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Research Report

Name : Lin DING

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Title of Research: Impact of emission trading scheme in China on carbon mitigation and carbon leakage

Purpose of Research: (200 words)

Global warming occurs when GHGs collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. CO₂ emissions from the burning of fossil fuels are the main cause of rising global GHGs emissions. If we're unable to reduce our emissions, climate change could lead to the deaths of more than 250,000 people around the globe every year and force 100 million people into poverty by 2030.

Mankind is working to mitigate the climate problems. The conferences of the parties (COP) have held since 1995 to assess progress on climate change. The conferences set an objective, reducing global GHG emissions by 50% by 2050 and sets targets for developed countries to cut GHG emissions by 5.2% by the end of 2012 from 1990 levels. Except for developed countries, in recent years, China, India and other emerging economies have been participated in emission reduction project and share the responsibility of mandatory emission reduction. China expressed that it would assume the obligation to limit total emissions after 2020 based on reducing energy consumption per unit of GDP.

Under the pressure of domestic resource and environmental constraints, and transformation of economic growth pattern, China's 12th Five-Year Plan planned to implement ETS in the pilot provinces. Therefore, it is important to study the effectiveness of ETS to mitigate CO₂ to avoid climate change. However, carbon leakage may happen during the policy implementation. Carbon leakage is a shift of CO₂ emissions from a region with emission constraints to an unregulated area. To capture the real impact of ETS, the research proposes to the analytical framework to consider the spillover effect and to estimate the correct impact of ETS.

Content/Methodology of Research: (400 words)

After the pilot implementation of ETS, apart from the policy impact caused by ETS, the heterogeneities of each province and the time-related effect bring out various amount of emissions reduction. Use difference-in-difference (DID) method, I construct analytical framework to formulate the models.

I decompose the impact of ETS into two parts. The first is that ETS affect carbon emissions by influencing carbon intensity, that is, by influencing technologies such as fuel choices and investments in energy efficiency. The second is that ETS affect output in order to produce an impact on the demand for energy, which in turn affects carbon emissions. Therefore, in the research we consider two models with carbon intensity and output as dependent variables simultaneously.

First, taking carbon intensity as dependent variable. We consider how ETS influence carbon intensity in the pilot provinces. For the reason that there might be some other environment policy implement in the province, stringency level of the environment policy affect carbon intensity, and also the impact of ETS. Thus, we take environment policy intense and cross term with ETS into account as control variable.

Secondly, taking output as dependent variable. In addition to the impact of ETS on pilot cities, we consider the impact of neighboring cities on pilot cities which is the carbon leakage effect. At the same time, consider all independent variables that affect output, such as population, urbanization rate, and environmental policies intense. Similarly, we consider cross term of environmental policies intense and ETS.

When the ETS policy is announced, companies in the pilot cities have the intention to adopt measures to reduce their carbon emissions, which is called the announcement effect. After the enforcement of the ETS policy, the regulated enterprises in the pilot cities may have more intention to reduce their carbon emissions within the limits of the emission quota, which is a process known as the enforcement effect. In my study, we clarify the difference between the announcement effect and the enforcement effect.

Furthermore, after the enforcement of the ETS, I estimate the different impact of the ETS in each year. At the beginning of enforcement, because the carbon trading market mechanism is not well developed, the impact may be smaller. As the years go by and the market matures, the impact may grow. Or vice versa. That's why I looked at different effects over years.

Thus, in the study, we not only estimated the impact of ETS, but also tested different hypotheses, including

announcement effect, enforcement effect and how did the impact change over years. After getting the estimation results, I make simulation to assess the impact of ETS.

The data used in this paper are arriving from China Statistical Yearbook, China Industrial Statistical Yearbook, Chinese Local Input-Output Tables (CIOTs) and China Emission Accounts and Datasets (CEADs) from 2005 to 2017. CIOTs covers 46 industries, and we primarily use inflow and outflow data in the tables. CEADs covers 47 industries and sectors, and we use the data of energy consumption and carbon dioxide emission from various departments in the database in this paper. The data of 13 years from 2005 to 2017 is merged into panel data. According to “Industrial classification for national economic activities” published by General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, the Industry is adjusted to 39 industries.

Conclusion/Observation (200 words)

In this research, using the data from 2005 to 2017, the effect of ETS in pilot cities is analyzed using the DID model. First, ETS influences carbon emissions by changing the structure of energy consumption and technological innovation, a path reflected in the impact of ETS on carbon intensity. China announced in 2011 that it would establish an ETS market in pilot cities before the carbon trading market was officially established in 2013. As there is a regulatory threshold for enterprises to be included, enterprises will consciously reduce their carbon emissions in the hope of avoiding regulation. Therefore, as previous research suggested we considered the existence of the announcement effect, but the results showed that it was not significantly present, but the implementation effect was significant.

Second, this paper examines whether ETS achieves carbon emissions by influencing production. The empirical results indicate that carbon leakage did not occur in the pilot cities, which is consistent with some previous studies. We agree that carbon leakage should be carefully estimated. If carbon leakage is present, to some extent ETS is not an efficient policy to control carbon emissions.

At the same time, empirical results show that the stringent policy environment and industrial structure affect carbon emissions. Under the stringent policy environment, carbon emissions have been significantly reduced and the implementation impact of ETS is improved. The development of the secondary industry also seriously threatens the environment, which is reasonable carbon-intensive industries is becoming main regulated objects.

In summary, CO₂ ETS is efficient for pilot cities. The establishment of pilot cities provides experience for China to establish market-based environmental policies. On July 16, 2021, the carbon emissions trading market was established in the country, which is expected to effectively control carbon emissions and reduce emissions.