

Institutional Evolution and Sino-Foreign Comparison of China's Carbon Finance

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Abstract. In recent years, global environmental challenges have become increasingly severe. To promote the green transformation of the economy, governments and international organizations around the world have explored green finance as a regulatory tool through research and practice. In order to achieve green development, energy conservation and emission reduction, and promote new productive forces, China has put forward increasingly improved green financial market mechanisms and related policies, among which carbon finance is highly representative. How to formulate and developing a carbon finance mechanism that is in line with China's economy, technology, and people's livelihood to achieve the "dual carbon" goals as soon as possible is a research issue of great significance at present. This paper will select carbon finance policies from different developed countries, systematically sort out the development process and existing accomplishments of China's carbon finance, and review existing literature to summarize the relevant relationships between carbon finance and economic development. energy conservation and emission reduction, etc. Combined with the relevant characteristics of China's economy, it will draw relevant enlightenment with certain reference value.

Keywords: Carbon finance, carbon emissions, dual carbon goals

1. Introduction

Since the beginning of the 21st century, China's economic strength and technological level have achieved significant improvement, and Its economic growth has shifted from a stage of rapid expansion to a stage of high-quality advancement. The traditional single goal centered on "improving efficiency and increasing output" is gradually transitioning to a goal of "taking environmental impacts into account and promoting green development" [1]. However, as an aggregation of a large number of enterprises, the core purpose of industries remains to pursue profits, and the green development model inevitably affects enterprises in terms of cost and efficiency.

Against this backdrop, the government has become a key driving force in promoting the green transformation of industries. After years of practical exploration, China has gradually built a green financial system that suits its national conditions, and carbon finance, as a core component of green finance, is representative in the governance of pollutant emissions [2]. Currently, China has clearly put forward the goals of the "14th Five-Year Plan" and the strategy and commitment to achieve

carbon neutrality by 2060, which not only demonstrates China's determination to promote green development [3]. Although China has achieved phased results in the field of carbon emission governance, compared with some developed countries, there is still a gap in carbon financial market mechanisms and other aspects, which require further exploration and improvement [4].

The theoretical significance of this study lies in enriching the theoretical system of green finance and providing a new analytical perspective for understanding carbon finance by systematically sorting out the mechanism of action of carbon finance on China's green financial system. It provides a reference for the government to formulate carbon finance-related policies, helping China to better achieve the goal of carbon neutrality. At the same time, exploring the future possibilities of carbon finance in the development of green financial systems is of great practical significance for promoting the transformation of China's economic model to a low-carbon one and fostering new productive forces. It can also contribute China's experience and solutions to global environmental governance.

This research focuses on the function of carbon finance within China's green financial system and its possible future development as the core theme, and specifically focuses on the following contents: the concepts of green finance and carbon finance; their function in driving economic transformation; the evolution and present status of China's carbon financial system; and a comparison between foreign carbon financial systems and China's. This study will adopt the literature research method to systematically sort out domestic and foreign theories, research results, and existing theoretical foundations related to carbon finance and green financial systems. It will also use the comparative research method to analyze the experiences and lessons of some developed countries in the construction of carbon financial systems, so as to provide references for the development of China's carbon finance. Lastly, it will examine and draw conclusions about the future prospects and trends of carbon finance.

This research seeks to accomplish the following goals: to identify the inadequacies in the development of China's carbon finance in comparison with that of developed nations; to examine the features and current situation of China's carbon finance; to explore potential remedies for the existing issues in carbon finance at present and to provide operable countermeasures and suggestions for China to improve its carbon finance system, thus contributing to the realization of the goal of transforming towards high-quality and green economic development.

2. The concepts of green finance and carbon finance and their role in promoting economic transformation

2.1. The function of green finance in driving economic development

Green finance is an investment and financing tool that promotes the flow of funds into greener fields. The essence of green finance is to gradually identify and quantify a series of negative externalities caused to the environment in production through the input of financial funds, and then convert them into the internalized costs of relevant enterprises. In recent years, empirical analyses in academia have proven that carbon finance plays a significant role in controlling carbon emissions. Green finance helps to encourage enterprises to engage in greener and more sustainable production activities, enabling them to gain profits in production while minimizing the negative externalities of production, thereby increasing the overall social benefits. In a broad sense, green finance can be defined as all financial activities aimed at supporting the green economy. Over a range of past practices in the financial and economic field, green finance has exhibited a clear positive promotional effect and a positive spatial spillover effect on the green transformation of the economy.

It can promote industrial optimization through advancing technological innovation and facilitating the optimization of industrial structure, among other aspects. It can thus be seen that in the 21st century, if enterprises are to achieve green and efficient transformation, green finance is not only an effective and reasonable means but also an inevitable method to be adopted in the process of enterprises' green transformation. As the world's largest developing country, China is a major country with high international influence. It attaches great importance to and holds firm determination for the green transformation of the economy. The "14th Five - Year Plan" puts forward important directives to speed up the development of green finance, promote green and low - carbon development, and advance the all - round green transformation of economic and social development. By the end of the fourth quarter of 2024, the balance of local and foreign currency green credit in China had hit 36.6 trillion yuan. The growth of green finance has produced specific outcomes and scale, and it has significantly influenced the green development and industry transformation [5].

2.2. Carbon finance's contribution to the economy's green transformation

"Carbon emissions" are one of the main triggering factors of major environmental issues that have received increasing attention in recent years, such as air pollution and global warming. Therefore, under the green financial system, "carbon finance" is one of the highly representative financial models. China attaches great importance to carbon emissions and has pledged at the United Nations to achieve "carbon peak" by 2030 and "carbon neutrality" by 2060 [6]. This reflects that carbon governance is not only a focus but also a microcosm of China's environmental governance. In a broad sense, carbon finance can be regarded as financial activities aimed at restricting all carbon emissions [7]. It is proposed that current carbon finance mainly revolves around carbon emission rights trading, which can be roughly divided into three categories of tools: financing, trading, and support [8]. It cannot be ignored that the healthy and effective operation of carbon emissions not only depends on the completeness of the carbon financial system but also is inseparable from government supervision and management. The government also plays an important regulatory role in aspects such as tax control, index formulation, and support for relevant enterprises. Thus, research into the development process of China's carbon financial system is of great significance for China's future carbon emission governance and the realization of green economic transformation [9].

3. The evolution and current status of China's carbon financial system

3.1. The evolution of China's carbon financial system

China's carbon financial system can be roughly divided into four periods based on its relevant characteristics, namely the period of international introduction and exploration (2005–2011), the period of local pilot experiments (2011–2020), the period of national carbon market launch (2020–2024), and the period of deepened reform (2024–present).

Period of International Introduction and Exploration (2005–2011): A key landmark of this period was the entry into force of the Kyoto Protocol, after which the economic development of major countries worldwide began to shift toward a green and sustainable model. Against this backdrop, as an important member state of the United Nations, China systematically introduced the concept of green development, and carbon finance, as a branch of the green financial mechanism derived from the concept of green development, began to enter China. During this period, the number of China's Clean Development Mechanism (CDM) registered projects grew rapidly, reaching 634 by 2011.

Period of Local Pilot Experiments (2011–2020): In 2011, the National Development and Reform Commission gave the green light to pilot projects in 7 provinces and municipalities, namely Beijing, Shanghai, Guangdong, Shenzhen, Tianjin, Hubei, and Chongqing. This marked a shift in China's carbon finance scale from a decentralized development model dominated by financial institutions to a more comprehensive and systematic financial system based on cities. In 2014, the National Development and Reform Commission formulated the "Interim Measures for the Administration of Carbon Emission Rights Trading", which standardized China's carbon emission trading mechanism, encouraged increased involvement of relevant financial institutions, and enhanced the integration of carbon emission rights with financial markets via trading activities.

Period of National Carbon Market Launch (2020–2024): After localized pilot programs in some cities, China's carbon finance model had initially matured and gained the capacity for nationwide promotion. In July 2021, the national carbon emission rights trading market was formally put into operation, bringing 2,162 key emission entities in the power sector into its scope. This formally marked the expansion of China's carbon finance to a national scale, encompassing roughly 4.5 billion tons of annual carbon dioxide emissions.

Period of Deepened Reform (2024–present): With the basic establishment of the carbon financial system, China's carbon finance has reached a certain scale. In March In 2024, seven key departments in China jointly issued the "Guiding Opinions on Further Strengthening Financial Support for Green and Low - Carbon Development." This incident indicated that China's financial market had entered a phase of in - depth development, with equal emphasis on quality and scale. In the same period, the China-EU Carbon Pricing Dialogue Mechanism was also set up, allowing for deeper integration with international norms.

Overall, the evolution of China's carbon financial system is characterized by rapid development, strong overall planning, distinct phases, a progression from point to area and from shallow to deep, and a high level of international exchanges.

3.2. The current status of China's carbon financial system

The mandatory compliance industries in China's carbon market include power, steel, cement, and aluminum smelting. Enterprises in these industries with carbon emissions exceeding a certain scale are subject to mandatory compliance requirements, totaling over 3,680 enterprises, covering more than 60% of the country's carbon dioxide emissions. This has a significant impact on China's carbon dioxide governance and constitutes the basic scale of the carbon market's capacity. A growing number of enterprises are joining the voluntary emission reduction market, a trend that has expanded the reach of the carbon market and further boosted its overall capacity. A certain number of enterprises participating in the voluntary emission reduction market are from Belt and Road cooperation projects, greatly promoting international exchanges. There are currently 7 pilot markets, including Beijing, Shanghai, Guangdong, Hubei, Tianjin, Chongqing, and Fujian, covering most economically developed provinces and cities. It can be concluded that China's carbon market has achieved a certain scale in terms of enterprise coverage, international exchanges, and city coverage, but full coverage has not yet been realized.

The emergence and growth of China's carbon financial system have been characterized by a high degree of government involvement, with relevant policies continuously improving alongside the evolution of the carbon financial system. In In 2021, the State Council issued the Opinions on Fully, Accurately and Comprehensively Implementing the New Development Concept to Ensure the Effective Implementation of Carbon Peak and Carbon Neutrality Initiatives. This document has notably boosted the orderly progress of China's carbon market, accelerated the building of a

comprehensive carbon trading market, and promoted the growth of relevant financial products and sectors. It highlights the important function of the carbon financial market in China's energy conservation and emission reduction efforts and provides guidance for achieving the "dual carbon" goals through carbon finance.

The release of the "Catalogue of Projects Supported by Green Finance (2025 Edition)" has refined the classification of green credit, bonds, and other instruments, covering 271 sub-projects across 9 major fields. This has made carbon financial transactions more standardized and institutionalized, guiding for enterprises to participate in carbon finance. At the local level, various provinces and cities have issued policies tailored to their development status. For example, Beijing released the "Beijing Green Finance Development Plan (2025-2030)" in March 2025, aiming to reduce carbon emission intensity by more than 35% compared with 2020. It also plans a "one core and two wings" layout consisting of Financial Street (green finance headquarters) + the city's sub-center (green infrastructure) + Zhongguancun (green technology).

4. Comparison between foreign carbon financial systems and China's

In recent years, China has made significant progress in carbon finance and achieved certain results in environmental protection. However, there are still some shortcomings compared with some developed countries in the world [10]. As the first country in the world to carry out environmental governance through government means, the United States has rich historical experience. At the same time, the United States has certain similarities with China in terms of national size, so it has great reference significance. South Korea, which is geographically located in Asia like China and has a similar industrial take-off time, can also provide a unique reference perspective for China.

4.1. The United States – carbon governance driven primarily by technology

Since the end of World War II, the United States has seen rapid development in industry and technology, with its economic aggregate ranking first in the world for many years. Its economic green transformation began earlier than that of China, and it already achieved "carbon peak" in 2007. This shows that compared with China, the U.S. carbon financial system is in a more advanced stage and has a certain forward-looking reference value to some extent.

The U.S. government attached importance to environmental issues relatively early. As early as 1969, it enacted the National Environmental Policy Act, which was also the first legislation to establish environmental protection as a national policy. Although concepts related to green finance and carbon finance did not emerge during this period, the early initiation of environmental governance undoubtedly gave the United States a significant first-mover advantage in the field of green finance, proposed against the backdrop of environmental protection.

As a technological powerhouse, the United States primarily achieves carbon emission reduction in its carbon governance by applying advanced technologies to traditional enterprises and energy companies and promoting their technological transformation. For example, Duke Energy, one of the largest electric power companies in the United States, has significantly improved its carbon dioxide absorption rate by retrofitting its existing thermal power equipment with amine absorption-based carbon capture devices. It captures around 1.5 million tons of carbon dioxide each year, significantly lowering carbon emissions from thermal power plants. At the same time, by selling the collected carbon dioxide to beverage enterprises for the production of carbonated beverages, it has also brought about extra income for the company. At the same time, American enterprises also attach importance to investment in the environmental protection field. Tesla has not only disrupted

traditional fuel vehicle companies but also made substantial investments in the environmental protection sector. For instance, Tesla acquired SolarCity, integrating solar energy technology with new energy vehicles to promote the use of green energy.

On the government side, the United States has implemented the Clean Energy Finance Corporation (CEFC) model. Through state-level green banks, it provides preferential loans, loss-sharing agreements, and other means to support enterprises in carrying out energy conservation and emission reduction projects in the financial sector.

4.2. South Korea – government-driven environmental governance

South Korea, like China, is an Asian country, and both had relatively weak industrial foundations in the early stages. Therefore, it has a certain reference value in the field of carbon finance. South Korea achieved a "carbon peak" around 2013 and has made certain progress in carbon emission governance in recent years, which shows that South Korea's carbon governance methods have unique advantages.

In 2021, South Korea launched the Green New Deal, attracting private enterprises to invest in fields such as renewable energy, green infrastructure, and industrial green upgrading through means such as the government establishing green funds and issuing green bonds. At the same time, the South Korean government has formulated the Korean Emissions Trading System, which covers 89% of the country's greenhouse gas emissions, playing a significant role in regulating greenhouse gas emissions.

South Korea's green finance features distinct public-private cooperation. For example, the Korea Green Investment Bank (K-GIB) was established with government funding in collaboration with the National Pension Service (NPS) and the Korea Development Bank (KDB). This system effectively reduces the government's fiscal burden and promotes the in-depth participation of private financial institutions.

5. Conclusion

While China's carbon financial system has made some progress in recent years, it still falls short of the international cutting-edge standards and confronts the following issues: First, given China's huge economic scale, the existing influence of carbon finance is insufficient to significantly reduce the country's carbon emissions. Second, China's current carbon financial system relies excessively on the government, making it difficult to effectively mobilize the autonomy of enterprises and financial institutions, thus leading to over-reliance on macro-control. Third, financial institutions lack sufficient experience and participation in carbon finance, failing to provide relevant financial derivative products effectively. Fourth, there remain certain inadequacies in China's current green technology landscape, which hinders its effective application in energy conservation and emission reduction efforts.

On the basis of the comprehensive research conducted in this paper regarding the development of China's carbon financial system and the carbon financial models of other nations, the following recommendations can be proposed: First and foremost, policies ought to fully motivate financial institutions to proactively explore and develop carbon financial derivative products within the existing carbon trading framework. By increasing the participation of financial institutions in the carbon finance field and accelerating nationwide will help rapidly expand the scale of, China's carbon finance, enhance its role appropriately expand their trading scope, and relevant financial institutions can exert their autonomy to develop new carbon finance-related financial products. This

will attract enterprises to participate in carbon finance from multiple angles and levels and help raise funds for carbon finance. Second, further promote the carbon financial system across provinces and cities nationwide to achieve broader coverage across the country. Currently, carbon finance activities are still concentrated in a few provinces and cities. Promoting the carbon financial system one large - scale initiative for energy conservation and emission reduction and realize the "dual carbon" goals better and faster. Third, enhance the backing of carbon finance for the growth of related green technology enterprises.

Through financial means such as establishing relevant funds or issuing green technology bonds, encourage enterprises to invest in research and development of green technologies. This will drive the advancement of relevant technologies and realize emission reduction through technological progress.

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