CSCanada
Cross-Cultural Communication
Vol. 8, No. 6, 2012, pp. 112-117
DOI:10.3968/j.ccc.1923670020120806.2415

ISSN 1712-8358[Print]
ISSN 1923-6700[Online]
www.cscanada.net
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Study on Developing Coal Resource with the Social-Economic Influence in Erdos City

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Received 25 October 2012; accepted 28 December 2012

Abstract

There is abundant coal resource in Erdos and coal industry is the largest pillar industry of the city. Coal resource development promotes economic growth, gains financial revenue, and increases inhabitants' employment opportunities and income. That impels Erdos, an originally poor city, to be a rich one. At the same time, coal resource development causes certain environmental effects and widens the economic gap among different regions. A comprehensive study on influences of coal resource development to Erdos' society and economy contributes to launching effective policies.

Key words: Coal resource; Erdos; Social-economic influence; Environment

LIU Huifang, YE Changxie, QI Xin (2012). Study on Developing Coal Resource with the Social-Economic Influence in Erdos City. *Cross-Cultural Communication*, *8*(6), 112-117. Available from: http://www.cscanada.net/index.php/ccc/article/view/j.ccc.1923670020120806.2415 DOI: http://dx.doi.org/10.3968/j.ccc.1923670020120806.2415.

INTRODUCTION

Erdos belongs to Inner Mongolia Autonomous Region of China, which is located in the second largest sedimentary basin of China – Erdos Basin and surrounded by the Yellow River on three sides, and includes one district and seven banners, with a total area of 87 thousand km^2 and a permanent population of 2.0 million. Erdos is rich in coal resource. In 2010, 169.6 billion tons of coal has already been expiscated in Erdos, accounting for 1/6 of China and 2/3 of the Inner Mongolia Autonomous Region, with coal-bearing area amounting to 70% and possible ore reaching 1 trillion tons. In addition, Erdos also contains a considerable amount of other mineral resources, such as natural gas, natural alkali, table salt, etc. Among them, natural gas reserves of 0.88 trillion m^3, amount to 1/3 of China.

Although begining at the end of 1940s, the coal mining industry did not have too much effect on the local economy for a long period. Erdos was one of the poorest regions in Inner Mongolia Autonomous Region. In 1979, 5 banners were national-level poverty-stricken banners and others were identified as the regional poverty banners by government. In the late 1980s, Erdos grasped the opportunities that the national energy strategy transfered from east to West, building a large scale of energy projects with coal as the center. Resource development makes the former poverty area a brand-new look. In 2011, the per capita GDP of Erdos reaches 163 thousand Yuan, and it is 4.65 times to national average level. It rankes second nationwide in per capita GDP of prefecture-level cities and reached the level of per capita GDP of a moderately developed country.

Some scholars have studied the mineral resources development of Erdos. It is a coal resource style city (BAI *et al.*, 2009). The city created a miracle officially named "Erdos economic phenomenon" by developing coal resource (ZHANG & AN, 2002). In just a few years, Erdos has established its leading position in industry, and formed pillar industries such as coal, chemical industry, electric power. And industries have realized scale development (AN, 2002). The city achieved an industrial great-leap-forward development and a sharply increase of the economic scale, and realized reversed industrial gradient transfer (AN, 2010). However, the heavily dependence on coal mining in economic development has many issues (CHENG, 2005). The low integral quality of national economy of Erdos City, single industrial structure (BA, 2011), serious waste (WANG *et al.*, 2005)

and negative environmental effects (MA & YANG, 2006) of coal mining are main problems. Though "resource curse" phenomenon has not appeared in Erdos (LIU & LI, 2012), how to realize sustainable development is still an important topic that has to be discussed in the development of economy and resources of Erdos (GUO *et al*., 2010).

However, there is lack of comprehensive analysis about the influence of coal mining on social and economic development in Erdos. This paper is therefore a research based on the previous research achievement, with a view to objectively evaluate the economic and the social role of coal resource development, providing reference for economic policies of the city. Meanwhile, the paper provides testimonies for significant effects of the mining in regional social and economic development.

1. THE INFLUENCE OF COAL RESOURCE DEVELOPMENT ON ECONOMY IN ERDOS

Coal mining is the main force of the GDP growth in Erdos. In 2011, the per capita GDP amounts to 25,239 dollars. It is 2.34 times of 2007 and 14.17 times of 2000. The amount of coal mining reaches to 587.94 million tons, which increases 3 times over 5 years. The added value of coal mining industry is 120.64 billion Yuan, amount to 70.56% of industrial added value. In addition, the strong market demand promotes coal pithead price to rise by 10 times over 20 years, as a result of impelling the coal industrial output growth and gaining greater economic benefit.

As a result of coal mining that promotes regional economic development, the role of secondary industries more and more important in Erdos. According to statistical data of Erdos, the proportion of secondary industry is only 28.37% in 1987, which is more than 50% in 1999 and has hit 60.1% in 2011. The contribution ratio of secondary industry has exceeded 65% continuously for four years.

Coal mining is a dominant factor of economic development in Erdos city and directly impacts on its economy. At the same time, price increase of the national coal market results in larger gains of the city. As a national base of coal production which is more concentrated in a few large companies, there are less mutual influence between the amount of coal mining in Erdos City and the market price. So, the effect of coal mining to social economy can be studied through the establishment of econometric models.

According to the analysis above, the city's GDP, raw coal production (coal), coal producer price index (PI) are preliminary selected as variables before establishing economics model to analyze the influence of coal resource development to economic development of Erdos City. There are 32 sets of time series data which start 1980 to 2011.

In order to judge the accuracy of the variable selection and the causal relationships between variables, the variable Granger test of causality should be taken in the first place. Test results show that GDP granger causes coal, PI granger causes GDP, but not vise versa.

First of all, time series are taken the natural logarithms to overcome heteroscedastic phenomenon. Then, the double logarithm model of long-term equilibrium is established according to the integrated situation of the sequences to analysis the impact of coal resource development on economic development in the long term.

In order to test the stationary of time series and avoid "spurious regression", lnGDP, lncoal and lnPI are taken unit root test to view integrated situation. The test result shows lnGDP~ I(1), lnoil~ I(1), lnPI~ I(1) and three variables have the precondition of cointegration test. Thereupon, the long-term equilibrium model is established for cointegration test: $\ln GDP = \delta + \omega \ln coal + \varepsilon \ln PI + \upsilon$.

Model estimation with the use of generalized difference method results:

$$LNGDP = -3.805494266 + 0.9316449808*LNCOAL + 0.5208737224*LNPI + e \quad (1)$$

t = (-3.623855) (6.237679) (1.679574)

$\bar{R}^2 = 0.995834$ DW = 2.168273 F = 1493.869

That t statistics of lnPI in Model (1) is not significant indicates that although coal prices can give Erdos City greater economic benefits by developing coal resource, there is no long-term equilibrium between the coal price and the city's economy. Because with more open of the coal market and better sensitivity of market reaction to coal price, the price may not rise aways in the long run and the price change is just a factor of market short-term fluctuation.

According to the result of those analyses above, the final model would be:

$\ln GDP = \delta + \omega \ln coal + \upsilon$.

The estimation result of the model is:

$$LNGDP = -1.955943389 + 1.157889545*LNCOAL + e \quad (2)$$

t = (-8.614967) (30.34791)

$\bar{R}^2 = 0.994823$

DW = 1.638749

F = 2883.58

The estimation result of Model (2) is effective and estimated value (e) of the balanced residual in the model is a stationary time series (Table 1).

Table 1
The Result of Augmented Dickey-Fuller Test to e

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.428991	0.0015
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

The long-term equilibrium equation shows that the long-term elasticity is 1.158, therefore, economic growth of Erdos City is elastic on coal production. It shows that: for a long time, the coal mining in Erdos City has played a great role in promoting economic development.

Moreover, the coal mining in Erdos City drives the development of other related industries such as electric power industry, transportation and warehousing industry, manufacturing industry of automobile and equipment, which further promote local economic development. In 2011, coal-fired power industry creates added value of 9 billion Yuan, and the added value of transportation and warehousing industry is 34 billion Yuan. Outbound freight of 70% coal production in Erdos City and the depreciation of mining equipment impel the development of vehicle and equipment manufacturing industry. In 2011, the city has completed 11.5 billion Yuan investment in the equipment manufacturing industry and reached the added value of 9 billion Yuan. The number of vehicle production has been more than 6,000 with 200,000 additional capacity of production.

2. THE INFLUENCE OF COAL RESOURCE DEVELOPMENT ON THE CITY'S FINANCIAL REVENUE AND EXPENDITURE

Coal resource development has contributed to the sustained growth of financial revenue in Erdos over the years. The development of the coal industry which is the greatest leading industry is the main reason for financial revenue growth. In 2011, the total financial revenue hits 79.65 billion Yuan and increases by 5.5 times than that in 2005. Mining production net tax has achieved 17.477 billion Yuan and resource tax has achieved 1.745 billion Yuan, approximately accounting for 1/4 of financial revenue in 2011. At the same time, the industries related to coal resource development such as coal intensive processing, mining equipment manufacturing and transportation industries contribute to the city's fiscal revenue.

The increase of financial revenue is the guarantee of fiscal expenditure. Government finance provides a powerful financial source for the projects of people's livelihood as well as social public service and ensures the harmonious development of the society. During the decade of rapid economic development, the financial expenditure of the city adds up to 165.234 billion Yuan, showing an average annual growth of 35.88%. In 2011, the financial expenditure of the city is 44.75 billion Yuan and its 56% is used on projects of livelihood development (Figure 1).

The increase of fiscal transfer payments improves residential general welfare. Take education for instance. The financial expenditure for education is 4.937 billion Yuan in 2011, accounting for 20% of the people's livelihood expenditure. Official data show that in 2006, the city's students were firstly available to nine-year free compulsory education, which was three years earlier

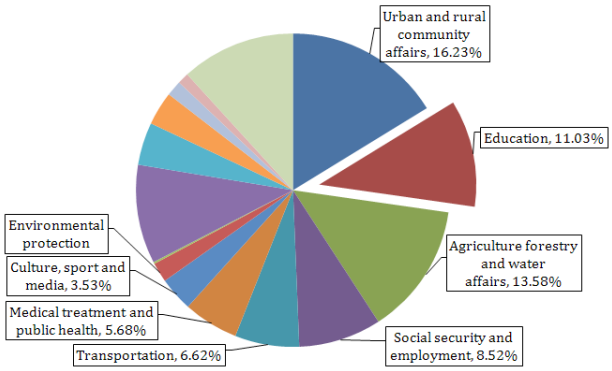

Figure 1
Classification Items of People's Livelihood Expenditure and Proportions Between Items and Fiscal Expenditure

than the nation. In 2010, the city created a precedent for the 12-year free education and a 15-year free education was underway in 2013. The city could be more equal and harmonious through the financial transfer payments. In 2010, the city helped 13000 residents to realize steady out of poverty, fetched out the price subsidy of 330.4 million Yuan for the poor and needy, and promoted annuity of urban and rural residents to 100 Yuan and 60 Yuan every mouth.

3. THE INFLUENCE OF COAL RESOURCE DEVELOPMENT ON EMPLOYMENT AND RESIDENTS INCOME IN ERDOS

Coal resource development increases the employment opportunities of the city and residents income. The employment of mining industry of which the main body is coal resource development accounts for 17.76% of total employment at the end of year 2011 in Erdos city and the total amount of remuneration of mining industry is 11.159 billion Yuan, which accounts for 22.24% of the social workers' labor remuneration, increasing 22% from last year. The average labor remuneration of mining industry is 2462 Yuan higher than the average of the city. At the same time, the mining industry also drives the employment of related industries and increases residents' income (Table 2).

Table 2
The Employment and Average Wages of Mining Industry and Related Industries in 2010

	Staff and workers/person	Average wage/Yuan
Mining industry	30352	55477
Electricity and gas production and supply	8078	58661
Transportation and warehousing	3137	43571
Manufacturing industry	29123	35441
Total social employment	170912	53015

As a coal resource dependent city, coal industry increases the residents' income and high income increases residents' consumption level which promotes the development of service industry and improves the employment. In 2010, per capita consumption level increases 26.91% from last year. The proportion of service industry is 37.1% and the proportion of the employment is 43.42%.

In short, the coal resource development increases the residents' employment and income in the Erdos city not only by direct influence of the mining industry and related industries, but also by indirect impetus function through improving consumption level.

4. THE INFLUENCE OF COAL MINING ON ENVIRONMENT IN THE CITY

The pollution caused by coal resources development is more serious, a large number of industrial "three wastes" emissions constitute a great threat to environment of the city. And the negative impact becomes more and more serious, such as noxious gases, dust pollution, water pollution, the land occupancy by coal gangue and so on. Among them, waste water is mainly discharged from coal chemical industry and sulphur dioxide is mainly discharged from coal plant. In 2010, industrial waste gas emission is 43.23 million m^3, industrial dust emission is 6021.87 tons and industrial wastewater emission is 33.77 million tons in Erdos City. Industrial solid waste is mainly composed of coal gangue, including mining waste rock and washing coal gangue. But the comprehensive utilization rate of the coal gangue is only 20% and stacked coal gangue occupies a large amount of land. In 2010, coal gangue produced from the coal mining, washing and screening occupied more than 700 mu of land.

The severe soil erosion is another serious problem that Erdos City has to face to while developing coal resource. The soil and water loss mainly caused by coal resource development concentrates in the eastern hill and gully including Jungar Banner, Dongsheng District, the eastern part of Ejin Horo Banner, the south of Dalate and so on. The coal resource is rich and the amount of coal mining is mass in this region. In 2010, the amount of coal mining in this region occupies 95.5% of total amount. At the same time, the region is one of the key areas of the soil and water conservation, which distributes the arsenic sandstone bare area that is called "the earth cancer" and "the worst soil erosion in the world", and inputs 160 million tons of sediment to Yellow river every year (REN *et al.*, 2004). Coal resource development destroys the surface san-fixation vegetation and looses sandy land to increase the soil erosion and ecological vicious cycle.

Coal resource development makes the water resource further tend to be in short supply in Erdos City and the shortage of water resource would become a limited factor for its development. Firstly, the total amount of surface water and groundwater resource in the city is 2.88 billion m^3 and the per capita possession of water resource is 2114 m^3 which belows the provincial and the national average level. Although the supply and demand of water is in load range at present, it is expected that the gap between water resource supply and demand will reach to 770 million m^3 (GAO *et al.*, 2004). With the construction of energy and chemical projects, the water demand will increase and water resource will be in short supply severely. Secondly, coal resource development is easy to cause the pollution of groundwater and imbalance of water reserving system. The exploition of coal causes the loss of 131 million m^3 of groundwater resource every year, resulting in serious waste of water resource and groundwater recession.

5. THE INFLUENCE OF COAL RESOURCE DEVELOPMENT ON DIFFERENCES OF COUNTIES IN ERDOS

Because of the uneven distribution of coal resource, coal mining exacerbates economic imbalance among the banners in the city. The banners with abundant coal resource have high GDP, more finance revenue and expenditure, high employment and income of residents. By contrast, economic development of the banners lack of coal resource is relatively backward: GDP is lower, fiscal revenue and expenditure is less, and employment and residential income are lower, too (Figure 2). Because of concentrating distribution of coal processing in Dongsheng District, Dalate Banner, Jungar Banner, Wushen Banner, Ejin Horo Banner, the economic aggregate of these banners is large as well. Among them, in the eighth evaluation of county economic basic competitiveness, Jungar Banner and Ejin Horo Banner which are based on the coal mining respectively rank first and fourth and Wushen Banner that is based on the nature gas development ranks 35th in the west of China.

GDP growth increases fiscal revenue that provides capital source for fiscal expenditure. The more financial revenue, the more expenditure could be made. And financial expenditure would improve people's general welfare. Take as example the development of the banners with largest financial revenue in recent years, such as Dongsheng District, Jungar Banner, Ejin Horo Banner.

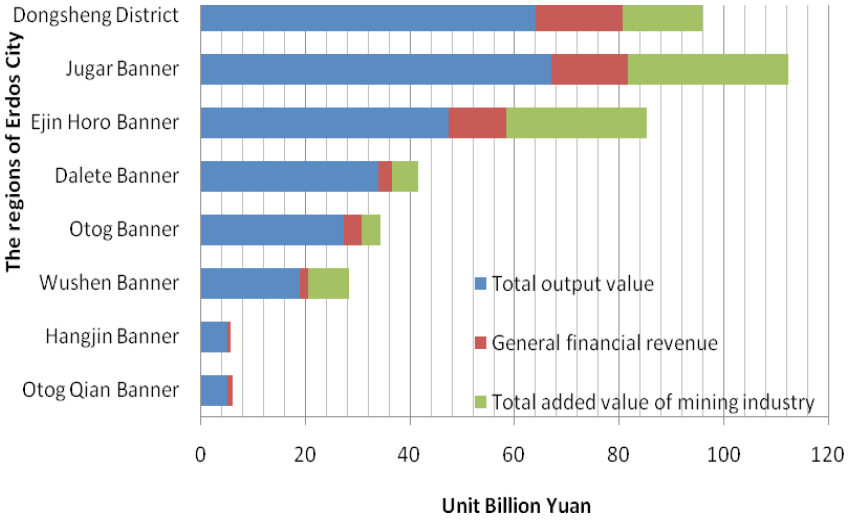

Figure 2
The Numbers of Total Output Value, General Financial Revenue, and Total Output Value of Mining Resource Development in Different Banners of Erdos

In 2007, Jungar Banner practiced 12-year free education to create a national precedent and realized free education of the vocational high school at the same time. Then, Dongsheng District and Ejin Horo Banner practiced 12-year free education. With the strong financial supporting, Dongsheng District, Jungar Banner and Ejin Horo Banner become the pioneer of education reform in Erdos City. These three banners achieved financial transfer payments of billions Yuan only on education subsidies. In Spring 2012, Jungar Banner achieved 15-year free education firstly. The kindergarten education realized financial transfer payments of 54.41 million Yuan and each person has, benefited 12000 children with 2300 Yuan subsidy per person each year.

CONCLUSIONS

The study shows that coal resource development has a significant role in promoting the economy in Erdos. Coal resource development has averaged up its economic development level, raised government revenue, enhanced resident's income and elevated employment rate. General welfare of Erdos residents has gradually advanced through fiscal expenditure.

However, coal resource development has polluted and damaged the local ecological environment. And the inner structure of coal resource industry is unitary in Erdos, lack of deep processing. It strongly depends on primary resource industry that limits the accumulation of human capital and advancement of science and technology level. At the same time, the coal resource is scarcity and exhaustible. These easily lead Erdos economy into the dilemma of "resource curse". In addition, the uneven distribution of coal resource has widened the gap between the rich and the poor and caused unbalanced development of Economy, which limit the whole city's economic development. The major serious challenges that Erdos faces are whether Erdos can achieve the sustainable development of nature, coal resource development and economic development, and narrow the gap between the rich and the poor.

In order to promote economic sustainable development, the city should actively carry out the work of energy-saving and emission-reduction, deepen the work of pollution control and protect water sources from being polluted. Secondly, the city should carry out policies of industrial upgrading, extending the coal industry chain, going on deep processing of coal resource, developing coal industries such as coal chemical industry, power plant industry and coalification natural gas industry, and reducing outward transport of primary coal resource and improving added value of minerals. Thirdly, the city should strengthen the input in science and technology and actively attract the high level talents and flourish the field of science and technology, especially coal deep processing technology. Finally, more financial support is needed from backward counties to promote their advantage industrial development and narrow the gap between the poor and the rich.

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