

PRICE OR POLICY INDUCED ENERGY-SAVING INNOVATION? EVIDENCE FROM CHINA'S INDUSTRIAL PATENTS DATA

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Overview

Since 2005, China has set national level energy/carbon intensity target for every Five-Year Period, and now steadily formed a roadmap for GHG abatement policy scheme before 2030. Differentiated with command-and-control (CAC) method which applied regularly in the past tens of years, market-oriented policy tools, which will form a price for carbon, have now been emphasized. Energy-saving innovation is the key for China to realizing its abatement target. Could price tools or regulation polices induce energy-saving innovation? Which policy tool is more effective in China? Although theoretically, market-oriented tools are thought to be superior to CAC, it is open to discuss in the developing countries, which usually face factor price distortion and low government efficiency.

To find the answers, we construct a sectoral panel dataset including energy-saving patents, energy price index and policy enforcement indicators during 1999-2012. Firstly, because China does not have a nationwide carbon price yet, we estimate the coefficient of exogenous increase in energy price to identify the potential price inducement effect. Secondly, in our dataset, 9 out of 29 sectors do not have enforcement measures even after 2005. We can test the effect of policy enforcement by comparing the two groups. Thirdly, the role of state-owned enterprises (SOE) also interests us. Although they are accused of low efficiency in some cases, it might have positive influence in abatement, because Chinese government exerts particular strict environmental regulations on them. Besides, we also show some sector specific inducement features among different sector types.

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 and robustness check respectively. And the final part discusses the policy implication and concludes.

Methods

In the first step, we use fixed effect (FE) and dynamic panel data model to test the price induced energy-saving innovation. Systematic GMM estimation is used to solve the endogenous problem. And our results can be treated as a potential inducement effect of price tools.

In the second step, we test the effect of policy enforcement. On one hand, we divided the sectors into the group with policy enforcement and the group without enforcement and apply the Difference-in-difference regression. On the other hand, we construct an indicator of the sectors' accumulated enforcement intensity and apply the FE regression.

Besides, in order to test the heterogenous effect of SOE type and sectoral type, we also add cross terms between price or policy and dummies that indicate different categories to the above regressions.

Finally, we use the propensity score matching in the robustness check in order to avoid the bias of endogenous policy enforcement among sectors.

Results

Firstly, exogenous increase in energy price could induce energy-saving innovation significantly, which indicate that policy tools would potentially have a positive effect on inducing energy-saving innovation, and it would spillover to other classification of innovation activities.

Secondly, regulation is also effective in China, and its effect is stronger on invention patents than on utilities, and the former contains more creation efforts. Besides, the national level abatement target relies on the the policy enforcement, and policy enforcement in turn, could enhance the effect of national policy target.

Thirdly, state-owned enterprises play a positive role in energy-saving innovation. Policy inducement effect is significant only in sectors with higher state-owned assets rate.

Finally, policy regulation have stronger positive effect in power sectors, while price tools' effect in manufacturing is larger. This is probably due to the coal purchasing price regulation for the power sector in China. Among the high energy consumption sectors, price tools effect is much stronger in steel and non-ferrous metals sector.

Conclusions

Both energy price and regulation policy can induce energy-saving innovations in China. In our result, the price tool has a advantage that its inducement effect can spillover to innovation activities other than energy-saving. For CAC measures, policy enforcement is essential, and the state-owned enterprises have played a positive role in China.

References

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