

The Mechanism and Path of Green Finance of Commercial Banks to Empower Rural Areas Under the Dual Carbon Goal

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Abstract. Under the macro background of the "double carbon" goal and the in-depth implementation of the rural strategy, the green allocation of financial resources has become the key driving force to promote the transformation of agriculture and rural areas. At present, rural areas are facing practical difficulties such as poor financing of green industries, a lack of realization mechanism of ecological resource value, and insufficient motivation for green transformation of traditional industries. This paper focuses on the rural green finance of commercial banks, combs the research hotspots and evolution context, and constructs a 'direct-indirect' two-dimensional mechanism framework. And explore the collaborative path from the government, financial institutions, and agricultural business entities. This paper deepens the theoretical cognition of the coordinated development of green finance and rural areas, provides theoretical and practical reference for the green financial products and services of commercial banks and improving the relevant policy system, and is of great value to promote the comprehensive green transformation of the rural economy and society and common prosperity.

Keywords: Commercial banks, green finance, rural areas

1. Introduction

The rural strategy is a key component of China's grand blueprint for national rejuvenation. As the core of the financial system, the green financial practice of commercial banks has become a key link between the national strategy and the needs of rural development. Both of them are highly consistent with the internal development needs of rural areas and become the key to promoting rural development needs. In recent years, policies have guided financial resources to tilt towards green agriculture, rural ecological protection and other fields, providing an institutional framework for green finance to empower rural areas. At the same time, rural development is facing multiple challenges such as industrial structure adjustment and ecological environment governance, which should be supported by innovative financial instruments. Green finance can not only promote the ecological upgrading of rural industries, but also improve the rural living environment and promote the sustainable development of agriculture by guiding credit investment. This process reflects the profound transformation of financial services from a single economic goal to the comprehensive benefits of the economic and social environment, and indicates the arrival of a new era of

sustainable rural environment, which will become an important cornerstone in the process of national development.

With the in-depth implementation of the rural strategy, the in-depth implementation of the rural strategy faces higher requirements for financial support. As a key driving force, the green finance of commercial banks has increasingly attracted academic attention. Relevant research shows that green finance can promote regional rural green development through empirical tests [1]. Green financial reform can effectively accelerate the process of rural green development [2]. It can also reshape the rural income structure and enhance agricultural resilience. It is in harmony with rural [3, 4]. At the same time, the synergy between green innovation and financial capital can help green economic growth and provide support for rural green transformation. Although the existing research has clarified the empowerment value of green finance, there are still some limitations, such as the lack of a deep dismantling of the industrial mechanism, the lack of a differentiated empowerment mechanism, and the lack of discussion on deep issues. Based on this, this paper focuses on the core issues of rural revitalization empowered by green finance of commercial banks, systematically combs the research evolution and academic hotspots in this field, constructs a 'direct-indirect' two-dimensional mechanism analysis framework, analyzes the direct effects such as capital injection and technology empowerment and the indirect effects such as ecological value transformation and industrial chain synergy, and combines the three levels of government, financial institutions and agricultural business entities to build a coordinated development path and look forward to the future trend.

In terms of marginal contribution, this paper deepens the theoretical cognition of green finance multi-level driving rural development, explores the collaborative application path of diversified financial instruments from the perspective of transcending single green credit, and provides a theoretical reference for the product design of financial institutions. Focusing on the regional heterogeneity and conditionality of the mechanism of action, it points out the direction for subsequent empirical tests and differentiated policy design and makes up for the shortcomings of existing research.

2. Green finance development trend

The comprehensive implementation of the rural strategy provides a clear direction and broad space for the development of green finance of commercial banks. The relevant policy system has been gradually improved. Through the dual mechanism of restraint and incentive, commercial banks are guided to deeply integrate green financial business with the rural strategy and promote financial resources to the rural green field. It has laid a good policy foundation for the development of rural green financial business of commercial banks. In recent years, the rural green financial market of commercial banks has shown the dual characteristics of scale expansion and structural differentiation. From the year-on-year growth rate of market size, 2019-2025 presents the stage characteristics of 'rising first, then falling back', which intuitively reflects the rhythm of scale expansion. The slowdown in growth rate has not changed the trend of total continuous growth, but rather the embodiment of the market's transformation from high-speed expansion to high-quality development. It not only fits the development rhythm of the gradual maturity of green financial business and the steady release of rural green project financing demand, but also fits the overall background of policy guidance of financial supervision departments and strong green demand in the market, and continues to promote the steady expansion of scale.

Rural commercial banks and rural credit cooperatives account for the highest proportion and are rising year by year, which is the core support for scale expansion. The proportion of urban

commercial banks has steadily increased and has become an important supplement. Although the proportion of large state-owned commercial banks is lower than that of local banks, they dominate the total business volume by virtue of their asset scale advantages. The proportion of national joint-stock commercial banks is the lowest, but it also shows a steady upward trend, contributing incrementally through product innovation and cross-regional linkage.

The continuous expansion of market scale and the differentiated distribution of the proportion of each bank further promote the iterative upgrading of the rural green financial business model of commercial banks, making it more suitable for the needs of scale growth. With the continuous growth of the total amount and the proportion of each bank, especially the deep participation of local banks, the diversified combination model is gradually promoted, which not only responds to the policy's encouragement of collaborative innovation of financial instruments, but also accurately matches the scale contribution positioning of different types of banks and the differentiated financing needs of rural green industries.

3. Direct empowerment mechanism

3.1. Capital injection effect

The capital injection effect is the most direct and basic path for commercial banks' green finance to empower rural industries. Its core is to solve the long-term financing constraints faced by rural green industries through targeted financial instruments. Rural green industries, such as ecological agriculture and clean energy projects, often face the high threshold of traditional financing due to the lack of qualified collateral, long operating cycle and difficult quantification of environmental externalities. By innovating green credit products, commercial banks have accurately invested funds in rural projects that meet green standards, effectively reducing the mortgage requirements of financing entities. For example, for photovoltaic agriculture, organic farming and other industries, banks can use the future carbon sink income or green certification of the project as a basis for credit enhancement, thereby alleviating the dilemma of insufficient mortgages. Tools such as green bills provide convenient short-term financing channels for small and medium-sized enterprises in the agricultural green supply chain, and improve the efficiency of capital turnover [5]. This directional delivery mechanism establishes the precise connection between funds and green projects, extends the coverage from large-scale rural infrastructure to small and micro green agricultural business entities, and guides the continuous flow of financial living water into the key areas of rural development.

3.2. Technology empowerment effect

The core of the technology effect of green finance of commercial banks lies in the deep binding of financial support and green technology solutions through innovative financial products and service models, thus effectively promoting the technological upgrading of rural industries. Banks do not provide credit in isolation, but play a key role in resource integration and risk sharing. Specifically, by designing a portfolio of 'green credit + technical services', banks have linked loan issuance to the introduction of certified third-party agricultural green technology service providers. These service providers provide farmers or agricultural enterprises with technical solutions, including water-saving irrigation, organic planting, waste recycling, and clean energy applications [6]. This model directly directs financial capital to the application side of technology, reducing the

information cost and trial risk faced by agricultural business entities in seeking and adopting new technologies alone.

The conversion efficiency of technology landing is affected by multiple factors. On the one hand, the collaborative screening and process supervision of banks and technology service providers is crucial. The bank screens customers according to the green project standard, and the technical service provider is responsible for the technical suitability evaluation and landing guidance, forming a transmission chain of " bank screening project-service provider providing scheme-subject implementation transformation. " On the other hand, the conversion efficiency of technology ultimately depends on the acceptance and application ability of the business entity. The research shows that there is still room for improvement in the adoption rate of green production technology by farmers, and the service ability of grassroots agricultural technology promotion is one of the constraints. Therefore, in the bank-service provider-subject tripartite coordination mechanism, the continuous tracking training of service providers and the post-loan management of banks have become the key to improving the transformation efficiency. This embedded service mode not only promotes the application of single technology, but also subtly improves the overall green technology literacy and sustainable innovation ability of rural industry.

3.3. Structural effect

The structural effect is reflected in the fact that commercial banks guide capital from traditional agricultural projects with high pollution and high energy consumption to eco-friendly green formats through green financial instruments, thus reshaping the rural industrial structure. Commercial banks have differentiated the allocation of credit resources according to environmental protection standards, and imposed stricter credit approval conditions or higher financing costs on traditional projects such as excessive use of pesticides, livestock and poultry breeding pollution, which objectively inhibited expansion [6]. At the same time, through green credit, green bonds and other tools, banks provide preferential interest rates and priority credit for green formats such as ecological planting, organic agriculture, rural tourism, and rural photovoltaics, which significantly reduces their financing threshold. This parallel capital allocation strategy of " restriction " and " tilt " directly drives the upgrading of factors within the rural industry. Studies have shown that green finance has effectively promoted the transformation of rural industries from resource-consuming to environmentally friendly by the credit structure, and promoted the value of the industrial chain [7]. This combination of financial orientation and policy incentives has accelerated the green transformation process of the rural economic structure.

Table 1. Evolution of the proportion of output value of rural green business and traditional business in 2020-2025

particular year	The proportion of traditional high energy consumption / pollution agricultural output value	The proportion of output value of green formats	Proportion of neutral traditional agricultural output value
2020	41.9%	13.3%	44.8%
2021	39.7%	16.2%	44.1%
2022	36.8%	19.4%	43.8%
2023	33.3%	22.5%	44.2%
2024	30.2%	26.0%	43.8%
2025	26.8%	29.2%	44.0%

In order to quantify this structural change trend, based on the simulation analysis of public statistical data and industry reports, Table 1 shows the evolution of the proportion of rural green format and traditional format output value from 2020 to 2025. It can be seen that the proportion of green business output value has shown a steady upward trend.

4. Indirect energization mechanism

4.1. Ecological value transformation

The transformation effect of ecological value is the key indirect mechanism for commercial banks' green finance to empower rural areas. Its core is to transform rural ecological resources into marketable assets that can be traded and financed through financial instruments. Green credit and green bonds play a central role. Green credit directly supports specific practices such as forestry carbon sink development, water rights trading, and pollution control by providing targeted financing for ecological product value projects. For example, the long-term and low-interest green loans issued for national reserve forest construction projects not only solve the financing problems caused by the long growth cycle of trees, but also lay a material foundation for subsequent carbon sink certification and trading by supporting forest tending and management, and the initial transformation from ecological resources to carbon assets [8]. Green bonds provide a stable capital flow for the overall ecosystem restoration and protection projects in rural areas by raising large-scale, maturity-matched special funds. The ecological environment quality improved by these projects itself constitutes quantifiable ecological capital [9].

4.2. Industrial chain collaborative extension

Through the synergistic effect of the industrial chain, the green finance of commercial banks connects the production, processing and circulation links of the rural green industry, effectively bridging the breakpoint of the industrial chain. Tools such as green bills and green industry funds play a key role. With its high liquidity and short-term financing characteristics, green bills accurately meet the working capital needs of upstream and downstream enterprises in the industrial chain in raw material procurement, order production and other links, facilitating green agricultural product producers to pay prepayments to processing enterprises [5]. Through equity or long-term debt investment, the Green Industry Fund focuses on supporting the technological upgrading and capacity expansion of rural green processing enterprises, as well as the construction of circulation infrastructure to improve the synergy efficiency and product added value of the whole chain [10]. This kind of financial support led or participated in by commercial banks not only connects agricultural business entities with the modern market, but also guides the industrial chain to green and high-value extension through the flow of funds.

4.3. Factor agglomeration guidance

Green finance of commercial banks constructs the factor gravity field through product innovation, and guides the directional flow of urban high-quality factors to rural green industries. Its core driving logic is that green credit, green bonds and other tools significantly reduce the initial investment risk and uncertainty of rural green industry projects by providing low-cost, long-term targeted financing, thus releasing clear industrial support signals to the market. This signal not only improves the rural investment environment, but also binds financial support to specific technical

cooperation and industrial landing projects through 'talent + project' and other models. For example, special green loans for rural photovoltaic, ecological agriculture and other projects, which are accompanied by technical service agreements or industry-university-research cooperation requirements, directly attract technical experts and managers in related fields to the countryside to provide guidance and services [9]. This financially embedded cooperation makes the flow of talents and technology no longer a one-way public welfare support, but a sustainable value co-creation based on market-oriented projects.

5. Enabling path construction

5.1. Government system guidance

Government system guidance is the key support for commercial banks' green finance to empower rural areas. The policy tools mainly include direct fiscal incentives such as fiscal discounts, tax breaks, investment subsidies, and the establishment of sharing mechanisms such as green loan risk compensation and green insurance premium subsidies [11]. These tools aim to reduce the financing costs of green projects and the business risks of financial institutions, and guide capital to flow to rural green industries. However, there are blocking points in the implementation of policies, which are manifested in the fragmentation of incentives caused by insufficient inter-departmental policy coordination, the ambiguity of some grass-roots implementation standards, and the assessment of commercial banks mostly focuses on quantitative indicators such as the scale of green credit. The evaluation mechanism of the actual environmental benefits of funds and the driving effect of rural industries is still not perfect [10]. The future direction is to strengthen cross-sectoral policy coordination and form a joint force of finance, currency and supervision. At the same time, it is necessary to refine the assessment mechanism, incorporate medium and long-term benefits such as carbon emission reduction and ecological improvement of rural green projects into the performance evaluation system of financial institutions, and explore the establishment of differentiated regional green financial support catalogues to improve policy accuracy and effectiveness.

5.2. Bank product innovation

The innovation of green financial products of commercial banks needs to closely adapt to the characteristics of rural industries and financing needs. In view of the common pain points such as insufficient collateral and unstable cash flow in rural green projects, banks should develop exclusive green credit products, such as incorporating agricultural waste resources and organic planting into the scope of support, and designing flexible repayment methods based on the future carbon sink income or environmental benefits of the project. Agricultural green bonds are another key direction, which can be targeted to raise funds for medium-and long-term projects such as rural clean energy and ecological restoration, but the issuance and certification process needs to be simplified to reduce the participation threshold of agricultural operators [6]. Emerging tools such as carbon sink pledge financing can effectively recycle rural ecological assets. The core is to establish a scientific carbon sink measurement and risk assessment model to solve the valuation and risk control problems in the market-oriented ecological value.

The key to product design lies in the innovation of risk control mode and the simplification of the process. The bank can introduce the sharing mechanism of "bank, government and insurance," and comprehensively use satellite remote sensing, Internet of Things and other scientific and technological means to dynamically monitor the environmental benefits and operating conditions of

the project, instead of relying too much on traditional fixed asset mortgages. In terms of process, should establish a special approval channel for green financial business, integrate environmental information disclosure and credit evaluation links, and improve service efficiency. Product innovation also needs to be deeply integrated with the rural industrial chain, such as developing supply chain financial products covering the whole chain of production, processing and sales of green agricultural products, and guiding production factors to gather in rural green industries with financial instruments [12].

5.3. Enabling business entities

Improving the green financial literacy of agricultural business entities is the key link to empowerment. Financial knowledge training and green production technology guidance constitute the core of literacy improvement. Targeted training can help the subject understand the environmental benefits and financing processes of tools such as green credit and green bonds, while technical guidance is directly related to the green transformation of its production practice and enhances the feasibility and competitiveness of financing projects. However, subject participation faces multiple obstacles, including low awareness of green financial products due to information asymmetry, insufficient professional knowledge affecting project evaluation and application, and high barriers to entry due to the lack of traditional collateral. In order to break through the obstacles, it is necessary to establish a precise docking mechanism. Commercial banks can unite local governments and agricultural departments, use digital platforms to identify the needs of the main body, and push the appropriate green financial products and service information.

6. Conclusion

Green finance of commercial banks is the key financial support to empower rural areas, and the empowerment effect is achieved through the ' direct-indirect ' two-dimensional mechanism. At the direct level, capital injection through tools such as green credit has effectively cracked the financing constraints of rural green industries, while driving technological upgrading and industrial structure. At the indirect level, green finance promotes the market-oriented transformation of ecological value and rural ecological resources through tools such as green bonds, and promotes the agglomeration effect of factors such as industrial chain coordination and talent technology. On the empowerment path, a collaborative framework of " government guidance, bank innovation, and subject promotion " has been formed to provide a solid financial guarantee for the green and modern development of rural industries. However, combined with the existing research and the analysis of this paper, there are still obvious limitations in the current research in this field. First, the depth of empirical research is insufficient. Most studies focus on the description of macro-policy effects and lack micro-econometric testing of specific transmission paths. Second, the research on financial instruments is relatively single, focusing more on green credit, and the application and adaptability of other tools in rural scenes are insufficient.

Looking forward to the future, commercial banks ' green finance-enabled rural areas will show a trend toward precision and intelligence. With the maturity of rural green industry ecology and the expansion of the carbon market, the innovation of financial instruments will be more scene-oriented and asset-oriented. Green credit, bonds and insurance products based on expected carbon sink income and ecological rights and interests will continue to emerge, promoting more efficient rural ecological resources.

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