

Review

# An Overview of the Impact of Green Finance on Green Total Factor Productivity

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**Abstract:** This paper discusses the impact of green finance on the green total factor productivity of enterprises, and aims to summarize and analyze the research dynamics, trends and key issues of green finance on green total factor productivity. Since China put forward the goal of “double carbon”, green finance has become an important tool for optimizing resource allocation, enhancing technological innovation and measuring high-quality development in new industries, and its impact has been widely reflected in the social, scientific, technological and economic fields. The purpose of this paper is to comprehensively analyze the research results on the impact of various aspects of green finance on green total factor productivity, including green finance as a whole, green bonds, carbon finance and green credit, and provide theoretical references and practical guidance for future policymaking. Finally, this review discusses the outlook of the relationship between green finance and green total factor productivity in the future.

**Keywords:** Green Finance; Green Total Factor Productivity; Dual Carbon Target; Sustainable Economic Development.

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## 1. Introduction

In 2020, Xi Jinping solemnly put forward the “3060” dual-carbon major strategic goal at the 75th United Nations General Assembly, pointing out the direction for China's green development. In 2021, with the release of the “Opinions on the Complete and Accurate Implementation of the New Development Concept and Doing a Good Job of Peak Carbon and Carbon Neutrality” and the “Circular on the Issuance of the Action Plan for Peak Carbon by 2030”, as well as the clear mandate of the Central Economic Work Conference of 2022 to “promote the transformation of the ‘dual control’ of energy consumption to the ‘dual control’ of total volume and intensity of carbon emissions”, the focus of green finance has shifted more firmly to supporting the implementation of the “dual carbon” target. With the release of the Circular on the Publication of the Action Plan for Peak Carbon by 2030 and the clear mandate of the Central Economic Work Conference in 2022 to “promote the shift from ‘dual control’ of energy consumption to ‘dual control’ of carbon emissions,” the focus of green finance has shifted even more firmly to supporting the implementation of the “dual carbon” goal. In the process of supporting the realization of the “dual carbon” goal, green finance will play an important role and gradually become the core driving force for sustainable

economic development. At present, China's economy has entered the stage of high-quality development, which emphasizes economic sustainability, innovation and coordination. Green finance, as an important means to support green, low-carbon and environmentally friendly projects and technologies, can guide the flow of capital to these areas and promote the optimization and upgrading of industrial structure. The traditional total factor productivity is no longer sufficient to measure economic growth, Li and Xu first put forward the concept of green total factor productivity (GTFP) in 2009, GTFP comprehensively consider the impact of environmental factors on output and input factors, to realize the coordination between economic development and environmental sustainability, by improving green total factor productivity, it can reduce the process of economic growth, reduce resource consumption, reduce environmental pollution, and realize sustainable economic development [1]. China is still in a critical period of industrialization and modernization, with problems such as heavy industrial structure, coal-based energy structure and low energy use efficiency, and weak technological innovation capacity in the field of green manufacturing, China's industrial, economic and social transformation is facing great challenges. Green finance, by optimizing the flow of funds and guiding investment towards low-carbon and sustainable projects, can lead to the overall improvement of the relevant industrial chain and promote economic and social development in a more sustainable direction. Studying the impact of green finance on GTFP helps reveal the specific mechanism of green finance in promoting high-quality economic development, helps realize the goal of sustainable development, and provides a scientific basis for formulating more effective economic policies. In recent years, China has actively explored the construction of green financial system. According to the survey, the balance of green loans in both local and foreign currencies grew from 9.23 trillion yuan in the first quarter of 2019 to 33.77 trillion yuan in the second quarter of 2024, realizing a growth rate of up to 265.87%. Meanwhile, the issuance amount of RMB green bonds, which amounted to only 234.066 billion yuan in 2018, reached as high as 909.299 billion yuan in the first three quarters of 2022, and the issuance of green credits and green bonds still maintains a strong growth momentum. In the financial market, the more mature green financial products cover the fields of loans, bonds, trusts and investment banking. Green finance has ushered in rapid development and become an important force in promoting the sustainable development of green industry and economy.

The study of the impact of green finance on green total factor productivity not only has important theoretical significance, but also has far-reaching practical value. From the theoretical level, the study of the impact mechanism of green finance on green total factor productivity helps to expand and enrich the research results in the field of green economy and financial development and provides solid theoretical support for the formulation and implementation of green financial policies. Meanwhile, by constructing theoretical models, we can understand more deeply how green finance affects green total factor productivity through different mechanisms, opening up new ideas and methods for future academic research. From the practical level, studying the impact of green finance on green total factor productivity can help enterprises, industries and society to more accurately grasp the direction and path of green transformation and improve market competitiveness. In addition, this research can also provide a scientific basis for the government to formulate green financial policies and promote the healthy development of the green financial market, so as to realize the coordinated development of the economy and the environment. The purpose of this paper is to provide a comprehensive overview of the current status of research in

this area, to explore in depth how green finance affects green total factor productivity through different mechanisms, and to provide useful references and inspirations for future academic research and practical operation.

## 2. Research Status and Development Trends

In recent years, academics have carried out extensive and in-depth explorations in this field, and successfully constructed a multidimensional and comprehensive theoretical framework to explain the profound impact of green finance on enterprises' green total factor productivity (GTFP). Most scholars generally agree that there exists a positive relationship between green finance and GTFP, and that there are intricate and complex dynamic mechanisms such as mediation effect, moderating effect, and heterogeneity analysis behind this association. However, some scholars have pointed out that the relationship between green finance and GTFP is not purely linear, but shows a complex and variable non-linear characteristic, indicating that under certain circumstances, the promotion effect of green finance may need to reach a critical stage of development before its effectiveness can be significantly demonstrated.

The purpose of this paper is to systematically review the current research progress on how green finance affects corporate GTFP from the perspectives of green finance and its various subfields, and on the basis of this, to look forward to the future development trend of this field. The article will analyze how green finance can make precise efforts at macro, meso and even micro levels to effectively promote the economy's green transformation and help realize the ambitious goal of sustainable economic development. Through this comprehensive discussion, we expect to provide a more solid theoretical foundation and strategic guidance for the practical application of green finance.

### 2.1. A Study on the Impact of Green Finance as A Whole on GTFP

In recent years, the relationship between green finance and corporate green total factor productivity (GTFP) has become a hot research topic in academia. Scholars at home and abroad have proposed a variety of influence mechanisms, aiming to deeply analyze the intrinsic connection between the two. Regarding the positive impact of green finance on GTFP, the research mainly focuses on the direct impact, mediating effect, moderating effect and heterogeneity analysis.

#### 2.1.1. Direct Impact

Scholars have explored the direct relationship between green finance and GTFP in multiple dimensions. The studies of Yin et al. (2021) and Cheng et al. (2022) reveal a U-shaped relationship between green finance and GTFP, emphasizing the non-linear characteristics of green finance development. Shi et al. (2022) further point out that the enhancement of GTFP by green finance has a threshold effect, and the promotion of GTFP will be significant only after the development of green finance reaches a certain level. These studies not only reveal the complex relationship between green finance and GTFP, but also emphasize the possible negative effect and capital crowding-out effect at the early stage of green finance development, which provides an important reference for policy makers.

Specifically, at the initial stage of green finance development, its impact on green total factor productivity may not be significant and may even have a negative effect. This is due to the fact that

in the early stage, its environmental regulatory role has not yet fully emerged, and the investment of enterprises in green innovation may be constrained by the financial crowding out effect, which inhibits the innovation vitality of enterprises. However, with the continuous deepening of green finance, its spatial spillover effect on GTFP gradually increases, and ultimately effectively promotes the improvement of GTFP [2].

In addition, the study by Cheng et al. also delved into the potential impact of regional differences on this relationship. In regions with a high share of manufacturing industries, the lack of capital and strict regulation may hinder the transformation of enterprises and limit the enhancement of GTFP by green finance; however, with the continuous progress of regional green finance, enterprises will be granted more funds for green technological innovations, enhance the awareness of green development, and take the initiative to adjust their production methods, which will result in a long-term promotion mechanism for GTFP [3]. On the contrary, in less developed regions or regions with a lower share of manufacturing industries, green finance can rapidly improve GTFP due to the relative ease of industrial transformation, but the enhancement effect may weaken over time, showing an inverted "U"-shaped characteristic [3].

### 2.1.2. Intermediary Effect

This study explores the mediating mechanism between green finance and GTFP from the perspective of the impact dimensions and nature, which mainly covers multiple dimensions such as resource allocation efficiency and structure, technological innovation, industrial structure, environmental benefits and financial support.

First, improving resource allocation efficiency and optimizing resource structure are the basis for green finance to enhance corporate GTFP. By optimizing resource allocation and improving resource utilization efficiency, it can provide a stable material foundation for the development of a green economy. Feng et al. and He both emphasize the key intermediary role played by improving resource allocation efficiency and optimizing resource structure in this process [5-6]. Green finance provides a material basis for the development of a green economy by improving the efficiency of resource allocation and optimizing the structure of resources.

Secondly, green technology innovation is one of the intermediary factors in the category of technological innovation. Green finance injects the necessary capital for enterprises through innovative financial products [7], effectively supports the green transformation of enterprises, and stimulates their innovation in the field of green technology [7-8]. Zeng et al., Jing and He have pointed out the core intermediary role of green technology innovation in this process, highlighting its indispensability in promoting the benign interaction between green finance and sustainable development [9-10][6]. In addition, green finance also incentivizes enterprises to carry out technological innovation through a variety of measures, such as reducing the cost of enterprise R&D, easing financing barriers, broadening financing channels, strengthening talent cultivation in the pilot area, and improving environmental access standards, thereby significantly enhancing GTFP [11-16][5]. Meanwhile, green finance also directly supports the R&D activities of green technology research and development enterprises and the application of their achievements, providing strong support for the introduction and application of green technology in enterprises, thus promoting the optimization and upgrading of the industry. Zhang et al.'s study further points out that green finance significantly enhances GTFP by promoting the change of green technology

[17]. Green finance is a key intermediary factor in enhancing GTFP by supporting the green transformation of enterprises through innovative financial products and stimulating the vitality of green technological innovation.

Third, the aspect of industrial structure includes two mediating factors: transition to cleaner and industrial structure upgrading. The construction of green finance reform pilot zones promotes the development of clean industries, and Jing particularly emphasizes the key intermediary role played by the cleaner industrial structure between green finance and GTFP [10]. In addition, green finance also guides capital flow to green industrial projects, prompting the transformation and upgrading of high-pollution and high-energy-consumption projects to achieve industrial structure optimization [18], which in turn improves the efficiency of resource allocation and the overall industrial productivity of the society [19]. Therefore, Xu et al. and Xie et al., as well as emphasize that industrial structure upgrading is an important intermediary for green finance to enhance GTFP, which further validates the positive role of green finance in promoting the optimization and upgrading of the industrial structure and enhancing the overall productivity of the society [16,20]. Scholars share the view that green finance promotes the transformation and upgrading of industrial structure towards cleanliness and improves the efficiency of resource allocation and the overall productivity of society.

Fourth, reducing carbon emission intensity and promoting energy saving and emission reduction process are the mediating factors of environmental benefit category. The promotion of green finance generally helps to reduce carbon emission intensity [21]. Wang et al. found that there is a negative correlation between carbon emission intensity and GTFP in the agricultural sector in each region [22], based on which, Zhou et al. further proposes that green finance effectively promotes GTFP by reducing carbon emission intensity [23]. In addition, through a series of measures such as carbon emissions trading, clean development project mechanism and green credit, green finance effectively drives enterprises to transform into environmentally friendly industries [24]. Li et al. (2023) and Zeng et al. show that green finance can significantly enhance green total factor productivity by promoting the process of energy conservation and emission reduction [8-9].

Fifth, alleviating the maturity mismatch of enterprises is a mediating factor in the financial support category. Green finance solves the financing maturity mismatch problem for green enterprises, which enables green enterprises that obtain long-term borrowings to smoothly promote the production and investment of green projects [25]. In the long run, these green projects significantly reduce environmental pollution by effectively alleviating the maturity mismatch problem of environmental protection enterprises, injecting a strong impetus for the green development of China's economy and contributing to the enhancement of GTFP [26]. Green finance solves the financing maturity mismatch problem of green enterprises and provides long-term financial support for the production and investment of green projects.

These studies not only reveal the multiple paths of green finance's impact on GTFP, but also emphasize the positive role of green finance in promoting green technological innovation, industrial structure optimization and environmental protection.

### 2.1.3. Moderating Effect

First, enhancing carbon emission regulation can prompt enterprises to carry out green production and life, assist energy structure transformation and ecological value transformation, and thus improve

enterprises' green total factor productivity. He emphasizes the positive regulatory role of carbon emission regulation in green finance to promote corporate GTFP [6]. Second, compared with traditional financial institutions, FinTech can alleviate information asymmetry and credit rationing problems in various aspects and improve credit allocation efficiency. He et al. show that FinTech will increase the contribution of green finance to the overall performance of green total factor, and there is a threshold effect for this enhancement [27]. The study of moderating effects emphasizes the moderating role of external factors in the relationship between green finance and GTFP. Carbon regulation and fintech are two important moderating factors. Carbon emission regulation improves GTFP by inducing enterprises to carry out green production and life, while fintech enhances the contribution of green finance to GTFP by alleviating information asymmetry and credit rationing problems and improving credit allocation efficiency. These studies provide policymakers with the need to consider external factors in the development of green finance.

#### 2.1.4. Heterogeneity

Aiming at the complexity and diversity of the impact of green finance on green total factor productivity, the study mainly focuses on multiple perspectives such as geographic regional heterogeneity, heterogeneity of enterprise characteristics and heterogeneity of spatial spillover effects.

Firstly, geographic heterogeneity includes economic differences, differences between eastern, central and western regions, and provincial differences. In regions with more favorable economic and social conditions as well as developed markets [5,16,28], regions with a relatively underdeveloped digital economy [29], and the eastern region [4,17,26,27], and the western region [10,23], the impact of green finance on GTFP is positive and significant. In terms of provincial differences, Pang et al. use a more micro perspective to construct synthetic provinces and find that there is regional heterogeneity in the impact of green finance on green total factor productivity, with Zhejiang, Guangdong, and Jiangxi provinces showing positive policy effects overall [15].

Second, regarding the heterogeneity of firm characteristics, Li et al. point out from the perspective of microenterprises that green finance can enhance firms' GTFP, especially in the case of less institutional constraints and political pressures, fewer financial constraints, and more financing opportunities, and that the effect is particularly significant in non-state-owned firms, large-scale firms, and firms with weak financing constraints [30].

Finally, regarding the heterogeneity of spatial spillover effects, Xie et al. explore the spatial spillover effect of green finance on GTFP in Chinese cities, noting that this effect decreases sequentially in the eastern, central, and western regions, and that it affects large and medium-sized cities differently, whereas it does not have a significant spatial spillover effect on small cities [31].

The heterogeneity study explores the complexity and diversity of the impact of green finance on GTFP from multiple perspectives, including geographic regions, enterprise characteristics and spatial spillover effects. The study finds that the impact of green finance on GTFP varies under different economic and social conditions, with different degrees of impact in the eastern, western and central regions; there are also significant differences in the impact of green finance on GTFP under different enterprise characteristics; in addition, the spatial spillover effect of green finance on GTFP varies across cities and regions. These studies provide policymakers with differentiated policy recommendations for different regions and enterprises.

## 2.2. A Study on the Impact of Green Finance Segmentation Products on GTFP

### 2.2.1. A Study on the Impact of Carbon Finance on GTFP

Governments are increasingly emphasizing sustainable economic development, and this emphasis has greatly contributed to the flourishing development of the carbon finance market. China has actively responded to the international call for greenhouse gas emission reduction and has made every effort to explore the new path of low-carbon economy and sustainable development.

Zhang points out that carbon finance has a significant positive effect on China's green total factor productivity. Specifically, analyzed from a geographical perspective, both green total factor productivity and environmental efficiency were significantly improved in the eastern region with the help of carbon finance; in the central and western regions, green total factor productivity improved with the help of carbon finance; however, in the northeastern region, the promotion effect of carbon finance on green total factor productivity was not obvious. Further, carbon finance provides strong support for enhancing green total factor productivity in the distribution industry through three keyways: reducing transaction costs, diversifying innovation risks, and strengthening project supervision [32]. Wu et al. find that carbon finance can not only drive the optimization and upgrading of the structure of the distribution industry, but also promote the improvement of green total factor productivity in the distribution industry. In this process, the upgrading of the distribution industry structure plays a partly mediating role. The results of the heterogeneity test show that carbon finance has a more significant effect on the enhancement of green total factor productivity in the circulation industry in the east and central regions than in the western regions [33].

In summary, the impact of carbon finance on green total factor productivity is multifaceted and complex. It not only directly enhances green total factor productivity by reducing transaction costs, diversifying innovation risks and strengthening project supervision, but also indirectly enhances green total factor productivity by promoting the optimization and upgrading of industrial structure. At the same time, there are significant differences in the impact of carbon finance on green total factor productivity in different regions. Future research can further explore the internal mechanism of the impact of carbon finance on green total factor productivity, and how to optimize the design of the carbon finance market, strengthen policy guidance and other measures, so as to better play a positive role in promoting the development of low-carbon economy.

### 2.2.2. A Study on the Impact of Green Bonds on GTFP

Li et al., Zhang, Zhu et al., and Liu et al. jointly reveal that corporate green bond issuance has a significant positive enhancement effect on their green total factor productivity (GTFP) [34-37]. This enhancement effect is not only demonstrated through a variety of mediating mechanisms, but also presents obvious regional heterogeneity characteristics.

Specifically, the study of Li et al. reveal that there is a cumulative effect of the enhancement effect and points out that media attention plays a positive moderating role in the process of green bonds promoting technological innovations, and green technological innovations play a part in mediating the effect of green bonds on their green total factor productivity (GTFP) [34]. This implies that the issuance of green bonds is not just a one-time financing behavior, but its long-term effect has a profound impact on the green development of enterprises. In addition, the study also points out that media attention plays a positive moderating role in this process, which promotes technological innovation and thus

enhances GTFP by increasing public awareness of green bonds and corporate transparency. This finding reveals the social effect of green bonds, i.e., media attention, as an external supervisory mechanism, can help to enhance the market influence of green bonds and the incentive for green development of enterprises.

Zhang points out that reducing carbon emission intensity is another important way for green bonds to enhance GTFP, and this enhancement effect is more significant especially in regions with a higher degree of financial marketization and weaker environmental regulations [35]. This finding suggests that green bonds can work more effectively in regions with a higher degree of financial marketization, and also implies the importance of synergies between environmental regulatory policies and green financial instruments to drive the green transition.

In terms of regional differences, Liu et al. find that the enhancement effect of green bonds on GTFP is more prominent when the level of corporate financing constraints is higher and the level of marketization in the region is also higher [37]. This finding reveals the differences in the performance of green bonds in different market environments and emphasizes the important role of the level of marketization in the development of green finance. In regions with a higher level of marketization, the financial market is more complete, information disclosure is more transparent, and investors have a higher degree of recognition of green bonds, thus promoting the issuance of green bonds and the enhancement of GTFP.

In addition, the study by Li et al. (2021) emphasizes that in regions with more developed financial markets, corporate green bond issuance is more significantly effective in promoting GTFP [34]. This finding echoes Liu et al.'s study, which together reveal the impact of the level of financial market development on the effectiveness of green bonds [37]. In regions with developed financial markets, enterprises are more likely to obtain green bond financing, while investors are more likely to recognize and assess the value of green bonds, thus promoting the healthy development of the green bond market and enhancing GTFP.

In summary, green bonds, as an innovative financial instrument, have a significant positive effect in enhancing the green total factor productivity of enterprises. This role is not only demonstrated through a variety of intermediary mechanisms, but also presents obvious regional heterogeneity characteristics. Future research can further explore the differences in the performance of green bonds in different market environments, different industries, and different types of enterprises, and how to better play the positive role of green bonds in promoting the green transformation of the economy by optimizing the green bond issuance mechanism and strengthening the synergy between environmental regulatory policies and green financial instruments. At the same time, it is also necessary to pay attention to the long-term healthy development of the green bond market, strengthen investor education and market supervision, and improve the market recognition and financing efficiency of green bonds.

### 2.2.3. A Study on the Impact of Green Credit on GTFP

In recent years, with the increasing global attention to environmental protection and sustainable development, green credit, as an important part of green finance, has become the focus of academic attention for its impact on green total factor productivity (GTFP). Different scholars have explored the relationship between green credit and GTFP from various perspectives, such as internal mechanism, mediating effect, heterogeneity analysis and complex relationship, and formed rich research results,

which mainly illustrate the intrinsic connection between the two through the analysis of internal mechanism, exploration of mediating effect, heterogeneity analysis, and more complex relationship, such as the threshold effect, the U-shape relationship, and the spatial difference.

Xu et al. and Li et al. provide an in-depth analysis from the internal perspective, pointing out that the increase in green total factor productivity is mainly due to the promotion of green technological advances rather than changes in technical efficiency [38-39]. On the contrary, the studies of Liu et al. and Yang et al. show that, although green credit inhibits the rate of green technological progress in heavily polluting industries to a certain extent, it significantly improves the green efficiency of the industry, which ultimately enhances green total factor productivity [40-41].

In exploring the mediating effects of green credit on GTFP, researchers have suggested that industrial structure optimization [38,40], industrial structure upgrading and energy structure optimization [42], ecological research and development effects [40], debt maturity structure and reduction of commercial credit [43], corporate financing challenges [39], green technology innovation capacity [44-45], incentivizing firms to engage in innovation and resource allocation efficiency enhancement, improving the structure of energy consumption [46], and forcing firms to increase their environmental information disclosure [47], all of which play important positive effects in explaining the transmission mechanism between green credit and GTFP.

In terms of heterogeneity analysis, scholars believe that the impact of green credit on green total factor productivity is more significant under specific conditions. For example, in the northern region [40], non-state-owned enterprises [41, 43], small enterprises [43, 47], state-owned enterprises as well as those with higher financing constraints [47], high economic development level regions and stronger environmental regulations [45], regions with lower levels of financial development [43], regions with higher levels of financial development, less government intervention, and less pressure on economic growth [44], as well as the eastern and central-western regions [40-41][43][48]. Zhou, on the other hand, revealed significant inter-provincial differences between green credit and GTFP [42].

In addition, the relationship between green credit and GTFP exhibits more complex characteristics. Xu et al. point out that green credit can not only enhance the green total factor productivity in the region, but also exert a certain inhibitory effect on the neighboring regions through the spatial spillover effect. The threshold effect test shows that when the optimization level of industrial structure reaches a certain degree, the positive effect of green credit on green total factor productivity in the region will be significantly enhanced. The spatial threshold model, on the other hand, shows that the increase in the level of optimization of industrial structure in the region will reduce the inhibitory effect of green credit on green total factor productivity in neighboring regions [38]. Guo et al. find that industrial green total factor productivity shows a significant positive spatial agglomeration effect and a significant inverted U-shaped relationship between cost-based environmental regulation represented by sewage charges and industrial green total factor productivity; while investment-based environmental regulation represented by the amount of investment in industrial pollution control has a significant negative relationship with industrial green total factor productivity. The binding effect of public participation-based environmental regulation is relatively weak [49].

To summarize, the impact of green credit on GTFP is a complex and multifaceted process involving internal mechanisms, mediating effects, heterogeneity analysis and complex relationships. Future research can further explore in depth the influence mechanism of green credit in different

regions, industries and enterprises, and how to better play the positive role of green credit in promoting the green transformation of the economy by optimizing the green credit policy and strengthening the synergy between environmental regulation and financial policy. At the same time, it is also necessary to focus on the long-term healthy development of the green credit market, strengthen investor education and market regulation, and improve the market recognition and financing efficiency of green credit.

### 3. Brief Commentary

This review systematically compiles and integrates the research results on the impact of green finance on green total factor productivity (GTFP), builds a systematic analytical framework around the whole of green finance and its sub-divisions (such as green bonds, carbon finance, green credit, etc.), and comprehensively analyzes the mechanism of green finance's impact on GTFP. Through the in-depth exploration of direct impact, intermediary effect, moderating effect and heterogeneity analysis, this paper builds a multi-dimensional theoretical model, revealing how green finance can effectively promote the enhancement of GTFP through the paths of resource allocation optimization, technological innovation and industrial structure upgrading.

In addition, this paper pays special attention to the regional and enterprise heterogeneity of the impact of green finance on GTFP. By analyzing the moderating effects of the differences in economic development, the diversity of enterprise characteristics, and external factors such as financial technology in the eastern, middle and western regions, this paper reveals the diversified performance of green finance in different contexts. This heterogeneity analysis provides more targeted policy recommendations for the green transformation of different regions and enterprises and helps realize the coordinated development of regions and the green upgrading of enterprises.

On the basis of summarizing the existing research, this paper further looks forward to the direction of future research. In particular, in the area of how green finance can further enhance GTFP through mechanisms such as optimizing resource allocation, promoting technological innovation and facilitating industrial structure upgrading, this paper proposes key directions for deepening the research, providing new ideas and insights for subsequent academic research. Through a systematic overview of the impact of green finance on GTFP, this paper clarifies the core position of green finance in promoting sustainable economic development. This not only provides an important reference for the government to formulate green financial policies and optimize the allocation of financial resources, but also lays a theoretical foundation for promoting the green transformation of enterprises and realizing high-quality green development of the economy.

Future research should further deepen the dynamic relationship mechanism between green finance and GTFP, expand the breadth and depth of regional and enterprise heterogeneity analysis, explore the synergistic development path of digital economy and green finance, promote international green finance cooperation, and strengthen the comprehensive assessment of the long-term effects and social benefits of green finance. These studies will not only help to enrich and improve the theoretical system in the field of green finance, but also provide policymakers with more forward-looking and operational guidance, and ultimately promote the economy towards high-quality green transformation.

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