HOW COULD THE EMISSIONS TRADING SCHEME HELP CHINA CONTRIBUTE TO COMBATING GLOBAL CLIMATE CHANGE?

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Overview

The emissions trading scheme (ETS) has been an essential measure of greenhouse gas emissions reduction to limit ongoing global warming, considering its cost effectiveness. As the country with the greatest energy consumption and CO_2 emissions globally, China has offered series of initiatives to contribute to global efforts in curbing climate change. In its Intended Nationally Determined Contribution (INDC), submitted by the Chinese government to the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) in June 2015, Chinese government sets a goal of reducing its carbon intensity by 60—65% below 2005 levels, and has further declared to reach its CO_2 emissions peak by 2030. To achieve these goals, the ETS has been selected as the main climate policy to reduce emissions in the long term in China. It was first introduced in seven pilots at provincial and city level since 2013, and a nationwide carbon market is to be implemented in China in 2017.

The marginal abatement cost, which describes the additional cost per unit of extra reduction of CO_2, provides an important basis for the emissions trading market. By compasion of marginal abatement cost and the carbon price, the decision makers of emissions trading sectors need to decide whether to reduce the emissions themselves or buy allownces from the carbon market. The marginal abatement cost curses are usually assumed the same during different decision situation. However, the non-consideration of various types of interdependencies, intersectoral, and macroeconomic interactions brings uncertainty in quantifying of marginal abatement costs. This would in turn affect the efficiency of decision by decision makers in carbon market and further lead to different economic impacts at both regional and national levels in China.

Against this background, a China multi-regional computable general equilibrium (CGE) model will be introduced in this study and the relationship of different ETS designs and marginal abatement cost according to different sectors in regions will be investigated. Policy implications will be proposed finally.

Methods

A multi-regional CGE model that explicitly represents ETS and RE technologies in China is developed. Three main features of the model are summarized as follow.

Feature 1. Multi-regional CGE model.
The model has 30 regions in accordance with the administrative structure of mainland China, and 17 sectors in each region. It is capable of capturing labour migration, capital flows, and commodity trading among regions. Each region has a specific energy structure due to the diversity of resource endowments and spatial heterogeneity of economic development.

Feature 2. Emissions trading module.
The emissions trading module encompasses both the decision-making process of trading sectors and the impact path of reduction decisions on the production module of the CGE model. In the optimization model of ETS, each trading sector determines actual emission reductions under the objective of minimizing the total cost by comparing its marginal abatement cost with the carbon price.

Feature 3. Renewable energy technology specification.
A detailed representation of power generation technologies is especially important in China where the electricity sector is the main source of CO_2 emissions. For that reason, the electric power generation in the production module is represented by eight kinds of technologies: coal-powered, gas-powered, petroleum-powered, nuclear power, hydropower, wind power, solar, and other renewable technologies.

Results

The numerical results will be presented according to the following three parts:
1. Sectoral marginal abatement cost assessment with consideration of intersectoral and interregional interactions under ETS policy;

2. Marginal abatement cost assesment and economic impacts in regions with consideration of intersectoral and interregional interactions under ETS policy;
3. Policy implications in national ETS design in China.

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