

An event study of price changes in China’s national carbon market

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1. Introduction

China has been making great efforts in developing a national emissions trading scheme (ETS) since 2014. After years of preparation and based on the experiences from the local pilot ETS, online trading of China’s national carbon market launched on July 16, 2021 by only covering power generation entities. As of the end of May 2024, the national carbon market has been running for a total of 695 trading days, resulting in a cumulative trading volume of around 459.24 million t-CO₂, a total trading amount of 26.435 billion Yuan, and an average trading price of 57.6 Yuan/t-CO₂. In spite of cyclical fluctuations in daily trading volume, the trading prices show a stable upward trend in overall. This analysis applies the event study method to detect whether or not there exist overreactions in prices of China’s national carbon market.

2. Research method

An event study is developed to examine carbon price changes in this analysis. The considered events and their occurrence date, event window and estimation window are defined in Table 1. The events include the announcements of Ministry of Ecology and Environment (MOEE) on the allocation plan of emission allowances and the allowances settlement in various period, and the release of “Interim Regulations on Carbon Emissions Trading Management” approved by the State Council. Assuming the event date (t) is 0, the event window is [-10, 30] (41 trading days). Limited by the effective trading days before the event date, the estimation window of event No.1 is 50 days. The estimation window of other four events is [-135, -15], namely 121 trading days.

Table 1: Definition of the events considered in this study.

No.	Event	Date	Event window	Estimation window
1	Notice on emission allowances settlement in the initial period	26/10/21	12/10/21-07/12/21	16/07/21-28/09/21
2	Release of draft emission allowances allocation plan for 2021 and 2022 for public comment	03/11/22	20/10/22-15/12/22	14/04/22-13/10/22
3	Release of emissions allowances allocation plan for 2021 and 2022	15/03/23	01/03/23-27/04/23	22/08/22-22/02/23
4	Notice on emission allowances settlement in 2021 and 2022	17/07/23	03/07/23-28/08/23	22/12/22-26/06/23
5	Release of “Interim Regulations on Carbon Emissions Trading Management”	05/02/24	22/01/24-27/03/24	20/07/23-15/01/24

The daily carbon price volatility is defined as:

$$V_t = \left| \frac{P_t - P_{t-1}}{P_{t-1}} \right| \times 100\%$$

Where, V_t is the carbon price volatility on day t , P_t is the price on day t , P_{t-1} is the price on day $t-1$.

The average carbon price volatility in the estimation window is defined as:

$$\bar{V} = \frac{1}{n} \times \sum_{t=1}^n V_t$$

If the price volatility in the event window is significantly higher or lower than the average volatility in the estimation window, the market is confirmed to have an overreaction to the event.

3. Results

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3.1 Change of trading volume in China’s national carbon market

The calculation result of daily turnover rate, which is defined as proportion of the daily trading volume and the total trading volume during the analysis period, is plotted in Fig.1. Obviously, the trading was once concentrated in the approximately one and a half months leading up to the first compliance due date, 31 December 2021. Since the beginning of 2022, market trading volume dropped significantly. There appear signs of recovery in trading volume around December 2022. 2023 is the year for the settlement of emission allowances of 2021 and 2022, and the market liquidity has gradually increased, with the trading volume growing significantly from August to December 2023. This confirms that China’s national carbon market is still at an early stage, and the main purpose of trading is for the ETS target entities to fulfill their obligations.

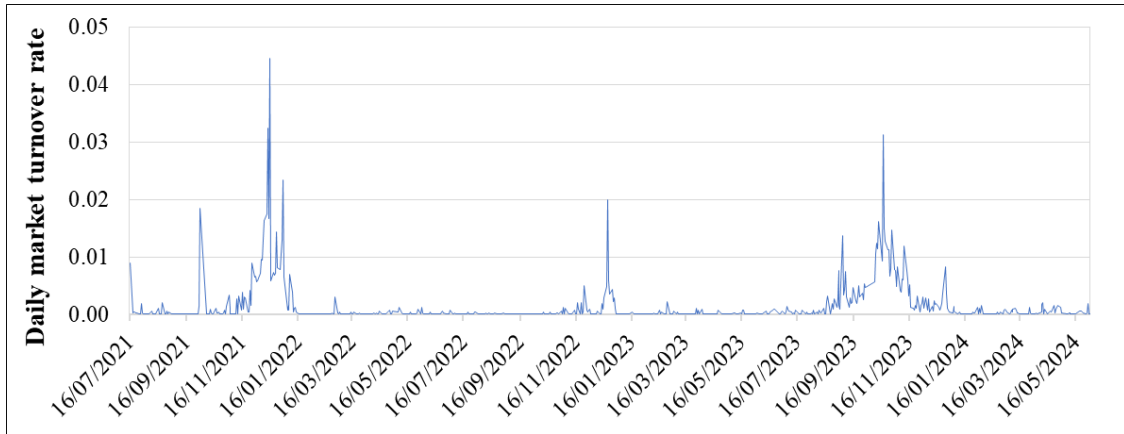


Fig.1: Daily turnover rate of China’s national carbon market (16/07/21-31/05/24).

3.2 Empirical test of market prices overreaction

The results of overreactions of China’s national carbon market prices to the considered events are listed in Table 2. The market prices were confirmed to have an overreaction to the notices on emission allowances settlement (Event No.1 and No.4) and the release of emissions allowances allocation plan and the interim management regulations (Event No.3 and No.5). So far, only the ETS target entities can participate in the trading in China’s national carbon market. Their knowledge on carbon market may be not sufficient and the information available to them may be incomplete. They tend to count on their own forecasts and judgement. This may more likely lead to higher carbon price volatility and ultimately cause overreactions.

Table 2: The result of prices overreaction to the target event.

No. of event	Average price volatility (\bar{V})	$V_t - \bar{V}$				
		Mean	Std. dev.	t-value	p-value	Degree of freedom
1	2.27%	-0.0184	0.0058	-20.38	0.000***	40
2	0.52%	0.0002	0.0067	0.14	0.445	40
3	0.42%	0.0054	0.0222	1.57	0.062*	40
4	0.64%	0.0123	0.0206	3.83	0.000***	40
5	1.90%	0.0088	0.0265	2.12	0.020**	40

Note: *, ** and *** denote a significance level of 10%, 5% and 1%, respectively.

4. Conclusions

This study gives a summary of the development of national ETS in China and the latest progress in the market operation. The market prices were confirmed to have overreactions to a series of relevant events. This implies that China’s national carbon market is not mature. The market information disclosure should be improved. The capacity building for the target entities should be enhanced and the participation of institutional investors should be encouraged to avoid the overreaction of market participants and maintain lower carbon price volatility.