Development Status of China's Carbon Sequestration Trading Market

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Abstract: In 2020, China proposed the goals of "carbon peak" in 2030 and "carbon neutralization" in 2060. Based on this, China will take a variety of ways to reduce carbon dioxide emissions, among which the way of increasing forest carbon sink will play a key role in reducing emissions. Building a carbon sequestration market can accelerate the growth of forest carbon sequestration and encourage enterprises to reduce carbon emissions through various methods. This paper will introduce the background, prospect and development situation of Chinese carbon sink market, then put forward policy suggestions that can help to improve the carbon sink trading market.
Keywords: Emission Reduction; Carbon Market; Emission Rights Allocation

Introduction

China possesses a vast territory and the largest population in the world, but only a small amount of per capita share of resources. In the meantime, China's energy efficiency is very low, there is a huge waste of natural resource, and possess a very serious environmental pollution. Therefore, adjusting the energy structure and seeking for "Energy saving and emission reduction" are the strategic direction of China's development (Wang et al. 2021).

In this paper, I will review some literature, introduce the development and prospect of China's carbon trading market, explain the distribution mode and pricing mechanism of carbon sequestration, find out the existing problems in the carbon trading market, and then, I will put forward policy suggestions that help to complete China's carbon market.

1. Introduction to Chinese carbon sink and carbon trading market

A study on the carbon sink of Chinese forests shows that, by 2020, the carbon reserves in China's forests will reach 12.87 Pg C. By 2020, the total amount of forest CS is estimated to 1.35 Pg C. The China's carbon potential is even greater when considering the substitution effect of forest wood (Jin et al. 2020). It shows that China has a huge potential in forest carbon sequestration.

China has issued a series of policy documents and taken practical measures for the construction of the carbon trading market. In 1992, after the signing of the United Nations Convention, China publicly published the ten countermeasures for China's environment and development, signed the Kyoto Protocol in 1998, becoming the 37th signatory in the world (Wang et al. 2019).

The cumulative online quota trading volume of the seven pilot carbon markets has exceeded 135 million tons and reached a trading volume of more than 2 billion yuan, which has accumulated some experience for establishing the future national carbon market (Wang and Chen 2018).However, a study on the effectiveness of China's carbon trading market found that, the analysis results show that Beijing's carbon trading secondary market belongs to a weak efficient market (Zhao and Wang 2018).

2. Porter's Diamond Model-Comparative analysis

2.1 Carbon emission rights allocation mechanism

The mechanism of carbon trading market can be divided into two parts: carbon emission rights allocation mechanism and carbon sink pricing mechanism.

At initial stage of carbon market operation, China will implement the carbon quota distribution mode of free distribution and timely introduction of paid distribution (Liu et al. 2019).

From the macro aspect, based on the CGE model, some scholars set differentiated policy scenarios for key issues and simulated and analyzed the impact of different mechanism designs on the carbon market and macro-economy. It is found that the introduction of quota auction mechanism in the national carbon market can help to cut down the carbon trading price, expand the scale of the carbon market. The implementation of carbon tax supporting measures for industries that haven't covered the carbon market can help to reduce the carbon price, increase the trading volume of carbon quota (Zhang et al. 2022).

A study took the panel data of Listed Companies in pilot provinces and cities of carbon emission trading from 2010 to 2016 as the research object to explore the impact of ETS on enterprise carbon emission reduction. The results show that, first of all, the average and dynamic policy effects of ETS on the carbon emission intensity of the whole sample enterprises weren't significant, indicating that Chinese ETS has failed to form a binding force on all pilot enterprises. Secondly, the policy effect shows a trend of first increasing and then decreasing, indicating that China's ETS can not continuously and stably promote the carbon emission reduction of enterprises (Zhang et al. 2022).

2.2 Carbon sink pricing mechanism

According to the theory of marginal productivity, the price of a factor of production originates from the supply-demand relationship of the factor market and is determined by its marginal productivity. The price of a factor of production is equal to its marginal productivity. When forest carbon sequestration is introduced into the production function model as an input factor, its shadow price is the marginal productivity, which reflects the real value of forest carbon sequestration resources when the allocation of various resources is optimal (Chen et al. 2022).

The specific function model is:

$$\ln y_{it} = \alpha_l \ln l_{it} + \alpha_k \ln k_{it} + \alpha_c \ln c_{it} + \alpha_{lc} \ln l_{it} \ln c_{it} + \alpha_{kc} \ln k_{it} \ln c_{it} + \alpha_{kl} \ln l_{it} \ln k_{it} + \alpha_{cc} (\ln c_{it})^2 + \alpha_{ll} (\ln l_{it})^2 + \alpha_{kk} (\ln k_{it})^2 + \varepsilon$$

Where, y is the total output value of forestry production; For Forestry labor force; Forestry capital stock; Represents forest carbon sequestration; i indicates time; t represents the study area; ε is a random error term. α_l, α_k, α_c, α_{lc}, α_{kc}, α_{kl}, α_{cc}, α_{ll}, α_{kk} respectively represent the output elasticity of Forestry labor force, forestry capital stock and forest carbon sequestration, as well as the elasticity between square terms or cross terms of various factors.

Derivation and simplification of the above formula, we get:

$$\frac{dy}{dc} = \frac{y}{c}(\alpha_c + \alpha_{lc} \ln l_{it} + \alpha_{kc} \ln k_{it} + 2\alpha_{cc} \ln c_{it})$$

According to the theory of marginal productivity, the price of forest carbon sequestration is equal to its marginal productivity, so it can be further expressed as:

$$P = \frac{dy}{dc} = \frac{y}{c}(\alpha_c + \alpha_{lc} \ln l_{it} + \alpha_{kc} \ln k_{it} + 2\alpha_{cc} \ln c_{it})$$

The formula Chen(2022) obtained through ridge regression analysis is:

$$\ln y_{it} = -0.679 \ln l_{it} + 0.056 \ln k_{it} + 1.748 \ln c_{it} - 0.036 \ln l_{it} \ln c_{it} + 0.005 \ln k_{it} \ln c_{it} + 0.001 \ln l_{it} \ln k_{it} + 0.061 (\ln c_{it})^2 - 0.024 (\ln l_{it})^2 + 0.002 (\ln k_{it})^2 - 0.627$$

According to the results, it can be seen that the regression coefficient of forestry capital stock and forest carbon sequestration is positive and significant at 1%, indicating that they play a positive role in promoting forestry economic growth, while the regression coefficient of Forestry labor force is negative and significant at the level of 1%, indicating that the investment of Forestry labor force may not contribute to forestry economic growth, However, it cannot be considered that the increase of Forestry labor input will reduce forestry output.

Derivation and simplification of the above formula, we get:

$$P = \frac{dy}{dc} = \frac{y}{c}(1.748 - 0.036 \ln l_{it} + 0.005 \ln k_{it} + 0.122 \ln c_{it})$$

Forestry labor force, forestry capital stock and forest stock can be obtained from China's forestry statistical yearbook and the national inventory of forest resources. The formula of forest carbon sequestration is as follows:forest carbon sequestration = forest stock × Expansion coefficient × Dry weight coefficient × Carbon content coefficient of trees + forest volume × Carbon sequestration of understory plants + forest stock × Carbon sequestration in forest land, which can be simplified to

$$c = 2.439(V \times 1.9 \times 0.5 \times 0.5)$$

Where c is forest carbon sequestration and V is forest stock.

The price of Chinese forest carbon sink can be calculated from the above.

3. Policy recommendations

Overall, in order to complete the carbon trading mechanism, the following suggestions are put forward:

(1) Continue to increase the proportion of carbon trading mechanism in carbon emission distribution, which can encourage enterprises to reduce carbon emissions;

(2) Establish fair and efficient market standards to ensure that different carbon markets can be compared and ensure the normal operation of the market;

(3) Policy-making should adjust measures to local conditions, appropriately increase the proportion of paid allocation of carbon quotas in areas where the carbon market is not active;

(4) Use government administrative intervention to make up for the failure of market environment regulation. For enterprises participating in cleaner production and energy conservation and emission reduction projects, the government can give financial subsidies and tax incentives to mobilize the enthusiasm of enterprises to invest in emission reduction technologies;

(5) Accelerate the construction of carbon trading legal system and regulatory platform. An independent regulatory body should be established to manage the carbon market, improve the allocation of carbon emission quotas, the formulation of carbon prices, the verification of carbon emissions and the punishment of excessive emissions (Zhang et al. 2022).

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