

PRICING CARBON AND CHINA'S INDUSTRIAL ENERGY CONSUMPTION: EXPLORING THE SECTORAL HETEROGENEITY

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Overview

Aside from the effective carbon emissions abatement, pricing carbon might generate co-benefit in relieving other environment and energy problems which are also sourced from the fossil-fuel consumption. China is planning to launch its nationwide carbon emissions trading system (ETS) within 2017. Its potential synergic effect on the energy consumption and fuel-mix is with especially importance as it could contribute to the country's fuel-mix adjustment target as well as the reduction of other pollutants. Therefore, the empirical relationship between the carbon price and the industrial energy consumption by sector is to be studied. However, two problems need to be solved in such empirical studies. One problem is that before implementing the ETS nationwide, China has not yet produced a sufficient long-term carbon price data series for empirical studies. The other problem is that the parametric panel data regression is limited (i.e. degree of freedom) in exploring the sectoral heterogeneity coefficients.

In order to explore the sectoral heterogeneous impact of carbon prices on China's industrial energy consumption and fuel mix, this paper uses a panel dataset including 36 industrial sectors in China during 2000-2013, and adopts the following methodologies. In the first step, the semi-parametric smooth varying-coefficient regression approach (Li and Racine, 2010) is applied to capture the sectoral heterogeneity per observation, and the sectoral price elasticities of energy and fuel consumption are estimated. Second, we introduce a counter-factual method referred to as 'mapping carbon price' (Cullen and Mansur, 2014), which links the carbon price scenarios to the energy price changes by sectors according to their differentiated energy costs and fuel mix. Carbon price scenarios from 1-500 RMB are mapped, and combined with the regression coefficients, their impacts on total energy consumption and fossil-fuel consumption are calculated.

This paper is arranged as follows: after an introduction, Chapter 2 is the empirical design. Chapter 3 describes the construction of the dataset. Chapter 4 and 5 show the empirical results of the above two steps respectively. And the final part discusses the policy implication and concludes.

Methods

The semi-parametric smooth varying-coefficient regression
Mapping carbon price

Results

First, the sectoral heterogeneity in the price elasticity of energy consumption is obvious (Figure 1). The estimated price elasticity is best fitted when the second-order Gaussian kernel type is applied (Model "sc1"). The mean price elasticity in the varying-coefficient model is bigger (-0.26) than that in the parametric panel data model (-0.15). And the distributions of the price elasticity of energy consumption between ETS and non-ETS sectors show no significant difference.

Second, by mapping the carbon price scenarios into the energy price changes, the carbon prices' influence on sectoral energy consumption changes can be calculated. In the ferrous metals sector (G25), power and heat (G34), and petrochemical sector (G18) carbon price could generate largest amount of energy consumption.

Third, at the carbon price of 50, 100 and 200 Yuan, the industrial total energy consumption could be reduced by 41.3 million tce (1.43%), 79.4 million tce (2.75%) and 147.9 million tce (5.12%) respectively, compared to scenarios with no carbon price.

Conclusions

Pricing carbon could generate synergic effect on energy consumption reduction. The sectoral heterogeneity in the impact of carbon price is significant. Although the distributions of price elasticity of energy consumption show now significant difference between ETS and non-ETS sectors, by mapping the carbon price into the changes of energy price, it could result in the most dramatic decrease of total energy consumption in the ferrous metals sector, power and heat sector, and petrochemical sector, which will covered by China's nationwide ETS.

References

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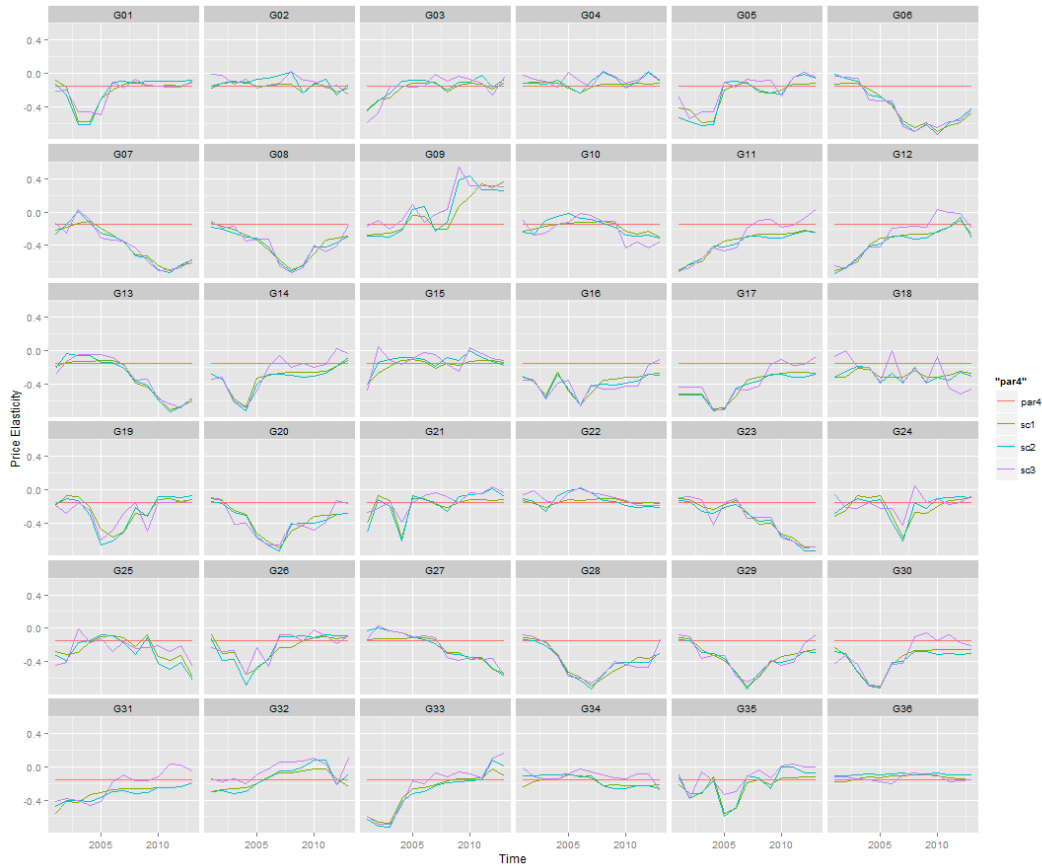


Figure 1 Sectoral Heterogeneous Price Elasticity of Energy Consumption