A macro- and microeconomic analysis of coal production in China

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ABSTRACT

This paper examines coal production in China and reaches two primary conclusions: (1) Before 2014, the growth rate of coal production in China began to decrease, although coal production output had increased. In 2014, coal production declined because of China's growing dependence on imported coal. Net coal imports increased rapidly after 2008. Changes in coal stock should not be the primary manner in which the gap between production and supply is offset. Similar to the growth rate of coal production, investment in coal production decreased in 2013. The distribution of coal production was not balanced in China in 2013 because coal reserve distribution is not geographically homogeneous. (2) In the firm production field, the average total output value, inventory value and profit from coal mining and washing firms in China increased from 2007 to 2009. The operation status in this industry was not greatly influenced by large coal imports in 2009. Only a few coal production firms in China exported their product to foreign markets although the average export value to these exporters was considerable. The output elasticity of capital was larger for labor and with decreasing returns to scale in the Chinese coal mining and washing industry between 2007 and 2009.

1. Introduction

China, as a developing country with rapid economic growth, requires large amounts of energy, which is a primary concern of policy makers. Energy, as a production factor or a daily necessity, must be produced and available as a stable supply. However, China has been unable to achieve production that is equal to their energy consumption and has thus been required to depend on energy imports (Odgaard and Delman, 2014). In the process of Chinese development, huge energy use, including the use of coal, has led to some criticism of the method of production and supply is offset. The increasing trend in coal production in China had lasted more than 30 years. China also produced more than 3000 million tons of coal beginning in 2009 based on the Coal Balance Sheet in China from the China Energy Statistical Yearbook of 2014, Li et al. (2015) indicated that approximately 77% of energy production was generated by coal in China. The increasing trend in coal production in China had lasted more than 30 years.' However, new trends in coal production and supply in China have appeared. First, the output of raw coal decreased in China beginning in 2014 based on the Statistical Bulletin of the National Economy and Social Development in China of 2014. According to the Statistical Bulletin of 2015, the growth rate of raw coal was ~3.3%, and its quantity was approximately 3750 million tons in China in 2015. Hence, the declining trend in coal production in China had largely begun by 2014. China, as a developing country, paid great attention to energy structure and attempted to resolve the problem of the over-capacity of coal production. Policy makers technically decided to stop the approval of new coal mine projects for the next three years in China (Wang, 2007; Xu et al., 2015). China had 114,500 million tonnes of coal reserves that were verified at the end of 2015 (Han et al., 2016).

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For details, see: http://www.stats.gov.cn/tj/zytb/indexl.htm (Chinese version). The data revealed that the growth rate of raw coal relative to the previous year was ~2.5% in China in 2014. According to the Statistical Bulletin in China, 2013 (see: http://www.stats.gov.cn/tj/zytb/indexl.htm), the growth rate relative to the previous year was 0.8% in China in 2013. However, the raw coal output in China in 2013 was 3680 million tons and in 2014 was 3870 million tons, according to the bulletin. The authors were uncertain of the reason for the data error although we suspect that the bulletin publisher modified the raw coal output in China in 2013 when measuring the output in China in 2014. A similar analysis can be observed on the website http://www.askci.com/news/chanye/2015/02/27/16562831xa.shtml (Chinese version).

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based on the Policy of Resolving the Overcapacity and Achieving Development from the Dilemma Regarding the Coal Industry, which was released by the State Council of the PRC in 2016. The new coal mining moratorium intended for coal production in China to decrease over the next few years. Second, China had become a net coal importer beginning in 2009. Lin and Liu (2010) estimated that China’s net coal imports would emerge in the coming year based on China’s coal import and export data from 1995 to 2008. Their forecast was accurate; China became a net coal importer in 2009 although China was a net coal exporter in 2008, which was the most recent information included in Lin and Liu (2010). However, China’s net coal imports in 2009 should have surprised everyone, perhaps even Lin and Liu, because coal imports were approximately three times greater than in 2008. Lin et al. (2012) also noted China’s coal imports in 2009 and described the effects of carbon intensity and energy security constraints on coal imports in China. The gradual decline of China’s coal production output while their imports increased was a new trend for China’s coal production and supply. However, we should also note that although China became a net coal importer in 2009, coal production nevertheless increased that year, and coal (raw) production declined until 2014. Hence, China’s changing from exporter to importer of coal was likely because coal consumption increased rather than because production declined. Additionally, the lower price of coal in foreign energy markets may have been a primary reason why other countries would sell coal to China, and China gradually became a net coal importer.

Coal is a primary resource in China and plays an irreplaceable role in many areas of people’s lives. The coal supply in China was quite large, and coal consumption was also a primary sector of the economy. According to the Coal Balance Sheet in China from the China Energy Statistical Yearbook of 2014, coal consumption had been increasing for more than 30 years. The growth rate of coal consumption in China in 2013 was only 3.1% based on the quantity of coal consumption in 2012 and 2013, 411,727 ($10^4$ t) and 424,426 ($10^4$ t), respectively. Compared with economic growth in China, the growth of coal consumption was relatively low. Coal demand expanded in China because industry accounted for approximately 95% of the coal consumption in China in 2013 based on Consumption of Coal and Its Main Varieties by Sector from the China Energy Statistical Yearbook of 2014, and the Chinese economy depended heavily on industry. Hence, the coal consumption increase in the industry sector was a primary reason why coal use increased in China. Additionally, the production and supply of electrical power and heat power as a small sector of the industry accounted for approximately 45% of total coal consumption, and residential consumption accounted for only 2.2% in China 2013. China must closely evaluate coal production and implement appropriate policies to ensure their energy security. In particular, the percentage of raw coal used for primary energy production exceeded 80% by calorific value calculation, and the ratios were also greater than 75% by coal equivalent calculation during 2004–2013 in China based on the Primary Energy Production and Composition from the China Energy Statistical Yearbook of 2014. The percentage of total energy use attributed to coal consumption during the same years was approximately 70%, which was lower than coal production, based on the Total Energy Consumption and Composition from the China Energy Statistical Yearbook of 2014. Consequently, the greater proportion of coal used for the energy to operate the Chinese economy indicates that the future development of coal supply security is quite important. Additionally, the share of coal-based energy in the consumption field declined gradually beginning in 2005. The changing energy structure in China indicated that energy policies, including coal policies, should be handled carefully.

This paper examines coal production in China by macro- and micro-economic analysis. Macroeconomic analysis is useful for examining the status of coal production in China on a national level, to evaluate coal production and supply. Macroeconomic analysis facilitates an understanding of coal production in firms’ operations to examine the characteristics of coal production. We primarily address these areas by empirically analyzing the following questions: What is the status of coal production, exports and imports, stock change, investments, and their changing trends in China? What is the primary power that maintains a special structure of coal production and consumption in China? What are the production and operation states of mining and washing firms in the coal industry, and what is their production technology? What are the policy implications based on our macro- and microeconomic analysis of coal production in China?

2. Macroeconomic analysis

We used the China Energy Statistical Yearbook of 2014, which was documented in the introduction, to obtain information regarding the energy status on a macro level. We discovered interesting phenomena regarding energy production in the Chinese economy. The yearbook series is quite popular in academic studies, such as in Fan et al. (2015).

First, we collected data regarding the primary energy production (local production) of coal (total) from Energy Balance of China (Physical Quantity) from 2004 to 2013. In the 2014 yearbook, the newest year of Energy Balance of China (Physical Quantity) was 2013, and the first year was 2000. We only searched the data from 2004 to 2013 because we believed that a ten year period would be sufficient to reveal meaningful information and describe changes and trends. Additionally, this yearbook contained the information regarding energy investment that we could use in the analysis of 2005–2013, 1995, and 2000. We only used the data on energy investment from 2005 to 2013 for continuity. Hence, we used the data on coal production and other information from Energy Balance of China (Physical Quantity) from 2004 to 2013 and compared coal production and investments in similar time periods. This information is depicted in Fig. 1 and indicates that coal (total) production increased between 2004 and 2013. The production trend gradually increased during those ten years although the growth rate was quite small; the highest rate was approximately 10% in 2010 and in 2013 was lower than 1% based on calculations using the original data. Chinese raw coal production, which is nearly equal to total coal production in China, decreased in 2014, according to the Statistical Bulletin of the National Economy and Social Development in China of 2014. Additionally, the quantity of raw coal was 397,432.20 ($10^4$ t) in China in 2013 based on the Energy Balance of China (Physical Quantity) in 2013, which is different from the information cited in the Statistical Bulletin of the National Economy and Social Development in China of 2013. This information could indirectly be used to verify our analysis in the second footnote.

Second, we calculated the ratio of coal (total) production to the total primary energy supply (available for consumption) of coal, and we present this information in Fig. 2. The coal supply primarily derived from and gradually met the increased coal demand from 2004 to 2013 in China, and the ratio of production to supply should be more meaningful. A ratio greater than 1 indicates that the coal supply in an economy could depend on its own production. When the ratio in an economy is lower than 1, the economy must rely on other coal sources, such as importing coal from foreign energy markets or using coal stock. We could not include this new perspective on coal production in China in Fig. 1. Fig. 2 shows that the ratio gradually decreased from 2004 to 2013 (except in 2008), and the ratio was lower than 1 beginning in 2006, which indicates that China’s coal production could not satisfy the country’s supply needs beginning in that year. Hence, coal imports were used to meet the demands for coal in China.

Third, China became a coal importer in 2009, and this trend toward net coal imports is depicted in Fig. 3. According to the Fig. 3, the speed of this trend increased rapidly after 2008 in China. Net coal imports

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*For details, see: [http://www.gov.cn/zhengce/content/2016-02/05/content_5039686.htm](http://www.gov.cn/zhengce/content/2016-02/05/content_5039686.htm) (Chinese version).*
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