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Does energy-price regulation benefit China's economy and environment? Evidence from energy-price distortions

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ABSTRACT

China's energy prices have long been regulated due to the critical role energy plays in economic growth and social development, which leads to energy-price distortion to some extent. To figure out whether energy-price regulations will benefit China's economy (measured by GDP growth) and environment (measured by carbon emissions), we conducted an in-depth simulation using path analysis, where five energy products (natural gas, gasoline, fuel oil, steam coal, and coking coal) are selected and three measurements (absolute, relative, and moving) of energy-price distortions are calculated. The results indicate that, with a series of energy pricing policies, the price distortion for a single type of energy has gradually transformed, while the energy pricing system in China is not fully market-oriented yet. Furthermore, China's economy benefits from relative and moving distortions, while the absolute distortions of energy prices have negative impacts on economic growth. Finally, with regard to the environment, carbon emissions call for fewer distortions.

1. Introduction

As one of the most common instruments of energy subsidies (another being tax credit (Liu and Li, 2011)), price regulations have been used worldwide. In fact, the Chinese government has regulated energy prices at a lower level for a long time (Ouyang and Sun, 2015), due to the critical role that energy plays in economic and social development. According to Garbaccio et al. (1999), in the 1990s, about 46% of the coal and 80% of the oil consumed were priced below the prices required by government regulations. Although most of these government regulations have been eliminated since 1999, energy prices are still mainly controlled by state-owned enterprises, which will inevitably lead to energy-price distortion (e.g., Anand, 2016; Li and Lin, 2014; Shi and Kimura, 2010; Sun et al., 2016; Wang and Tian, 2015). According to the latest data released by the International Energy Agency (IEA),[1] the average subsidization rate of China's fossil fuels was 2.6%, equivalent to 0.2% of the GDP, in 2013. Although policymakers hope such price regulations will benefit the domestic economy and environment, the induced price distortion may actually exert negative impacts. The distortive price signals could distort resource allocation by encouraging excessive energy consumption, promoting capital-intensive industries, and accelerating the depletion of energy resources (International Monetary Fund (IMF), 2013). Along with its rapid economic development, China is undergoing rapid growth in energy demand. However, the country's current energy-pricing policies actually reduce the cost of energy resources, going against the control of excessive development in high-energy-consuming sectors, resource-intensive enterprises, and low-value-added, low-technology industrial products.

Currently, many international institutions and researchers have completed series of empirical research on energy-price subsidies or distortions, and have conducted analyses of their impact on economy, society, and the environment. The first study on China's fossil-fuel subsidies was conducted by Larsen and Shah (1992), and found that China has the second highest level of energy subsidies in the world, accounting for 5.49–6.12% of the world's total fossil-fuel subsidies during 1985–1992. The results of Liu and Li's (2011) study showed that China's total fossil-fuel subsidies were 384.6 billion CNY in 2007, accounting for 9.67% of its total fiscal expenditure and equal to about 4.1 times the environmental protection expenditure that year. Adopting a computable general equilibrium (CGE) model, Lin and Li (2012) found that removing fossil-fuel subsidies was conducive for saving energy, but the effects varied among different sectors and families. Moreover, Wang and Lin (2014) conducted a similar study

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[1] Data source: IEA's World Energy Outlook 2014. For more information on this publication please visit: http://www.worldenergyoutlook.org/publications/weo-2014/.

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on the natural gas subsidies of different sectors. In addition, fossil energy regulation increased the unemployment rate. The Intergovernmental Panel on Climate Change's (IPCC, 2001) study indicated that the countries that removed energy subsidies lost nearly 174,000 jobs (in France, Germany, Spain, Britain, Japan, and Turkey) from 1990 to 2010.

Many studies have also confirmed the vital role of energy-price regulation in energy savings. According to Lin and Du (2013), market distortions account for 24.9–33.1% of total energy loss, and the elimination of these market distortions can increase energy efficiency by 10% and reduce energy consumption by 145 Mtce per year. Such results suggest that the "real" and "effective" energy prices play important roles in energy conservation. Moreover, He et al. (2014) proved that the optimization of the electricity-price mechanism could achieve energy savings and the maximization of the total social surplus. Then, Ouyang and Sun (2015) conducted further studies on the energy-saving potential in China's industrial sector, from the perspective of factor-price distortion and allocative inefficiency.

Several studies have focused on the relationship between energy-price regulation and energy mix, even with regard to the environment. Jochem (2001) insisted that fossil-fuel subsidies decreased the external costs of energy use. Even worse, Nwachukwu and Chike (2011) proved that fossil-fuel subsidies encouraged wasteful consumption. Moreover, some results show that energy-price regulation policies may also inhibit or postpone energy-mix improvement (Kalkuhl et al., 2013; Liu and Li, 2011). The IEA (1999) found that eight non-Organisation for Economic Co-operation and Development (OECD) countries' energy consumption and CO_2 emissions would decrease by 13% and 16%, respectively, as a result of the removal of energy subsidies. Further, Riedy and Diesendorf (2003) introduced the idea that the reform of inefficient subsidies would be conducive to energy conservation and emission abatement, while Wang et al. (2009) suggested that a government-regulated, electricity-pricing mechanism would discourage energy conservation and efficiency improvement.

This paper focuses on China, a large developing economy, for two reasons. First, the country's fast economic growth creates a huge demand for energy resources. Second, it maintains a number of means of intervention, such as price control, in the domestic energy market. Examining the impact of energy-price distortion will not only present important implications for policymakers, but will also lead to a better understanding of energy-market integration. Although China's energy-price regulations have been surveyed in some of the extant literature, these studies have only estimated the magnitude of energy savings after subsidies removal, while failing to consider its impacts on both the economy and environment, let alone from the perspective of energy-price distortion. In addition, our sample data has a wider time frame, from 2001 to 2014, when compared with existing China-based studies. Such a large data sample ensures the credibility of the empirical results.

Moreover, the overall investigation of the long-term trends of energy-price distortions will provide more reasonable policy recommendations. As such, the contribution of this paper is three-fold. First, we explicitly introduce the role of energy-market-price distortions into the thoroughly examined energy-economy-environment nexus. Second, we argue that the energy-price distortions caused by energy-price regulations will have significant impacts on China's economic and environmental systems, which will lead to significant implications for policymakers in China and other developing countries. Third, our study also provides a better understanding of energy-market-price regulation, which is often hindered by subsidies and other price-control measurements in the energy-pricing markets.

The rest of this paper will be organized as follows. Section 2 generalizes the history of energy-price regulations in China. Section 3 describes the transforming mechanism between energy-price regulation and distortion in China and, at the same time, provides a brief introduction of the methodology used in this paper; especially, the measurements of energy-price distortion are given. In Section 4, we demonstrate the data source and benchmark used in this paper and calculate the absolute, relative, and moving degrees of energy-price distortion in China. Section 5 empirically analyzes both the economic and environmental effects caused by absolute, relative, and moving energy-price distortions. Finally, Section 6 concludes the paper and provides some policy implications.

2. Domestic-energy-price-regulating system in China

2.1. Coal

Because China decided to gradually deregulate its coal price since 1992, energy consumption has experienced accelerating growth and, since then, the coal price has been continuously rising due to market demand and price control.

The Chinese government recently announced a series of plans to launch a coal reform program, including a levied coal resource tax, based on the resource price rather than quantity. In order to reduce the burden, several coal-related fees were cancelled, including the coal-price-regulation fund, environmental-compensation fund for primary mineral products, and local-economic-development charge. These reforms, which began on December 1, 2014, are aimed at promoting energy (especially coal) savings and emissions reductions.

2.2. Oil

China's domestic oil price has been experiencing significant changes since the 1980s; the regulation history is listed in Table 1. Besides trying to enable China's domestic-oil-price markets to follow the lead of the international market, policymakers also intended to insulate the domestic markets from the volatility of petroleum prices in the global markets (IEA, 2010). Thus, even with the liberalizing reforms to the domestic oil price, the oil pricing system is still under control, and non-transparent, inconsistent enforcements still exist.

In the oil-regulation rules presented in March 2013, the central government would adjust the domestic oil price every 10 working days, according to changes in the international oil price. It seems that such a new mechanism is more responsive to global-oil-market changes and will help the country to better conform to overseas resources. However, the government retains the authority to suspend, postpone, or downsize the price adjustment in special cases, and there are no pre-defined conditions under which the government will intervene (Shi and Sun, 2013). Generally speaking, even though China is gradually liberalizing the pricing mechanism of domestic oil products, significant price control still exists in the oil market.

2.3. Natural gas

China's natural-gas pricing mechanism has been highly regulated. Before the new pricing regime was introduced nationwide in July 2013, China's natural-gas pricing approach was characterized as costs plus profit margin. Fig. 1(a) presents the old pricing regime of natural gas in China. To achieve this substantial increase, China has reformed its natural-gas pricing mechanism, as highly-regulated and non-transparent prices have been limiting factors for expanding the supply of natural gas.

Fig. 1(b) depicts how the natural prices are determined by the new pricing regime. We can see that, currently, the natural gas prices in the new mechanism are established for a certain period, but with no clear indication of the duration. Government authorities provide the city-gate prices, but they do not list the data sources used (Paltsev and Zhang, 2015).