

# **Coping with Externally Imposed Energy Constraints: Competitiveness and Operational Impact of China's Top-1000 Energy-Consuming Enterprises Program**

*Yuxian Xiao,<sup>a</sup> Haitao Yin,<sup>b</sup> and Jon Moon<sup>c</sup>*

---

With the growing global concern regarding climate change, policymakers in nations around the world have developed various programs to reduce their energy footprints. These programs could be market-based, negotiated agreements, or in a command-and-control form. Understanding how enterprises will respond to these constraints is increasingly important for optimizing the design of such regulations.

Among the three types of energy constraints, the command-and-control approach has received the least attention. This may be because the environmental regulatory regime is moving toward a more market-oriented approach, encouraged by the success of several grand cap-and-trade policy experiments. However, in many less developed countries, markets for environmental externalities are at a nascent stage, and the primary tool to reduce energy use and environmental pollution is still the traditional command-and-control approach. There is a growing need to carefully study how enterprises may respond to the command-and-control based energy constraints, as well as the economic impacts of such constraints.

This study is a response to this need. It investigates China's Top-1000 program, which sets up an amount of energy saved (AES) target for the country's top-1000 energy-consuming enterprises. Since the methods of calculating the achieved amount of energy saved critically hinge on how much the considered companies could lower their energy intensity, it is in essence an intensity standard.

In this paper, we use propensity score matching to identify pairs for each of the Top-1000 firms, then use a difference-in-differences approach to identify the program's resulting changes in profitability and operational choices. The firms covered by the Top-1000 program have clearly slowed down their production growth and increased their investment in fixed assets. These actions increase the production costs of covered firms, thus affecting their competitiveness. The linkage between these observed outcomes and the program design are discussed. The findings confirm the expensiveness of command and control regulations and draw attention to many potential pitfalls associated with intensity-based asymmetric standard mandates.

This study is not only useful for understanding the corporate impacts of China's Top-1000 program, but also sheds light on the incentives induced by intensity standards in general.

a Department of Economics, Michigan State University.

b Corresponding author. Antai College of Economics and Management, Shanghai Jiao Tong University. Send correspondence to Antai College of Economics and Management, Shanghai Jiao Tong University, 1954 Huashan Road, Shanghai, China, 200030. E-mail: htyin@sjtu.edu.cn.

c Korea University Business School, Korea University.