武汉大学 气候变化与能源经济研究中心

CCEE

# Multi-dimension post-Assessment of China's ETS pilots

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# Introduction

- Post-assessment of ETS pilots in China now is significant.
- Too much Pre-assessment based on CGE at the beginning of ETS pilot around 2014.
- Too little post-assessment based on empirical/econometric regression after7-8 years of ETS pilot.
- Too little post-assessment based on multi-dimension analysis controlled economic variables as much as possible.

# Motivation

- Try to develop a multi-dimension post-assessment method based on empirical/econometric regression in province and sector level.
- Try to find out whether the ETS pilot really promoted emission reduction, reduced carbon intensity and energy consumption, improved energy efficiency and structure as well as industry structure, employment and return of covered sectors.
- Try to compare which pilot is better.
- Try to compare which allowance method is better

# Data Sources

**Panal data of 30 provinces and 39 sub-industies from 2008 to 2016**

- **China Energy Statistical Yearbook**:Various types of energy consumption
- **China Macroeconomic Database**: GDP, FDI, CPI, Investment in fixed assets, Export, Import, Consumption level, Unemployment rate, Population, Employment, Wages, Industrial added value(Total ,first, second and third industry), Total afforestation area, Patent application acceptance, Patent application authorization, Energy industry investment
- **China Third Industry Database**: Industrial pollution control investment
- **EPS database**: capital, income, profit and employment data of 39 sub-industries

# Main dependent variables

- CO2 emission (calculated according to provincial energy consumption)
- CO2 emission intensity 1 = CO2 emission / GDP
- CO2 emission intensity 2 = CO2 emission / Industrial added value or profit
- Total energy consumption
- Energy structure = Coal consumption / Total energy consumption
- Industrial structure: The added value of the second industry
- ROA, number of employment and main business income of 39 sub-industries

# Method and model

- Difference-in-difference(DID ) model of  provinces
- The difference-in-difference-in-difference (DDD)  model of sub-industries
- Robust test of provinces and sub-industries
- Heterogeneity test of provinces and sub-industries

# Basic Findings of DID analysis of province

- China’s ETS pilot  significantly reduced CO2 emissions and reduced carbon intensity
- The pilot policy had a certain reduction effect on the total energy consumption
- It also improved  energy structure and industry structure

# Robust  test results of provinces

- The reduction in CO2 emissions, carbon intensity and improvement in industrial structure are due to the 2013 pilot policy.
- From 2012 to 2016 , with the gradual progress of the ETS pilot, the continuous improvement of the trading mechanism, and the continuous expansion of the coverage ,the effect is also getting stronger.
- The impact  on energy structure, when it was first implemented in 2013, it did not have a significant impact. Since 2015, the impact on the energy structure was significantly negative. It is certainly not a one-time move, but based on a long-term impact.

# Heterogeneity test results of provinces

- Beijing is the total champion
- Hubei is outstanding in carbon emission and intensity as well as energy consumption.
- Shanghai is impressed in energy and industry structure.

# Basic findings of DDD analysis of sub-industry

- ETS reduces the carbon emissions/intensity of energy-intensive industries. The more energy-intensive the covered industries are, the more CO2/CO2 per capita/CO2 intensity decrease.
- The more energy-intensive  the covered industries are in the ETS pilots, the more total energy consumption/energy intensity decrease. ETS pilots policy has no significant effect on energy structure of industries.
- ETS pilots policy decreases the revenue of energy-intensive industries, while it has no significant effect on employment and ROA of industries.

# Robust test results of sub-industry

- CO2, CO2 intensity, energy consumption and energy intensity are not significantly reduced in 2012, whereas they are significantly reduced in/after 2013.

- The decline effect on energy and CO2/intensity does result from the ETS pilots policy built in 2013. And the more energy-intensive the covered industries are, the more energy and CO2/intensity decrease.

# Heterogeneity test results of allowance allocation method

- Covered industries with benchmark are more beneficial to CO2/CO2 intensity/CO2 per capita decrease than industries with grandfather
- Covered industries with benchmark are more beneficial to energy structure improvement and energy per capita decrease than industries with grandfather
- Covered industries with benchmark increase employment compared with grandfather
- Covered industries with grandfather increase ROA compared with benchmark

# Thank you