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Why is electricity consumption inconsistent with economic growth in China?

Boqiang Lin [a,*], Chang Liu [b]

[a] Collaborative Innovation Center for Energy Economics and Energy Policy, China Institute for Studies in Energy Policy, Xiamen University, Fujian 361005, PR China

[b] The School of Economics, China Center for Energy Economics Research, Xiamen University, Xiamen, Fujian 361005, PR China

HIGHLIGHTS

- We analyze the deviation between GDP and electricity consumption in business cycle.
- The inventory investment adjustment mainly impacts the deviation in China.
- Concentrated electricity consumption of heavy industry magnifies the deviation.

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ABSTRACT

Studies have indicated that there exists a relatively stable and positive correlation between electricity consumption and economic growth and there should not be a large deviation between them. However, the deviation between electricity consumption and economic growth in China during the Asian Financial Crisis and Global Economic Crisis sparks intense debates. We attempt to explain the deviation from the perspective of inventory investment adjustment in the business cycle using the SVAR model in this paper. The results show that the effects of inventory investment adjustment shock and electricity consumption structure shock on the deviation are positive but tend to be negative for electricity efficiency shock. The results of historical decomposition of these shocks also show that the inventory investment adjustment shock is the main factor that influences the deviation during the Global Economic Crisis. Economic fluctuation in the short term can not change the economic development pattern and the characteristics of electricity demand. Once the economy returns to stable growth, the deviation between electricity consumption and economic growth will shrink and disappear soon.

1. Introduction

As the most important energy industry in China, the electric power industry is the key to the development of the national economy. The development of the electric power industry needs to meet three goals: supporting economic growth, promoting environmental sustainability and providing electricity service to the society. In developing countries, the goal of supporting economic growth is an essential prerequisite.

Electricity consumption is an important driver of economic growth in the process of urbanization and industrialization. There exists a relatively stable and positive correlation between economic growth and electricity consumption growth, and there should not be a large deviation between them (Lin, 2003a, b; Shiu and Lam, 2004; Yuan, et al., 2007). For example, the growth rates of the economy and electricity consumption are similar for the United States and Japan[1] in the stage of industrialization and urbanization (Jiang and Lin, 2012). Similarly, as the biggest developing country in the world, China's rapid economic growth corresponds with the increase in electricity consumption. During the process of urbanization and industrialization, China's electricity consumption increased from 2000 to 2014 with an average annual growth rate of 10% or more.

However, the growth rate of electricity consumption deviated

* Corresponding author at: Collaborative Innovation Center for Energy Economics and Energy Policy, China Institute for Studies in Energy Policy, Xiamen University, Fujian 361005, PR China. Tel.: +86 5922186076; fax: +86 5922186075.
E-mail addresses: bqlin@xmu.edu.cn, bqlin2004@vip.sina.com (B. Lin).

[1] The United States' economic growth rate in the stage of industrialization (1890–1950) was up to 6.6%, and the growth rate of electricity consumption was 6.3%. Japan's economic growth rate in the stage of industrialization (1950–1970) was up to 10.3%, and the growth rate of electricity consumption was 12.1%.

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from economic growth rate during the Asian Financial Crisis (1997–2000) and the Global Economic Crisis (2007–2010). The GDP growth rate was 7.8% in 1998 (during the Asian Financial Crisis), while total electricity consumption only increased by 2.8%. In 2000, the relationship between China's electricity consumption and economic growth began to reverse. The growth rate of electricity consumption which stood at 9.5% was greater than the GDP growth rate of 8.4%. In 2008 (during the Global Economic Crisis), China's GDP increased by 9.6% while electricity consumption only increased by 5.6%, indicating a gap of four percentage points. Strikingly similar to the Asian Financial Crisis period, the relationship between electricity consumption and economic growth reversed again two years later. The growth rate of China's electricity consumption at 13.2% was greater than GDP growth rate at 10.5% in 2010.

The large deviation between electricity consumption and economic growth in China during these two periods of economic crises sparks intense debates among researchers. Some foreign researchers such as Rawski (2001) and Carsten (2004) suspected the accuracy of data collected by (China's National Bureau of Statistics (NBS), 2009) during the Asian Financial Crisis. They argued that the inaccuracy of GDP measurement was the reason for the inconsistency between electricity consumption and economic growth in China. In 2009, the International Energy Agency doubted the accuracy of China's GDP. They argued that the fact that GDP growth rate for the first-quarter was 6.1% did not coincide with the weak demand for electricity (IEA, 2009). However, some Chinese researchers believed that it was the great change in industrial structure that led to the deviation (Liu and Cai, 2009; Zhang, 2009; China's National Bureau of Statistics (NBS), 2009), while others considered that the change in electricity efficiency in different industries was the main factor that caused the deviation (Lin et al., 2011). Nevertheless, we believe that despite current changes of industrial structure and improvement of energy efficiency, there is still a long way for China to attain its structural transformation and energy efficiency goals, and as such could not bring about such a large deviation between electricity consumption growth and economic growth.

Thus, what is the reason for such a large deviation between electricity consumption and economic growth in China during these two periods of economic crises?

In this paper, we consider that the short-term fluctuation in energy efficiency and change in electricity consumption structure could be the cause of the deviation, but the inventory investment adjustment in the business cycle could be a more important factor causing the deviation.

First, it is clear that the trends of electricity consumption and economic growth were extremely similar. Although the scale and the degree of influence were different during these two economic crises, the trend of energy (electricity) consumption showed a strong regularity. The growth rates of GDP and power generation[2] both declined and then increased, which appeared as a U-shape (Figs. 1 and 2). As the economic crisis deepened, electricity consumption declined sharply than GDP, and the deviation between them increased gradually. The biggest deviation appeared at the bottom of the U-shape. After the emergence of these two economic crises, the Chinese government implemented economic stimulus programs (including policies to expand domestic demand during the Asian Financial Crisis, and a $586 billion stimulus package during the Global Economic Crisis) to promote investment in infrastructure and social welfare. As a result, electricity

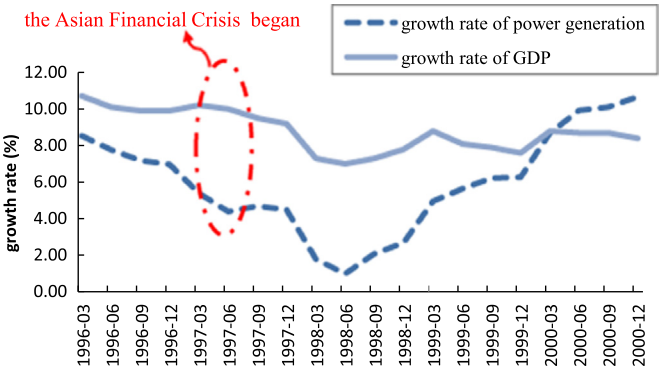

Fig. 1. The growth rate of GDP and power generation in China during the Asian Financial Crisis. *Source: China's National Bureau of Statistics, wind database.*

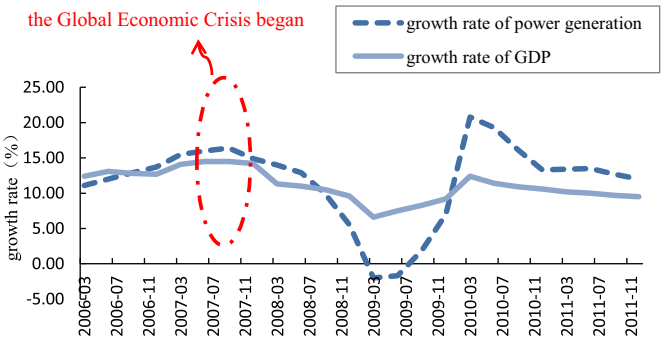

Fig. 2. The growth rate of GDP and power generation in China during the Global Economic Crisis. *Source: China's National Bureau of Statistics, wind database.*

consumption began to rebound. After the crises, the growth rate of electricity consumption accelerated and exceeded economic growth rate. However, electricity consumption declined and increased sharply during the Global Economic Crisis, making the U-shape more obvious.

China was in a similar stage of business cycle during these two economic crises. Many studies have shown that the fluctuation in inventory investment is correlated with the business cycle. Inventory investment represents a small proportion of GDP, accounting for less than 0.5% of GDP in a typical industrialized country. In recent years, inventory investment has accounted for less than 3% of GDP in China. However, the fluctuation in inventory investment deeply impacts GDP. Xu et al.(2012) measured that inventory investment, which accounted for only 3.5% of GDP annually during 1992–2010, contributed to 20% of GDP fluctuation. The economic fluctuation in China is always accompanied by sharp fluctuation in inventory investment, which implies that there is a strong correlation between them. A study by the Development Research Centre of the State Council (Li and Yu, 2009) also showed that China's industrial enterprises adjusted the inventory investment by reducing or suspending production, in response to weakening external demand in 2008 (Global economic crisis). The industrial inventory investment significantly reduced by 47.6% in the fourth quarter of 2008 and continued to shrink in the first quarter of 2009. The sharp reduction in inventory investment contributed to a decrease of 40.9% in the added value of the secondary industry.

At the same time, inventory investment adjustment affects industrial electricity consumption through enterprise activities. In the period of economic contraction, a sudden drop in the demand for industrial products results in dramatic increase in inventory. Most enterprises (especially manufacturing enterprises) anticipate a decrease in demand and begin to destock inventories. The cut in production leads to a sharp decrease in electricity consumption. In

[2] Limited to the availability of monthly data of electricity consumption in China during the Asian Financial Crisis, we put the growth rate of power generation as its proxy variable.