



# How does state-owned shares affect double externalities and industrial performance: Evidence from China's exhaustible resources industry

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## ABSTRACT

Excessive entries of business into resource industries can cause allocation inefficiency and externality problems, such as resource depletion and environmental pollution. These problems have been existed in China's resources industry for many years. After opening up to the world, China has even begun to lose some critical strategic resources. Theoretical studies suggest that state-owned shares as an indirect form of entry regulation could help the government reduce costs and control risk. This paper first empirically analyzed the co-integration relationship between double externalities and state-owned shares, using a Seemingly Unrelated Regression based on China's coal, ferrous metal and non-ferrous metal resources panel data for 1999 to 2015. The results showed that state-owned shares significantly reduced the intergenerational (0.760) and environmental externalities (0.265). However, higher state-owned shares might reduce industrial effectiveness; thus, this paper further tested the effect of state-owned shares under different threshold degrees of externality. The results showed that the effect of indirect regulation was the best when it was associated with a medium degree of intergenerational externality and high degree of environmental externality.

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## 1. Introduction

Most of China's resource-based industries are facing the problem of over-entry (meaning too many companies entering the industry even with negative-profits) and over-exploitation. The primary causes of distorted resource allocation are unbalanced entry and exit barriers in the industry, leading to imminent market failure (Xinqiao and Junfeng, 2001; Chen, 2005). This has accelerated the depletion of exhaustible resources and has led to significant environmental damage. Li and Yu (2016a) summarized as the two kinds of negative externalities in resource industries: intergenerational negative externalities [INEs] and environmental negative externalities [ENEs]). Externalities provide the chance for governmental intervention because there is no pricing mechanism to trade externalities in the appropriate transaction market (Arrow, 1969), and the market failure cannot be fixed by itself.

There are two traditional solutions on fixing externalities in the resources industry: direct regulation and trade adjustments, but they have unavoidable defects respectively.

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In terms of direct regulation, the government does not have sufficient information to effectively adjust regulation (Mankiw and Whinston, 1986; Suzumura Kiyono, 1987). Further, in the resources industry, taxation and output restrictions have induced more excessive entry and high welfare losses (Young and Motta, 1994; Matsumura and Okumura, 2014). Besides, given that China has belonged to the World Trade Organization (WTO) since 2001, direct government intervention in the market could easily trigger trade disputes and sanctions. For example, China's export quota system for rare earth before 2014 was prosecuted by America and Japan in the international court and resulted in cancelling the quota. Direct regulation has although protected rare earth resources, but it has also induced illegal smuggling and international trade disputes.

In terms of trade adjustments, although increasing resources' imports and reducing their exports can solve part of the externality problem, a high degree of foreign trade dependence triggers safety problems and trade risks. For example, the demand for high-quality steel products in China has recently increased, but iron ore resources in China are scarce. Many Chinese domestic large-scale enterprises have strengthened their investment in Australia. In 2012, the Australian government increased its resource tax up to 30%, which increased the price of iron ore and also increased

Chinese enterprises' uncertainty and risk. In contrast, China's rare earth reserves are relatively abundant, supplying more than 90% of international market demands each year. However, the price of rare earth is extremely low and China has no pricing power. These cases explain why international trade cannot be the main solution for addressing externalities in Chinese resources industry.

Therefore, how to offset the double externalities in Chinese resources industries in terms of open economy has to be reconsidered seriously.

In this paper, we choose to research the indirect entry regulation because unreasonable entry and exit barriers are main drivers for the externality associated with China's resource-based industries. Spulber (1999) noted that combining direct and indirect methods can be adopted to govern negative externalities generated due to a depletion of natural resources. As such, China's resource-based industries need to reduce double negative externalities, by combining indirect entry regulations with current direct regulations, such as taxation and output quotas. Adjusting the state-owned share does not limit the number of enterprises, it will change enterprise asset structures and properties in capital structures. This affects enterprises' objectives and behavior and helps the government achieve cost reduction and risk control (Bovis, 2013). A higher state-owned share proportion represents more willingness from government, that's why it can be treated as a regulation.

Many of the analyses on indirect entry regulation have been theoretical (De Fraja and Delbono, 1989; Matsumura, 1998; Matsumura and Kanda, 2005), they discuss the efficiency of state-owned shares under different constraints and get uncertain results. In an open economy environment, the effect of indirect regulation might be different, but there is lack of empirical study on that. Thus, **it is useful to quantitatively and empirically understand whether indirect entry regulation can effectively reduce the external costs of China's resource-based industries, whether the intergenerational negative externality and environmental negative externality of China's exhaustible resources can be solved through adjusting state-owned shares.**

Most research on state-owned shares and over-entry and entry regulation are predominantly theoretical. The few empirical analyses do not include externality characteristics (Mo et al., 2009; Wei, 2009; Zhang and Zhang, 2013). As such, this paper considered three types of resource-based industries in China: coal, ferrous metal and nonferrous metal, data from 1999 to 2015. We assess the influence of state-owned shares as a form of indirect entry regulation on externalities and industrial performances. Additionally, we assess double externalities as threshold variables to analyze their effect on whole industrial performance.

Here is a fundamental theoretical thinking. First, we assume that the double externalities could be solved by adjusting state-owned shares in an open economy background. Second, considering the inefficiency in most state-owned enterprises, the higher state-owned shares might induce efficient loss in resources industry. Therefore, we need figure out a properly range of state-owned shares proportion in resources enterprises, and also research the different conditions of entry regulation to work in proper way. **This is the theoretical and first highlight in this paper.**

To evaluate the relationship between the indirect entry regulation and double externalities, the first step is to measure double externalities. After that, combining double externalities, we use the two stage estimation to figure out a properly range of state-owned shares proportion in resources enterprises. In first stage, we detect if the state-owned share has significant effect on reducing INEs and ENEs by *seemingly unrelated regression* [SUR] model. Two important cases when SUR is more efficient than OLS are when the error terms

are in fact correlated between the equations and when each equation contains exactly the different set of regressors on the right-hand-side. SUR model could help us avoid the relative endogenous. In second stage, we construct two threshold models to figure out the range of double externalities, and study the proper power of regulation in China's exhaustible resources with rising INEs and ENEs. **The Innovation of econometric methods is another highlight in this paper.**

The rest of the paper is structured as follows. The second part discusses index selection and externality measurement, and analyzes the trends in the variation of double externalities and state-owned shares. The third part verifies the co-integration relationship between double externalities and state-owned shares. The fourth part tests the threshold effects of the two kinds of externalities and analyzes different influences of state-owned shares on the performance of resource-based industries under different externality degrees. Finally, the fifth part presents the results and discussion, and proposes policy recommendations.

## 2. Index selection and trend analysis

This section discusses the selection of indexes and the statistical trends of the key variables.

### 2.1. Sampling and variables setting

This study focused monthly data from the China Economic Statistics Database for the period March 1999 to May 2015. To ensure consistency and panel balance, incomplete information was excluded from the initial data. Cross-section types included three resource-based industries: coal, ferrous metal, and nonferrous metal. There are 354 data points in the sample.

Based on fundamental theoretical thinking, we need choose state-owned shares as the independent variable. The INEs and ENEs are dependent variables in first stage, the industrial performance is the dependent variable in second stage, while the INEs and ENEs as two threshold variables. The index settings were as follows.

#### (1) Indirect entry regulation [Stated-owned Shares-SOS]

Stated-owned shares represent the government's role, where larger shares mean more indirect regulatory power, and the regulatory objective is to minimize externalities. In China, direct stated-owned shares only appear in stated-owned enterprises; the stated-owned share is consistently the largest share across enterprises. Thus, the alternative index used in this paper was the proportion of stated-owned enterprise revenue to total industry revenue, because there was no direct monthly data for stated-owned shares.

#### (2) INEs

Li and Yu (2016b) stated two estimation methods are commonly used to evaluate INEs, one is the *user cost approach* [UCA]; the other is the *net price approach* [NPA]. UCA is used to measure real income of exhaustible resources reinvestment and estimate inter-temporal damages among each generation (Serafy, 1981; Serafy, 1999). NPA focuses on estimating losses from sunk costs in the resource exploitation process (Othman and Jafari, 2012). Li and Wu (2004) and Fan (2011) etc. used UCA to estimate capital value depletion of China's coal resources and oil resources under different discount rates. They found that China's resource exploitation indeed had uncompensated value. Given this, this paper uses UCA as a reference to calculate INEs.

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