industrial policy, environmental regulation, carbon markets, and supply chain finance. Only within this comprehensive framework can green finance truly become an important institutional tool to alleviate financing constraints for SMEs and promote their green and low-carbon transformation.

5 Conclusion

This systematic review indicates that green finance has reshaped the logic of financial resource allocation through four mechanisms: direct credit support, indirect credit enhancement, multi-format collaboration, and whole-process constraints, promoting a virtuous cycle of "improved financing - enhanced innovation - optimized environment - strengthened credit" for SMEs. However, the effectiveness of this effect is still limited by practical obstacles such as poor standard adaptability, product homogeneity, weak information disclosure, and lagging supporting mechanisms, making the mitigating effect not automatic. Therefore, in the future, concerted efforts should be made from four aspects: institutional innovation, corporate governance, policy sharing, and infrastructure improvement, to build a green inclusive financial system throughout the entire life cycle.

As a theoretical review, this paper clarifies the mechanism of action and the dilemmas involved, but has not yet conducted empirical tests. Future research can combine micro-enterprise data to further quantify the heterogeneous effects of enterprises of different sizes, industries, and regions, and delve into examining the moderating boundaries of factors such as digital finance and environmental regulation.

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