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Mining development, income growth and poverty alleviation: A multiplier decomposition technique applied to China

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ABSTRACT

Mining has grown rapidly and is expected to continue to develop solidly in the future with the economic development in China. Based on this trend, how an increase in the outputs of mining sectors affects household income and poverty alleviation is an issue worthy of study. A multiplier decomposition method within a social accounting matrix (SAM) framework shows the linkages through which a mining sector's output contributes to household income growth and poverty alleviation. The decomposition applied to China reveals that mining development has more significantly positive impacts on the high and middle income household than low income household. Moreover, the decomposition incorporated with the Foster, Greer and Thoerbecke (FGT) poverty measure shows that the 'coal' sector contributes most to poverty alleviation and the low income household group, which has the biggest poverty rate, is the smallest beneficiary from the mining development. Thus, the policy implication is proposed that the government should give appropriate adjustment on the distribution of income between rich and poor households and help the unskilled human capital from the household group at a low income level to handle advanced technology of mining through education and training to reduce poverty more effectively.

Introduction

Poverty alleviation is a main challenge in the growing process of developing countries, especially for China. According to the poverty line of the World Bank ($1.25 a day), China had 172.9 millions of poor in 2008, that is to say, 13.1% of the total population were living below the poverty line, though the proportion of the poor in China has declined from 60.2% in 1990 to 13.1% in 2008. Certainly, economic growth has played an important role in the poverty reduction (De Janvry and Sadoulet, 2010; Fosu, 2011; Xu, 2012). Recent works further show a key finding that the importance of sectoral growth on poverty (Thorbecke and Jung, 1996; Khan, 1999; Pyatt, 2001; Okalang, 2008). Furthermore, the mining sectors are considered to contribute to economic development and poverty reduction (Neary and van Wijnbergen, 1986; Pegg, 2006). As the foundation of the national economy, the mining industry provides abundant mineral raw materials for manufacturing sectors. Simultaneously, in order to import advanced technology and equipment and then achieve industrialization, export-oriented strategy for mineral products is usually adopted in mineral-rich developing countries with a skilled labor shortage (Owens and Wood, 1997). Unsurprisingly, a large number of investments and labors are concentrated to mining sector, which finally promotes economic growth and employment expansion. In Ghana, for example, mining industry generates foreign exchange earnings by at least 40% and gross domestic product (GDP) by more than 10% (Aryee, 2001). However, people working in mining are less likely to be in poverty than those with other occupations in Tanzania (Fisher et al., 2009).

China, as the largest developing country of the world, holds abundant mineral resources reserves. It is the world's largest producer of coal, lead, zinc, tin and rare earth minerals and also ranks high on output of iron ore, gold and bauxite. The value-added amount of mining reached CNY 1672.6 billion, accounting for 10.6% of the secondary industry and 4.9% of the total in 2010 (National Bureau of Statistics of China, 2011). Moreover, the output and value-added of the metals-intensive industrial sector grew by 9.3% and 14.8%, respectively, accounting for 48.6% of GDP in 2008 (Pitfield et al., 2010). The booming mining sector also increases employment and promotes income growth, especially for the household of miner resource-based regions which are mostly located in the center and west. In 2010, 5.62 million persons were employed in the mining sector, accounting for 4.3% of the national total in urban units (National Bureau of Statistics of China, 2011). Furthermore, the average wages of labor in mining sector were

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CNY 44196 in 2010, above the national average, which indicates that mining development can increase household income and reduce poverty (National Bureau of Statistics of China, 2011). Taking Shanxi province as an example, Shanxi is a major coal producing area in which the value-added accounted for 55.8% of the total value-added of this province and the annual per capita income of the state-owned key coal enterprises increased by 1.8 times of the income for 2005 in 2010 (Shanxi Provincial People's Government, 2011). However, the income increase has not reduced disparity gap between rich and poor. From 2005 to 2010, the Gini Index has increased from 0.32 to 0.34 for rural household and 0.29 to 0.33 for urban household, which are evaluated by means of using the published data. Therefore, it makes sense to explore whether the mining development can reduce the poverty or just benefit the rich household.

This study aims to apply a multiplier decomposition technique developed by Thorbecke and Jung (1996) to the 2007 China's social accounting matrix (SAM), which focuses on poverty alleviation by considering both the direct and indirect effects of mining industry development. A SAM is a comprehensive, economy-wide data framework which is shown as the form of a square matrix (Lofgren et al., 2002), reflecting the connections among the various socio-economic sectors and institutions in a given period (Zhao and You, 2008). A multiplier decomposition technique within a SAM reveals the effects on other endogenous accounts caused by the external injection on certain endogenous account (Li et al., 2004), which is adopted to investigate the impacts of mining of coal, petroleum, natural gas, metal and nonmetal ores on the income growth of high, middle and low income households. Furthermore, to derive the total poverty alleviation effects, the FGT poverty measure P_{∞}, proposed by Foster et al. (1984), is used to analyze the incidence, depth and severity of poverty separately within a SAM framework.

This paper consists of five sections. The section "Mining industry in China" describes the current status and future trends of mining industry. The section "The SAM for China and multiplier analysis" provides detailed discussion on constructing the Chinese SAM for 2007 with a disaggregated household classification and introduction of fixed multiplier decomposition technique. The section "Effects of mining industry development on household income with fixed price multiplier decomposition" shows simulation results of fixed price multiplier decomposition model on the effects of mining industry development on household income. The section "Incorporating poverty sensitivity effects into the multiplier decomposition" incorporates poverty sensitivity effects into the multiplier decomposition process. The section "Impacts of mining development on poverty alleviation" is devoted to results on the impacts of mining industry development on poverty alleviation. Finally, the section "Conclusion" draws summary and conclusions.

Mining industry in China

China is rich in mineral resources, particularly in rare earth, coal, iron, copper, aluminum, stibium and so on. Currently, China is one of the largest producers of 37 major mineral and metals and produces more than 50% of the world's total output of 12 of these (Pitfield et al., 2010). By the end of 2010, the national proven reserves of oil amounted to 31.28 billion tons, natural gas totaled 9.3 trillion cubic meters (Huang, 2011), and coal reached 114.5 billion tons (BP, 2011). In 2010, China also identified new reserves of major mining resources, such as coal, iron ore, copper, gold, silver, rare earth, grow in varying degrees (Huang, 2011). In the past few decades, exploitation, production and consumption of mineral resources effectively promoted China's economy and its contribution reached 0.512–0.798% (Liu et al., 2010), especially for mineral-based areas. In Yunnan, mining industry takes up about 11% of the gross domestic production (Huang et al., 2011). Similarly, China's rapid economic growth has greatly boosted the mining industry that has witnessed significant increase in investment and mineral production (Huang, 2011).

Mining of coal

China is by far the largest producer of coal in the world, producing 3.24 billion tons of coal in 2010, increasing by 9.0% compared to 2009, or approximately 48.3% of all coal produced in the world (BP, 2011). In the past 10 years, coal production increased from 1.47 billion tons to 3.24 billion tons, an increase of 421% (Fig. 1) and is set to increase to over 3.30 billion tons by 2015 (Pitfield et al., 2010).

China remains highly reliant on labor-intensive underground operations as the major method of coal mining, with 5% of the mines are extracted by surface technology (He and Song, 2012). Concerning mining safety, the government has drawn up policies to regulate the coal industry, particularly, the reform policies of closing mines and restricting the yield for the small coal mines. Some studies (Shen and Andrew-Speed, 2001; He and Song, 2012) have paid attentions on small coal mines since China has about 15,000 mines of which 12,000 mines produced less than 300,000 t annually (Peng, 2010). In the first nine months of 2010, China shut 1355 small coal mines with production capacity of 125 million tons (Hill, 2010). However, 20 large coal mining groups each with an annual output of 10 million to 40 million tons are planned to build by 2015 to replace outdated mines (Bai and Chen, 2010). Therefore, coal production will continue to increase to 4 billion tons in 2020 (Peng, 2010).

Mining of petroleum and natural gas

Strong economic driving and rapid growth of private vehicles have turned China into a net importer since 1993 and the second largest consumer of oil since 2003. In 2010, China produced 4.07 million barrels of oil per day (mb/d), an increase of 7.1% compared with 2009, accounting for 5.2% of the total world production (BP, 2011). During the period 2001–2010, oil production increased from 3.306 mb/d in 2001 to the current level, an average rate of 2.3% annually since 2001 (Fig. 2). Being driven by the growth in demand, China's oil production is estimated to increase to 4.1 mb/d by 2020 and furthermore 4.3 mb/d by 2030 (OPEC (Organization of the Petroleum Exporting Countries), 2010).

China's domestic natural gas production has expanded from 30.3 billion cubic meters (bcm) in 2001 to 96.8 bcm in 2010 (BP, 2011), a notable increase of 219% (Fig. 3), due to substantial investments for natural gas infrastructure, better economic benefits than coal (Higashi, 2009) and policy support. At the beginning of 2005, the full commercial supply of natural gas by the first West-East Pipeline started in order to transport inland domestic

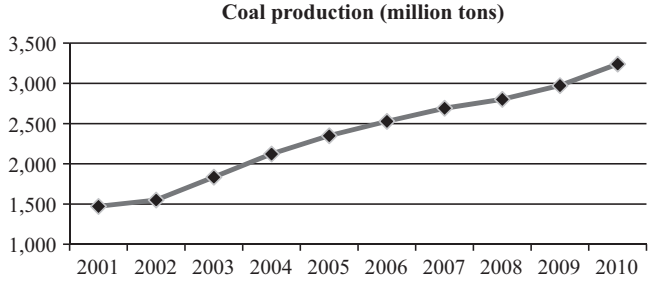

Fig. 1. China's production of coal between 2001 and 2010. Data source: BP, 2011.