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Reference of European Carbon Market to China's Carbon Market under the Unified National Market

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Abstract: Under the goal of global net zero emissions, China has established a carbon market to limit and allocate carbon emissions. Based on the establishment of China's national unified market and the official operation of China's carbon market, this paper compares China's carbon market with Europe's carbon market. Firstly, this paper first reviews the relevant papers, mainly including the summary of the development experience of the four stages of the European carbon market, the reference significance of the European carbon market for China's carbon market, and the scale advantage in the carbon market. Then, the paper compares and analyzes the European carbon market and China's carbon market from three aspects: regional development imbalance, financial attributes and limitations of the carbon market. It also analyzes the role that China's national unified market can play in the development of carbon market. Finally, this paper puts forward suggestions for China to use the national unified market to develop the carbon market from two aspects: reducing regional development imbalance and developing carbon financial instruments and financial products.

Keywords: unified national market, EU ETS, carbon finance

1. Introduction

Carbon finance refers to the low-carbon economic investment and financing activities arising from the Kyoto Protocol. Together with carbon trading, it constitutes two important elements of the carbon market. As Europe (Including the EU and UK, the same below), which is currently the world leader in carbon finance, has developed the financial industry, and its carbon market has a financial attribute since its emergence, there is no clear definition of carbon finance in the world. In the common understanding, carbon finance in a narrow sense refers to relevant financial activities generated in the process of carbon credit trading, including carbon emissions trading, carbon financial derivatives trading, and carbon asset management business. In a broad sense, carbon finance refers to the economic activities that support carbon neutral goals, efficient and economical utilization of resources, and limited emission of greenhouse gases, that is, financial services such as project investment and financing, project operation, and risk management in the fields of clean energy, environmental protection, and energy conservation. The trading products of the carbon financial market include various carbon financial instruments developed based on two basic carbon assets, namely, carbon emission quota and project emission reduction, mainly including trading instruments (carbon futures, carbon forward, carbon swaps, carbon options, etc.), financing instruments (carbon pledge,

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carbon repurchase, carbon custody, etc.) and supporting instruments (carbon index and carbon insurance, etc.).

Against the background of global carbon neutrality, the world's major economies have launched policies to establish a carbon market. By the end of January 2022, 33 carbon markets were operating in the world, covering nearly one-fifth of the total global greenhouse gas emissions, more than 30% of the global population, and more than half of the global GDP. Among them, Europe established the first and largest carbon market in 2005, and China established the carbon trading market with the widest coverage of greenhouse gas emissions in the world in 2017. The development of China's financial industry lags behind that of Europe, and China's carbon market has been established for a relatively short time. Therefore, China's current carbon market is mainly based on basic carbon trading, that is, the accounting, allocation, verification, and settlement of carbon emission quotas, but the financial content of the carbon market has not been fully developed. The problem of few trading industries and lack of participation in social capital is very prominent. For example, carbon financial instruments such as carbon futures and carbon mortgages do not play their due role in the carbon market, and only a few institutions and enterprises can participate in the carbon market, many institutional investors and individual investors are not accepted by the carbon market. This means that the financial attribute of China's carbon market is underdeveloped, so its scale advantage cannot be utilized. In April 2022, the Chinese government announced that it would start to build a national unified market, aiming to give play to the advantages of China's super large market. At present, China's carbon market covers a wide range, and because of China's huge financial market and emissions, the scale of the carbon market has great room for growth, so it is an inevitable trend that the carbon market will become a large-scale market in the future. In 2021, China's seven pilot carbon market exchanges completed a total of about 36.26242 million tons of carbon emission quota transactions, with a transaction volume of about 1.167 billion yuan. At present, there are many studies on the reference of the European carbon market to the Chinese carbon market, but the research on the reference of the development of the European carbon market to China's further development of carbon market by virtue of the market scale advantage under the unified national market is still blank. Based on these backgrounds, this paper reviews the relevant literature and summarizes carbon finance based on the rich experience of the four stages of the European carbon market and the research of scholars on European carbon finance, to increase the understanding of carbon finance and lay a foundation for China to further develop the carbon finance under unified national market.

2. Related Literature

The references in this paper are mainly composed of two parts. The first part is about the financial content of the European carbon market. Fossland introduced the carbon market in detail, especially the EU carbon market, analyzed the relationship between the European stock market and the price of EUA futures in the carbon market, and found that there is no linear relationship between the return of EUA futures and the return of the entire European stock market [1]. Busch paid attention to the capital constraints faced by many enterprises in the carbon market, especially emission-intensive enterprises, and the strong relationship between emissions trading and the financial market, and proposed that a large number of financial institutions should participate in the carbon market [2]. Kalaitzoglou and Ibrahim observed the European carbon futures market, analyzed the trading behavior of the carbon futures market at the early stage of development, and tested the over-the-counter trading and conventional trading under different market transparency conditions by using the enhanced ACD model [3]; Andersen and Greaker established the theory of fiscal externality, analyzed the impact of the initial allocation of national emission permits on its cost, price and globalization, and laid a certain theoretical foundation for European countries to trade emission rights

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with all emissions outside the European Emission Trading System [4]; Karpf, Mandel and Battiston regarded the European emissions trading system as a trading network, explained the reasons for the hierarchical structure in the trading network, and found that the asymmetry in the network leads to the low efficiency and information asymmetry of the market [5].

The other part is the research on the impact of the European carbon market on the Chinese carbon market and the scale advantage of a carbon market. Boute and Zhang critically questioned the legal and economic basis of environmental market price control by comparing the Emissions Trading Schemes of the EU and China, and analyzed the impact of regulatory agencies and governments of the EU and China on the carbon market [6]; Zhang, Liu and Su compared the ETS mechanism between the EU and China, and analyzed the differences in distribution mode, regulatory mode, trading mode, market risk management, market linkage mechanism, legislative guarantee, etc. [7]; Liu summarized and commented on the characteristics and performance of the EU carbon finance market and products [8], and put forward some policy suggestions and development directions for China to establish a carbon market; Meng, Hu and Mo studied the dynamic relationship between the European carbon emission price (EUA) and the Shenzhen carbon emission price (SZA) in the time and frequency domain, described the tail-depend through a wide range of static and time-varying link functions, and found that under different time scales, the construction of the dependency between EUA and SZA has significant time-varying characteristics [9]. Cao and Zhou proposed that when the market scale is large, the responsibilities of the state and local governments should be separated to take into account the development differences of different regions, improve efficiency, and ensure the normal and orderly development of the carbon market and the subsequent financial markets [10]. Ren studied the establishment of the carbon trading market mechanism and pointed out that China's carbon market is a huge space in the world financial market and properly introducing the financial market into the large-scale carbon market can achieve a win-win situation for the environment and finance, and summarized the role of investment banks in carbon finance [11].

3. Compare and Discuss

3.1. Unbalanced Regional Development

The carbon markets in Europe and China have many similarities. Carbon markets in Europe and China include many countries or provinces. Europe's carbon market includes 27 EU Member States, as well as Iceland, Norway, and Liechtenstein, and linked with Switzerland in 2020. Although the UK has withdrawn from EU ETS in 2021 and implemented a separate carbon trading mechanism after Brexit, the London carbon market is still under its framework. China's carbon market currently includes 31 provincial administrative regions, excluding Hong Kong, Macao, and Taiwan. Among these provincial-level administrative regions included in China's carbon market, the development situation is very different. According to Table 1, emission-intensive enterprises are concentrated in North China and Northeast China, accounting for most of the key emission enterprises included in the carbon market. The eastern province is developed, while the western province is underdeveloped. Therefore, as show in Table 2, the developed provinces in the East usually have higher emissions. To sum up, there are problems of unbalanced industrial distribution and large differences in development levels. These problems are very similar to those in Europe because EU member states have different resource endowments and economic development levels.

To solve this problem, the EU has adopted decentralized governance. EU ETS gives its member states greater independent decision-making power, mainly in the setting, allocation, and transaction registration of total emissions. The decentralized governance model can not only achieve the overall emission reduction plan of the EU but also take into account the differences among the Member States and balance the interests of countries and the EU. This system was proposed by the European

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Union in the second stage of its carbon market. Judging from the current situation, it has achieved good results in coordinating the interests of Member States and helping the development of less developed countries. China can learn from the mature system of the European Union and give provinces the power to make decisions independently. Provinces can independently determine the setting and allocation of total emissions according to their industrial structure and economic development, and then submit it to the state for assessment and final determination of provincial quotas. As a general rule, during economic development, at a certain stage of development, economic growth is highly correlated with pollutant emissions. After the peak of pollutant emissions, economic growth will be fully decoupled from pollutant emissions. Therefore, the Chinese government can make overall plans to determine the most appropriate quota for each province by virtue of the unified national market. Less developed provinces get relatively more emission quotas to ensure their economic development. Developed provinces receive relatively few emission quotas. In this way, it can promote the orderly transfer of emission-intensive industries in the east to the western region rich in new energy, so as to realize the transformation from the "high energy consumption and high carbon emission" mode to the "high energy consumption and low carbon emission" mode. And it is conducive to the formation of industrial clusters, promoting the economic development of underdeveloped provinces.

On the other hand, China can give play to the advantages of a unified national market and break regional trade protection. Now, the western region of China, that is, the underdeveloped region of China, is developing the clean energy industry by virtue of its resource endowment, a typical example of which is Gansu Province. Gansu Province is building a power generation industry cluster, using wind or solar power, and has built the largest wind power base in China. Gansu Province plans to sell this electricity to Hunan Province, one of the ten most developed provinces in China, as can be seen in Table 1. Therefore, they built the Jiuquan-Hunan UHV DC transmission project. However, the theoretical design transmission capacity of this UHV DC transmission project can reach 8 million kilowatts, and the conventional plan is about 5-6 million, but the actual use is only 2-3 million, which is equivalent to using only one-third. This is because Hunan Province wants to protect local power plants, so it is unwilling to receive electricity from other provinces, even if it is generated with clean energy. Such examples are quite common. This phenomenon of trade protection has caused the development of clean energy enterprises to be hindered and the development opportunities of backward regions to be limited. With the help of the national unified market, the Chinese government makes an overall plan for power generation using clean energy like Gansu Province and power generation using thermal power in other regions and provides policy support for clean energy power generation, which can greatly promote the development of clean energy enterprises and the development of the carbon market.

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Table 1: Top ten provinces in the number of key emission enterprises covered by China's carbon market (As of December 31, 2021). Source: Review and Prospect of China's Carbon Market (2022).

Region	GDP (Billion Yuan)	Population (Thousand)	Province Sectoral CO2 Emissions (Mt CO2)	Ranking of Emissions	Geographic Location
Guangdong	10,767.11	115,210	585.81	4	Southeast
Jiangsu	9,963.15	80,700	804.59	3	East
Shandong	7,106.75	100,702	937.12	1	East
Zhejiang	6,235.20	58,500	381.41	11	Southeast
Henan	5,425.92	96,400	460.63	8	Mid-east
Sichuan	4,611.58	83,750	315.16	13	Southwest
Hubei	4,582.83	59,270	354.75	12	Mid
Fujian	4,239.50	39,730	278.11	17	Southeast
Hunan	3,975.21	69,184	310.64	14	Southeast
Shanghai	3,815.53	24,281	192.91	23	East

Table 2: Emissions of the top ten provinces with the highest GDP (2019). Source: China Statistical Yearbook (2020), Carbon Emission Accounts & Datasets (CEADs) (15, 16, 17, 18).

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3.2. Development of Carbon Finance Products

The participants of European carbon finance are divided into three categories: suppliers, end users, and intermediaries, involving enterprises or countries subject to emission constraints, developers of carbon finance projects, consulting institutions, and financial institutions. Its coverage is very wide, including government-led carbon funds, private enterprises, exchanges, as well as international organizations (such as the World Bank), commercial banks and investment banks, and private equity investment funds. The EU carbon trading market has developed financial instruments such as EUA, CER, and ERU futures, forwards, options, and swaps, and has built exchanges such as the European Climate Exchange (ECX), Nord Pool, and GreenX to trade carbon futures and carbon derivatives. These financial instruments enable enterprises to prevent the risk of price changes, bring liquidity to the market, improve the effectiveness of the market, and also enable more investors to participate in the carbon market, increasing the amount of capital in the market. In 2020, the carbon trading volume of the EU carbon market reached about 169 billion euros; On a year-on-year basis, the turnover of China's carbon trading market 2020 was 1.267 billion yuan, far less than the amount of capital in the EU carbon market. The increase of funds in the market can enable innovative enterprises or pro-

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jects to obtain sufficient financial support and financing arrangements, thus promoting their development. Therefore, in the European carbon market, enterprises and projects related to renewable energy and alternative energy have developed well. At present, the listed companies of China's carbon neutral concept mainly include Longi (601012. SH), Sungrow (300274. SZ), Yangtze Power (600900. SH), Shenhua Energy (601088. SH), etc. The number, market value, and coverage are far smaller than those of similar European companies. In the EU carbon market, in addition to emission-limiting enterprises and clean energy enterprises, investment banks, insurance companies, and retail investors also invest a lot of money in the market and maintain the market's vitality. The main participants in China's carbon market are related enterprises, and financial intermediaries, financial institutions, and retail investors rarely participate in it, which not only makes the amount of capital in the market small but also makes the market less active. According to the daily trading volume fluctuation of China's carbon market (see Fig. 1), since there are almost only relevant enterprises in the market, the trading in China's carbon market mainly occurs at the end of the carbon emission compliance cycle at the end of each year.

In the context of the national unified market, the Chinese government is guiding different markets to integrate through policy support and other methods to improve market efficiency. It is a good opportunity to introduce the financial market into the carbon market. Compared with the EU, the state-owned capital in the Chinese market has a strong leading role. With the development of financial products such as carbon futures and carbon options by state-owned capital, and the entry of financial intermediaries and financial institutions such as investment banks into the market, China's carbon market can attract capital in a short time and enrich trading products. And the development of the carbon market can in turn promote the further development of the financial market. The public's carbon financial behavior also plays an important role in promoting the development of the carbon market. Financial institutions, such as banks, can launch deposit products to reduce the threshold for retail investors to enter, so as to expand the source of funds for low-carbon investment projects. China's financial market is very large, with a large number of retail investors and financial institutions. Introducing the financial market into the carbon market will bring a huge amount of capital to the carbon market and give play to the scale advantage of China's huge market. The improvement of the utilization of financial attributes of China's carbon market will promote the industrial transformation to low-carbon and high-quality development. At the same time, the exchanges used to trade carbon derivatives and the laws and policies guaranteeing carbon derivatives trading are also essential, which will ensure that the carbon market can play its market role normally.

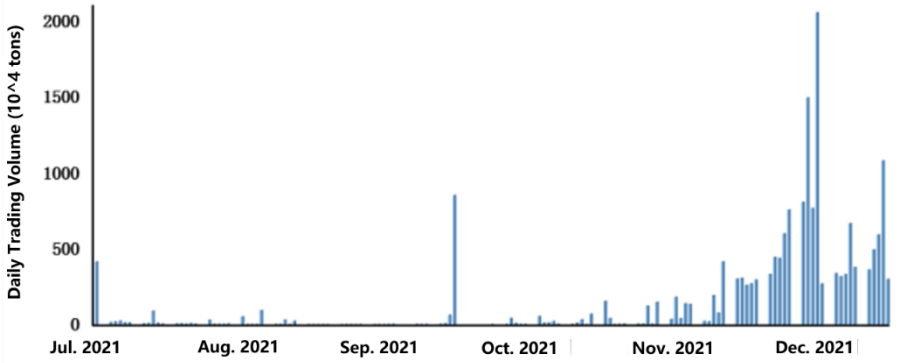

Figure 1: Daily trading volume fluctuation of China's carbon market (2021).
Source: Review and Prospect of China's Carbon Market (2022).

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3.3. Limitations

These proposals have their limitations. When local governments set carbon emission quotas, how much autonomy they have is a difficult problem. If the carbon emission quota of backward regions is high enough, some regions may choose to build many high emission enterprises, which can often bring huge economic growth in the short term, but is not conducive to long-term development. In the Chinese market, state-owned capital, personal capital, and foreign capital are mixed, which makes the situation more complicated than that in the European market. Therefore, during the development of carbon financial instruments, how to balance the relationship between these kinds of capital and let each kind of capital play a role is a difficult problem. The state-owned capital with great influence on the market must ensure that they choose the right direction. Moreover, when the carbon price or carbon futures price is linked to the stock market, it is likely to generate a new big bubble economy. Since carbon finance is linked to carbon emissions, its externality is also an important issue to be considered.

4. Conclusion

Based on the advanced experience of the European carbon market and the implementation and utilization of the national unified large market, this paper puts forward some suggestions from two aspects: reducing regional development imbalance and developing carbon financial instruments and financial products. Local governments need higher decision-making power, while the central government needs to make overall planning to enable regions with different development conditions to obtain appropriate carbon emission quotas, to promote the development of backward regions. In addition, regional trade protection needs to be broken so that the clean energy industry in backward areas can develop. China's state-owned capital in the carbon market needs to play its unique guiding role compared with the EU to develop suitable carbon financial instruments. At the same time, China's carbon market needs to allow more financial institutions, financial intermediaries, and retail investors to enter the carbon market to obtain more capital and higher activity. Through these two aspects, the current problems in China's carbon market will be solved to a great extent.

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