Literature review and research prospect prediction of carbon emission trading market

Huang Ye

Department of Economics and Management, Wenhua College, Wuhan, 430074, China

Keywords: Carbon emission trading market, carbon finance, literature review

Abstract: Around the carbon peaking and carbon neutrality target,more and more scholars focus on the "carbon" perspective, focus on the carbon market, and conduct in-depth research in the research fields they are good at. On the one hand, the academic achievements have promoted the improvement of the carbon emission rights trading market and the construction of the national carbon market. On the other hand, they also provide new ideas and development directions for the further research in the field of carbon economy and carbon finance.

1. Research background

Climate change is a common environmental problem faced by all countries in the world. As the world's second largest economy, carbon emission control has become an important link in China's ecological civilization construction. In December 2020, the Chinese president delivered an important speech at the climate ambition summit, promising that China would achieve the great goals of carbon peak by 2030 and carbon neutrality by 2060.Focusing on thecarbon peaking and carbon neutralization target, the state has issued various policies, such as energy restructuring, carbon emission reduction, and the construction of the national carbon market, to further promote the realization of the carbon peaking and carbon neutrality target.

Carbon peaking refers to that at a certain point in time, the emissions of carbon dioxide or greenhouse gases will no longer grow to peak, and then gradually fall back. Carbon peaking is the historical turning point of carbon dioxide emissions from increase to decrease. The peaking target includes the year and peak. Carbon neutrality generally refers to the total amount of carbon dioxide or greenhouse gas emissions directly or indirectly generated by countries, enterprises, products, activities or individuals. Through afforestation, energy conservation and emission reduction, it can offset the carbon dioxide or greenhouse gas emissions generated by itself, realize positive and negative offset, and achieve relative "zero emissions". From this, it can be seen that the realization of China's carbon peaking and carbon neutrality target is a gradual and two-step process. The first step is to realize the increase to decrease of carbon emissions, and then through a series of measures, the second step is to achieve the relative "zero emission" of carbon emissions.

The carbon market takes carbon quotas as the main commodity for trading, which is the market mechanism arrangement most directly related to carbon emission reduction. In the Kyoto Protocol signed in Tokyo, Japan in December 1997, the greenhouse gas emission right will be called "carbon emission right". The basic logic of carbon market trading is that the government controls the total

amount of carbon emissions of one or more industries, and allocates carbon emission right quotas to emission control subjects. Emission control subjects can choose to use the quotas issued by the government to offset or trade their emission reduction obligations according to their own conditions. Under this mechanism, carbon emission rights are endowed with specific property rights and have the attributes of transferable and exchangeable commodities. Through the market mechanism, carbon emission can be quantified, capitalized and marketized, giving full play to the decisive role of the market in the allocation of resources.

Developed countries such as Europe and the United States explored the carbon market and its quota mechanism relatively early. Now, relatively mature carbon markets have also been formed, including the European Union (EU ETS), Switzerland, South Korea, the U.S. Regional Greenhouse Gas Initiative (RGGI) and Canada(Quebec). Among them, the European Union (EU ETS) has the highest maturity and the largest trading volume of the carbon market, . These relatively mature carbon markets have formed a relatively sound market mechanism, which can increase public financial revenue through quota auction, and tend to continue to use the income obtained to finance climate change, forming a virtuous circle. From 2009 to 2020, the global carbon trading system has raised more than $103 billion through quota auctions, of which the European Union has raised $80.737 billion since 2009 alone, accounting for 78% of the funds raised in the global carbon market.

In October, 2011, China issued the notice on carrying out carbon emission trading pilot work, marking the official launch of starting the pilot project of China's carbon emission trading . In June 2013, China's first carbon emission rights pilot market was established in Shenzhen. Subsequently, seven first batch of carbon pilot markets including Beijing, Shanghai, Tianjin, Chongqing, Hubei and Guangdong were successively established. Later, Fujian became the eighth carbon trading market in China. The above pilot areas took the lead in trading and exploring carbon emission quotas, which played a leading role in the technological innovation of the national carbon market, the innovation of policies and systems, and the establishment and improvement of the national carbon trading market. In July 2021, the power industry took the lead in officially launching the national unified carbon market, which is of great practical significance to the realization of the the carbon peaking and carbon neutrality target. In addition to the power industry, the industry coverage of the national unified carbon market will be gradually expanded, such as steel, petrochemical, chemical, aviation and other key industries will be included in the national carbon market. With the passage of time, the trading products and methods of the national carbon market will be further enriched, and China's carbon market is likely to become the largest carbon market in the world.

2. Literature review on the influence of carbon market

According to the research on the carbon emission trading market that has been carried out in China, although the systems and price determination mechanisms of these carbon emission trading markets are different, these markets have promoted the research and development of low-carbon technologies and reduced the carbon emissions in their regions. The research of Song Xiaoling et al. (2018) shows that the trading volume of carbon emission rights has a significant positive impact on the change of industrial structure, indicating that the development of carbon emission rights trading market can promote the optimization of regional economic structure[1]. The research results of Wang Yong et al. (2019) show that the launch of the carbon trading market has a certain effect on the carbon emission efficiency[2]. The ranking of carbon emission efficiency in China's carbon trading pilot areas has remained unchanged or increased. Liaowenlong et al. (2020) found that the carbon trading policy has promoted the growth of green economy[3], and Yu Ping (2020) found that expanding the scale of carbon trading market is conducive to improving environmental quality and

promoting economic growth[4]. Because China's carbon trading market is not mature and the main carbon emission trading standards are formulated by foreign countries, China's competitiveness in the international carbon trading market is low. Zhang Xiufan (2021) made a comparative analysis of the current trading situation and trading mechanism of China's carbon emission trading market, and proposed the shortcomings of the current carbon trading mechanism[5]. Jing Guowen (2022) concluded through the double difference model that the carbon emissions trading pilot policy has a more significant effect on the high-quality economic development of the eastern region[6].

Based on the above literature review, the mechanism and efficiency of different carbon markets are compared; the theoretical and empirical research on the impact of carbon market on the economic benefits, technology, environment and other aspects of regions, industries and enterprises still has great research value and research space.

3. Literature review on spot trading price in carbon market

The core issue of the carbon trading market is the carbon trading price. The carbon trading price in each pilot area is quite different, and the carbon trading price is volatile and complex. Only when a reasonable carbon trading price is formed can the market mechanism effectively allocate resources. Therefore, it is necessary to comprehensively analyze the fluctuation characteristics of the carbon emission rights trading price, compare and analyze the regional differences and their influencing factors in the carbon emission rights trading price, And reasonably predict the price of carbon emission rights trading to provide theoretical support and experience for the unified and stable operation of the national carbon trading market.

In terms of the fluctuation characteristics of carbon trading prices, foreign carbon trading markets have been established for a longer time, the trading system is more perfect, and the market is more mature. Zhang Yuejun et al. (2011) took the EU carbon emission quota futures price as the sample data, and found that the EU carbon quota price yield fluctuated and did not obey the mean regression process. Yang Xing et al. (2017) believed that the yield of carbon trading price in the EU carbon emission market is non normal and nonlinear, which does not meet the basic assumptions of the efficient market theory[7]. Li Kelong et al. (2020) believed that both the EU carbon trading market and China's Hubei carbon trading market have multifractal characteristics, and there is a nonlinear and complex correlation. With the operation of China's carbon trading pilot, many scholars have focused on China's carbon trading market. LV Yongbin et al. (2015) analyzed the volatility of China's carbon trading price, and the results showed that China's carbon trading price yield has obvious volatility clustering characteristics, and there are regional differences in carbon trading prices. Zhou Tianyun et al. (2016) took the Shenzhen carbon trading market as the research object, and found that there was an obvious autocorrelation and conditional heteroscedasticity process in the carbon trading price, and it was most closely related to its lag term. Yao Yi et al. (2017) pointed out that the imbalance between supply and demand in the carbon trading market and the occurrence of major events will have a certain impact on the carbon trading price. Lu Jingye et al. (2019) believed that Hubei carbon trading price yield has strong memory characteristics and leverage effect. Li Shaoyun et al. (2020) found that the carbon trading prices of the eight pilot markets have a common trend, but with the increase of the number of trading pilots, the common trend between them decreased significantly.

Based on the above literature review, the comparative analysis of spot transaction prices in different carbon emission markets, the analysis of influencing factors, and the analysis of interaction; There is still great research space and potential for the impact of trading mechanism on trading price fluctuations and the analysis of the current situation of fluctuations.

4. Literature review on futures trading price in carbon market

The prediction of carbon trading price is of great significance to clarify the trend of carbon trading price, to government decision-making, to enterprises to reduce operating costs and to enterprises to control risks. Many scholars have proposed that the international carbon trading system has formed a relatively mature spot price formation mechanism, but there is a lack of research on the price formation mechanism of carbon financial derivatives. Some scholars believe that from the experience of the global carbon market, the development of the carbon financial derivatives market and the carbon spot market complement each other. Carbon options play a very important role in improving the price discovery function of the carbon emission market and avoiding the transaction risk of the carbon emission market. Shi Xuetao et al. (2017) built a pso-psr-lssvr model to study the futures price of EU carbon quotas. The db3-ga-rbf model of Yang Xing et al. (2018) has predicted the historical data of EU carbon trading price, and the prediction result is relatively accurate. Zhang Chen et al. (2016) took the carbon trading pilot in Shenzhen as an example to build a multi frequency combination prediction model to study the future trend of carbon trading prices. Peng Wuyuan et al. (2020) used MSM model to predict and analyze the carbon trading prices of all carbon trading pilots in China. On the influencing factors of carbon emission market trading price, price trend prediction, and the influence mechanism of futures price and spot price.

Based on the above literature review, there is still great research space and value for the price trend prediction of carbon market trading price, the research on the impact mechanism of futures price and spot price, and the related research on carbon financial derivatives market.

References

[1] Song Xiaoling, Kong chuiming, Empirical analysis of the impact of China's carbon trading market on regional structure, Macroeconomics, 2018,98-107.

[2] WANG Yong,ZHAO Han, The impact of China's carbon trading market on regional carbon emission efficiency, China population, resources and environment, 2019,50 -58.

[3] LIAO Wen-long, DONG Xin-kai1, WENG Ming, et al. Economic Effect of Market-oriented Environmental Regulation: Carbon Emission Trading, Green Innovation and Green Economic Growth, China Soft Science, 2020,159-172

[4] YU Ping, LIU Ji-xian. Research on the Effects of Carbon Trading Market Size on Environment and Economic Growth, China Soft Science, 2020,45-55.

[5] Zhangxiufan, Ananlysis of Status and Trading machanism of Carbon Emission Trading Markets in China,scientific development, 2021,82-91.

[6] JING Guowen, Pilot policy of carbon emission trading and high-quality development of regional economy,Contemporary Economy & Management. 2022.

[7] YANG Xing, LIANG Jing-li, et al. Price forecasting algorithm of carbon emission rights under multiscale fractal characteristics, Systems Engineering—Theory & Practice, 2018,224-231.

[8] WANG Q W, ZHOU P, ZHOU D Q, Efficiency measurement with carbon dioxide emissions: the case of China. Applied energy, 2012, 90(1) : 161-166.

[9] ZHAO Y,ZHAO L L,BIAN Y W, Measuring regional efficiency of energy and carbon dioxide emissions in China: a chance constrained DEA approach. Computers & operations research, 2016, 66: 351-361.

[10] ZHAO X G,WU L, LI A. Research on the efficiency of carbon trading market in China. Renewable and sustainable energy reviews, 2017, 79: 1-8.

[11] LIN B Q,DU KR, Date for: modeling the dynamics of carbon emission performance in China: a parametric Malmquist Index approach, Energy economics, 2015, 49: 550-557.

[12] DUMAN Y S, KASMAN A. Environmental technical efficiency in EU member and candidate countries: a parametric hyperbolic distance function approach. Energy, 2018, 147: 297-307.

[13] WANG HAN, CHEN ZHOPENG, WU XINGYI, et al. Can a carbon trading system promote the transformation of a low-carbon economy under the framework of the porter hypothesis? —empirical analysis based on the PSM-DID method. Energy policy, 2019, 129(6):930-938.

[14] CHENG B,DAI H,WANG P, et al. Impacts of carbon trading scheme on air pollutant emissions in Guangdong province of China . Energy for Sustainable Development, 2015, 27: 174-185.

[15] Hammoudeh S,Nguyen D K, Sousa R M. What Explain the Short-term Dynamics of the Prices of CO2 Emissions? Energy Eco‑nomics, 2014, (46).

[16] Koch N, Fuss S, Grosjean G, et al. Causes of the EU ETS Price Drop: Recession, Cdm, Renewable Policies or a Bit of Everything?——New Evidence. Energy Policy, 2014, (73).

[17] Zhu B Z, Wei Y M. Carbon Price Forecasting With a Novel Hybrid ARIMA and Least Squares Support Vector Machines Methodology. Omega, 2013, (41).

[18] Byun S J, Cho H J. Forecasting Carbon Futures Volatility Using GARCH Models With Energy Volatilities. Energy Economics, 2013, (40).

[19] Martos C G, Rodriguez J, Sanchez M J. Modeling and Forecasting Fossil Fuels, CO2 and Electricity Prices and Their Volatilities. Ap‑plied Energy, 2013,(101).

[20] Shimshack, J. P. et al. Enforcement and Over-compliance, Journal of Environmental Economics and Management, 2008(55).