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Inflationary effect of coal price change on the Chinese economy

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HIGHLIGHTS

- The pass-through effect of coal price change on Chinese economy is examined.
- The actual tariffs regulation policy is compared with two hypothetical policies.
- GDP deflator, CPI, PPI, and export price level changes are calculated.
- 5–25% of general price level changes are attributed to actual coal price shocks.
- Investors and foreigners afford about three quarters of the inflation expense.

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ABSTRACT

This study investigates the pass-through effect induced by coal price fluctuations on the Chinese economy 2007–2011 based on a non-competitive input–output model. Three scenarios with different domestic tariff regulation alternatives, i.e., Actual Regulation (AR), No Regulation (NR), and Strong Regulation (SR), are simulated to reflect the effectiveness of different policies. At the sectoral scale, the Coking sector has the largest price variation under all scenarios while agriculture sectors and services sectors are the least sensitive. Nation-level impacts are examined by the weighted price changes of commodities used for different purposes. With the government regulation in reality, about 5% of the GDP deflator and CPI changes as well as 25% of the PPI change over the research period are attributed to coal price increase. Comparison shows the AR scenario brings more stable fluctuations but higher inflation than the NR scenario. The SR scenario confirms that authorities can remarkably relieve short-run inflation by controlling domestic electricity and heat tariffs. The induced inflationary expense sums up to between 0.03% and 0.97% of China's GDP, around three quarters of which are burdened by investors and foreigners. The quantitative effect investigated in this study can serve as empirical evidence for policy makers regarding inflation control in China.

1. Introduction

The high dependency on energy resources brings also high uncertainties to our modern economy, especially when unexpected shocks are imposed on the energy commodities sustaining its operation. One of the widely concerned uncertainties brought forward is the pass-through inflationary effect along with its associated problems. When oil is the major energy commodities in most countries, a series of studies try to explain the consequences of external oil price shocks. Berument and Tasci [1] investigated the inflationary effect of crude oil prices in Turkey by constructing an input–output model. Their results suggest the oil prices increase might, in some cases, lead to hyperinflation if wages, profits, interest, and rent earnings are flexible. Cunado and de Gracia [2,3] analyzed the impact of oil price change using the cases of fifteen European and six Asian countries. Their main results suggest that oil prices have a significant effect on both price level and economic activity. Doroodian and Boyd [4] ran a computable general equilibrium model to examine whether oil price shocks are inflationary in the US economy under two separate cases and three technological scenarios. Their results show while the external shock has fairly severe effect on energy commodities, the aggregate price level changes can be significantly dissipated over time. Despite different models are employed and mixed evidences are observed from a variety of studies, it is widely accepted that energy price shock will pass through, at least partially and temporary, into inflation [5].

As one of the fastest developing economies, China is also becoming one of the largest energy consumers in the world [6,7]. However, comparing with other major energy consumers such as the United States, China depends heavily on coal [8–11], which contributes to approximately 75% of its energy production and 70% consumption during the past two decades [12]. This concen-

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trated energy structure of China brings even higher uncertainties from the shocks of energy supply and demand [13,14]. For example, if the Chinese government is to levy carbon tax on energy product, the relative cost of coal as a carbon-intensive energy will increase comparing to other energy, which might bring significant impact on China's domestic energy market.

In the meanwhile, the inflationary effect induced by energy price fluctuation on the Chinese economy is more complex than those on many other countries because of the special energy price determination mechanism in China. For example, in China about 80% of the electricity is generated by coal-fired power station, when coal price is determined by market factors, the electricity tariff is strictly regulated by a government authority named National Development and Reform Commission. Aside from electricity, price regulation is also applicable to many other energy commodities such as petroleum, natural gas, and heat. As a result, the pass-through effect of energy price change is distorted significantly by the price regulation policy in China.

Despite several studies attempt to investigate the impact of energy price increase in China (see e.g., [15,16]), the inflationary effect originated from the price change of its predominant energy commodity, i.e., coal product, has so far not been examined based on empirical data. Accordingly, this study attempts to contribute to existing literature by evaluating the quantitative impact of coal price change for the Chinese economy during 2007–2011 using empirical data. Besides, when previously studies usually focus on the price change of domestic energy resources, this study treats domestic and imported coal supply separately and thus examines both domestically originated and imported inflationary effects. Three scenarios regarding different price regulation alternatives are analyzed in order to provide concrete policy implications for the government authorities to adopt appropriate policies to keep inflation under control.

The rest of this paper is organized as follows: Section 2 describes about the methodological aspects and the employed data for this research, Section 3 examines the inflationary effects of actual coal price fluctuations for the Chinese economy under three scenarios, and the final section provides a brief discussion and concludes this study.

2. Materials and methods

2.1. Methodology

To track how the coal price change will pass through the production chain and lead to general prices changes of other commodities, this study applies a non-competitive input–output model to simulate the network structure of the Chinese economy. There are two major merits of the employed model. The first one is that it provides detailed information of all economic sectors and thus is applicable to not only nation-level but also industry-level analyses [17,18]. A second merit is that the non-competitive model configuration makes it possible to distinguish domestic and imported prices changes [19], which is of importance in the background that energy market is increasing its degree of globalization rapidly [20] and local and foreign shocks have very different influences on the economy. But it should be kept in mind that the international feedback effect, which is important for global supply chain, is not captured in such a single-region model (see details in [19,21]).

Portrayed in Table 1 is a schematic non-competitive input–output table for an open national economy which consists of n domestic industrial sectors (denoted as Sectors 1 to n) and imports goods from m foreign sectors (denoted as Sectors $n+1$ to $n+m$).

On the input side, a domestic industrial sector has to purchase products, pay for wages, taxes, and depreciation, and make reasonable profits to maintain its production. On the output side, the sector sells products to earn sufficient income to sustain its operation. In an equilibrium state, the monetary inflow and outflow of every sector is balance and can be described as

$$P_i Q_i = \sum_{j=1}^{n+m} P_j Q_{j,i} + V_i \quad (i = 1, 2 \ldots n), \tag{1}$$

in which P_i and P_j stand for the prices of outputs from Sectors i and j, Q_i stands for the volume (in physical unit, e.g., ton, cubic meter, or man-hour) of total output from Sector i, $Q_{j,i}$ stands for the volume (in physical unit) of output from Sector j used by Sector i, and V_i stands for the value-added (non-industrial input shown in Table 1) of Sector i, which includes wage, depreciation of fixed capital, net production tax, and profit.

To test the impact of external price shock on a single sector as well as on the whole economy, three assumptions are adopted in lights of previous input–output investigations [1,15]: (a) assume that enterprises are incapable to improve technology to reduce material input; (b) assume the value-added of each sector keeps constant; and (c) assume the price elasticities of all products are zero, which means price change will neither increase nor decrease supply and demand. Under those assumptions, the sectoral monetary balance after external price shock becomes:

$$P'_i Q_i = \sum_{j=1}^{n+m} P'_j Q_{j,i} + V_i \quad (i = 1, 2 \ldots n), \tag{2}$$

Table 1
Schematic non-competitive input–output table for an open national economy.

		Intermediate use				Final demand				
		Sector 1	Sector 2	...	Sector n	Domestic use				Foreign use
						Rural consumption	Urban consumption	Governmental consumption	Other domestic uses	Export
Local industrial inputs	Sector 1 Sector 2 ... Sector n									
Imported industrial inputs	Sector $n+1$ Sector n+2 ... Sector $n+m$									
Non-industrial inputs	Wages, taxes, depreciation, surplus, etc.									