Resources Policy 38 (2013) 448–457

Contents lists available at ScienceDirect

Resources Policy

journal homepage: www.elsevier.com/locate/resourpol

Economic and social effects analysis of mineral development in China and policy implications ☆

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ARTICLE INFO

Article history:
Received 5 December 2012
Received in revised form
12 June 2013
Accepted 19 June 2013
Available online 6 August 2013

Keywords:
Mineral development
Input–output
Industry linkage
Income distribution
Policy implication
JEL Classification:Q32

ABSTRACT

Mineral development has contributed greatly to China's economic and social development. Many challenges remain, however, including environmental pollution and resource waste in practice, as well as a dearth of systematic theoretical research. The goal of this study is to analyze the economic and social effects of various mineral developments in China from diversified perspectives, so as to provide the basis for the formulation of China's mineral development policy. The input–output effects, industrial linkage effects and income distribution effects of different mining industries are quantitatively analyzed by adopting basic hypotheses of input–output economics, industrial linkage model and income distribution antitheses based on the latest available official data from China Statistical Yearbook from 2004 to 2010 and the 2007 Input–Output Table of China. The empirical results obtained in this study indicate that all mineral development industries, especially coal mining and washing, and petroleum and natural gas extraction industries, have given a strong impetus to the increase of China's fixed asset investment and GDP. Moreover, they have provided a large number of jobs, thereby alleviating ongoing employment pressure, and they have also played a positive role in promoting China's technology investment. The analysis of industrial linkages demonstrates that mining industries are basic to the national economy and produce a significant impetus to its downstream industries, but create weak pull effects in terms of national economic development. From the perspective of income distribution, mining industries play an important role in increasing China's fiscal revenue and per capital income. Hence, China's mineral development policy should (1) encourage additional investment in technology for exploration and development to insure sufficient supply and expand the input effects; (2) attract additional talent to work in remote regions; (3) optimize the industrial structure and promote the industrial transformation in resource regions; (4) adjust the interest distribution between the central and local governments to enable the local regions to become more self-sufficient; and (5) enhance the legal environment so that companies can more readily undertake their social responsibilities voluntarily.

Introduction

Minerals are important material foundations for social and economic development. As an emerging industrial country, China is at the stage of rapid industrialization and urbanization, so the consumption of minerals is increasing significantly. According to the forecast of Ministry of Land and Resources of China (2011), China's demand for iron ore, refined copper and alumina will reach 1.3 billion tons, 7.3–7.6 million tons and 13–14 million tons respectively by 2020, which indicates rapid consumption growth of minerals in China.

In 2010, the total output value of China's mining sector amounted to 449.507 billion Yuan, accounting for 6.43% of the total industrial output value, more than that of the agro-food processing, textile, and machinery and equipment manufacturing industries; the number of employed persons in the mining sector reached 5.459 million, accounting for 4.46% of national employment, 1.78% and 3.09% higher than that of the agriculture, forestry, animal husbandry and fishery industry, and the information transmission, computer services and software industry, respectively. The annual average wage of employees in the mining sector is 44496 Yuan, 7349 Yuan higher than the annual average wage

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http://dx.doi.org/10.1016/j.resourpol.2013.06.005

industry-wide (National Bureau of Statistics of China, 2011). Hence, mineral development has made a positive contribution to promoting China's economic growth, providing employment opportunities and increasing the national income. However, mineral development also brings a series of negative effects, such as the destruction of the ecological environment, especially for the mineral regions. In 2009, the industrial waste water, waste gas and solid wastes (referred to as the industry's "three wastes") from mineral development respectively account for 7.25%, 3.08%, and 65.80% of the industrial three wastes, which brings heavy pollution to mineral regions. Moreover, over-reliance on the mineral development results in a single industry and employment structure in many mineral regions, creating problems such as mineral resource depletion and a decline in sustainable development in many mineral regions.

Many scholars have focused on the relationship between mineral development and socio-economic development, drawing disparate conclusions about the effects of mineral development on society and the economy. For example, Hajkowicz et al. (2011) found that mining activity had a positive impact on incomes, housing affordability, communication access, education and employment across regional and remote Australia. However, Auty (1993) supported the concept of a "resource curse" through empirical research, and Sachs and Warner (1995, 1997, 1999, 2001) confirmed this view by studying the impact of mining on economic growth in developing countries. Many studies have also been conducted in China, but few published works exist from the perspective of labor input and technical input, and the methods of industrial association analysis and income distribution are rarely used in existing research. In addition, previous research tends to focus on certain categories of minerals in individual provinces, with little work addressing the national effects of multi-mineral development. So it is difficult to comprehend the complete effects of mineral development and to compare them across industries since the indicators adopted to measure the effects of mineral development and data sources used thereby are different in previous research.

This study utilizes official data from the China Statistical Yearbook from 2004 to 2010, and the 2007 Input–Output Table of China. The economic and social effects of disparate mineral developments in China are comprehensively and quantitatively analyzed from the view of input–output effect, industrial linkage effect and income distribution effect by choosing relevant indicators as production factors, forward and backward linkages, response and influence coefficients, and the national, regional and residents incomes, to provide a more complete overview of China's mineral development effects.

A literature review

Economic and social effects analysis of mineral development

Due to the assessment of different dimensions, scholars using different indicators and data have reached diverse conclusions about economic and social effects of mineral development.

From the perspective of productivity, Habakkuk (1962) analyzed economic and social effects of natural resources development. He linked high productivity in the United States to resource abundance and claimed that the extraction of mineral resources made the United States the world leader in terms of industrial production on nineteenth-century. In terms of the proportion of natural resources in manufactured elements, Wright (1990) proposed that the abundance of natural resources was an important reason why U.S. manufacturers retained technological leadership at the turn of the twentieth century. In contrast, Auty (1993), one of the frontrunners of the resource curse literature, proposed that the abundant natural resources not only failed to promote the economic growth, but actually limited growth. Investigating 95 countries Sachs and Warner (1995, 1997, 1999, 2002) conducted a series of empirical tests associated with a prospective resource curse. Their results indicated that economies with a high ratio of natural resource exports to GDP in 1971 tended to have low growth rates during the subsequent period of 1971–1989. Based on the data of national capital market published by the World Bank Ning and Field (2005) measured natural resource abundance by natural resource dependence and natural resource endowment. They found that natural resource dependence had a negative effect on economic growth rates, while natural resource endowment had a positive impact on growth.

In China, most scholars study economic and social effects of natural resources development from the aspect of economic growth. From the perspective of the aggregate economy Guan (2004) compared the output value of resource property with the gross output value of agriculture and industry between 1985 and 2001, and calculated the contribution of natural resources to China's economic aggregate to be approximately 30%. Wu (2006) proposed that the exploitation and utilization of mineral resources had a positive role on economic growth in Tibet by analyzing the effects of mineral development on the aggregate economy, economic growth, and industrial structure. However, some scholars have argued that natural resource development had a negative impact on social and economic development. Based on the statistical data of GDP and energy consumption from 31 provinces of China between 1985 and 2004 Han et al. (2007) found a positive correlation between energy consumption, and economic output and growth rate; however, as energy production increased, economic development declined.

Other scholars analyzed economic and social effects of natural resources from the perspective of industrial structure. Based on 2002 data, the China Input–Output Association (2007) analyzed the inter-industrial linkages of energy sectors by using the improved structural coefficients, suggesting that the second energy industry had a positive effect on other national industries. Based on the 2002 Input–Output Table of Shaanxi Ji (2010) calculated the effects of input, output, industrial relevancy and revenue allocation in the Shaanxi energy industry via input–output analysis. Results demonstrate that energy exploitation industry was able to drive the investment in other industries; meanwhile, the output of the energy exploitation industry can also promote the development of other industries.

Scholars have also investigated the economic and social effects of mineral development. Due to different data and perspectives, however, they have reached different conclusions about the economic and social effects of different mineral developments across regions. From the spatial dimensions in previous research, many researchers outside of China have investigated comparisons across nations. In contrast, most Chinese scholars have examined the phenomena at the provincial level, especially western provinces in China, such as Xinjiang, Shaanxi and Tibet, with little attention to the national level.

With increased energy consumption in China, the effect of energy resources on national economic development is enhancing as well. Chinese scholars have investigated these issues, especially the relationships between oil, gas and coal development, and regional economic growth. There are relatively few studies on other minerals, such as metallic mineral resources and nonmetallic mineral resources. Many scholars have examined the economic effects of mineral development by utilizing economic aggregate and economic incensement as indicators, but few have assessed China's national economic structure and social development. Some scholars have analyzed the economic and social effects of some