Journal of Management Policies and Practices
December 2017, Vol. 5, No. 2, pp. 31-39
ISSN: 2333-6048 (Print), 2333-6056 (Online)

Published by American Research Institute for Policy Development
DOI: 10.15640/jmpp.v5n2a5
URL: https://doi.org/10.15640/jmpp.v5n2a5

Analysis of the Relationship about China's Environmental Governance and Economic Benefit of Coal Industrial Enterprise*

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Abstract

From 2001 to 2011, the rapid development of China's coal economy, but slow to develop since 2012, falling coal industrial enterprise economic benefits, one of its important reason is the Chinese government on environmental governance.The paper collects file of the Chinese government environmental governance and the actual data, the quantitative index for environmental governance, with the economic benefit of the coal industry enterprise by regression analysis and the conclusion is:China's environmental regulation is the greater,the coal industry enterprise economic benefit is the worse; Under the background of environmental governance,china's coal industrial enterprises if increase debt, economic benefits will be worse; Only keep the total assets of moderate growth, the reasonable control cost level, accelerate the current assets turnover, to improve the economic benefits of enterprises.

Keywords: China; Environmental governance;Coal industry enterprises;Economic benefit

1 Introduction

China is a developing country, the development of the national economy needs to consume a large amount of primary energy, such as the direct consumption of coal in China's enterprise production and people's lives. Direct consumption of coal products will emit carbon dioxide, sulphur dioxide and other harmful gases into the atmosphere, polluting the environment, affecting people's physical and mental health. To this end, the Chinese government to develop policies to protect the environment, to take measures to limit the production of carbon emissions, environmental governance efforts continue to increase. On the one hand, it improves the quality of living environment, on the other hand, it affects the economic benefits of energy production and consumption enterprises.In this paper,China's coal industry enterprises (referred to as "coal enterprises") as an example,we study the relationship between China's environmental governance and economic benefit of enterprises.

There are two important reasons for studying the economic benefits of coal enterprises: (1) China's coal economy developed rapidly during the period of 2001-2011, known as the "golden" development period [1], but from 2012 onwards, the slow development of coal economy, the economic benefits continue to decline. (2) during the rapid development of China's coal economy, Chinese experts and scholars do not attach importance to the study of coal economic benefits, there are two reasons: The first reason is the impact of foreign researchers.

* Major projects of the National Social Science Fund of China (No.: 15ZDB163) ; Top-notch Academic Programs Project of Jiangsu Higher Education Institutions(TAPP)
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Search foreign language database Emerald (Management、Engineering), On April 12, 2017, involved in the foreign language database "coal" title of economy class only 88 articles [2], focusing on the content of the relationship between coal recycling economy and energy efficiency evaluation, coal consumption and economic growth. The second reason is that China's research focus on the total amount of coal economic development. From the world's coal development, production and consumption of primary energy sources in the world coal energy accounted for about 30% of [3]. However, China coal energy consumption accounts for the proportion of total energy consumption is in commonly 70%, after years of effort, until the end of 2015 the ratio to 64%. Based on the fact that, in recent years, China's domestic research centre of gravity is prominent in four aspects: One is to highlight the main position of coal energy [4]; Two is to highlight the dominant position of government regulation, mainly to support the development of state-owned coal enterprises [5], coal economic transformation [6], low carbon development [7], coal resource type city transformation [8], etc.; Three is to highlight the integration research of coal resources, advocated the expansion of coal production scale [9], to the large-scale, huge large coal enterprises (base) (Group) development [10]; Four is to study the relationship between coal consumption and economic growth [11] [12]. But so far, no one has studied the relationship between the restriction degree of the government and the market to the coal economy and the economic benefits of the coal industry, this paper makes a trial.

2 Quantitative analysis of Chinese government's environmental governance

2.1 Environmental management measures

In order to control environmental pollution, in recent years, the Chinese government has worked out the documents and plans for energy production and consumption: The "People's Republic of China national economic and social development of the twelfth five year plan by outline" (released in March 16, 2011)," '12th Five-Year'energy development plan" (released in January 1, 2013), " '12th Five-Year' coal industry development plan" (released in March 22, 2012), " '12th Five-Year' electric power industry development plan" (released in December 10, 2010), "energy the development of a strategic action plan (2014-2020)" (released in June 7, 2014), "air pollution prevention action plan" (released in September 10, 2013), "People's Republic of China environmental protection law" (published in December 26, 2016).

In order to effectively implement the plan index, China government will relevant indicators of decomposition to all levels of government, and leading cadres at all levels to "target assessment tasks" linked to improved planning index execution [13].

Chinese government energy management departments often go to the grassroots inspection, supervision, and found problems, at any time to deal with environmental pollution incidents.

2.2 Quantification of environmental governance indicators

2.2.1 Chinese government environmental governance planning indicators

The Chinese government's environmental governance indicators related to coal production and consumption: (1) By 2015, the total coal production was controlled within 3900 million tons;(2) By 2015, coal consumption accounted for the proportion of total energy consumption control in less than 65%;(3) By 2015, chemical oxygen demand(COD), sulphur dioxide emissions decreased by 8% compared to 2010, ammonia nitrogen, nitrogen oxides emissions were reduced by more than in 2010 by 10%;(4) By 2015, energy consumption per unit of GDP was 16% lower than in 2010;(5) During "12th Five-Year", the amount of coal power generation (that is, the number of ways to generate electricity by burning coal) annual decline of 4%-5%.

2.2.2 Actual situation (indicators) of China's environmental governance

The author collected the data of energy production, consumption, import, carbon emissions, energy saving and coal power generation in China in 2010-2015, as follows (see Table 1):

Table 1 the actual completion of China's environmental governance planning indicators

Indicators	Line number	Project or Unit	2010	2011	2012	2013	2014	2015
X1: Coal production (output)	①	Unit: 100 million tons	34.2845	35.1600	39.4513	39.7432	38.7392	36.9495
	②	Sequentialspeed (preceding year=100)	100.00%	102.55%	112.21%	100.74%	97.47%	95.38%
X2:Impact of coal imports domestic coal production	③	Net imports of coal (100 million tons)	1.4400	1.6744	2.7912	3.1949	2.8548	1.9873
	④	Raw coal production in China(100 million tons)	34.2845	35.1600	39.4513	39.7432	38.7392	36.9495
	⑤	Net imports coal accounting for raw coal production in China %=1-③÷④	95.80%	95.24%	92.92%	91.96%	92.63%	94.62%
X3:Roportion of coal of energy	⑥	Unit:%	69.20%	70.20%	68.50%	67.40%	65.60%	64.00%
X4:Emissions of COD	⑦	Unit: 10000 tons	2551.96	2499.90	2423.73	2352.72	2294.59	2223.50
	⑧	Sequentialspeed (preceding ear=100)	100.00%	97.96%	96.95%	97.07%	97.53%	96.90%
X5:Emissions of sulphur ioxide	⑨	Unit: 10000 tons	2185.10	2217.91	2117.63	2043.92	1974.42	1859.12
	⑩	Sequentialspeed (preceding ear=100)	100.00%	101.50%	95.48%	96.52%	96.60%	94.16%
X6:Emissions of nitrogen oxides	(11)	Unit: 10000 tons	2273.76	2404.27	2337.76	2227.36	2078.00	1851.02
	(12)	Sequentialspeed (preceding ear=100)	100.00%	105.74%	97.23%	95.28%	93.29%	89.08%
X7:Energy consumption per unit of GDP	(13)	Unit:ton of SCE/10000 yuan	0.87	0.86	0.82	0.79	0.75	0.708
	(14)	Sequentialspeed (preceding ear=100)	100.00%	98.85%	95.35%	96.34%	94.94%	94.40%

Table 1 the actual completion of China's environmental governance planning indicators (Continued)

Indicators	Line number	Project or Unit	2010	2011	2012	2013	2014	2015
X8: Coal power generation accounted for the proportion of total electricity generation	(15)	Total electricity generation(100 million Kwh)	42017.6	47130.19	49875.53	54316.35	57944.57	58145.73
	(16)	Coal power generation(100 million Kwh)	33319.28	38337.02	38928.14	42470.07	43616.24	42420.71
	(17)	Proportion of coal power generation =(16) ÷ (15)	79.30%	81.34%	78.05%	78.19%	75.27%	72.96%

Data sources: the annual data of China Statistical Yearbook,Compiled by National Bureau of Statistics of China ,and Published by China Statistics Press in 2011-2016

2.2.3 China environmental governance index calculation

According to table 1 variable x1~x8 in the sequential speed or other relative indicators set the environmental governance index model is as follows:

$$y=ax1+bx2+cx3+dx4+ex5+fx6 \quad \text{(Model 1)}$$

In model 1: y:Environmental Governance Index; x1:Rate of change in coal production (compared with the previous year, the variables x 4~ x7 are more than the previous year) ; x2: Net imports coal accounting for raw coal production in China;X3: Coal consumption accounts for the proportion of total energy consumption; X4: Rate of change of chemical oxygen demand（COD）; X5: Rate of change of sulphur dioxide emission; X6:Rate of change of nitrogen oxides emission;X7: Rate of change of unit GDP energy consumption;X8:Coal power generation accounted for the proportion of total electricity generation.Model data selection table 1 in line ②⑤⑥⑧⑩⑫⑰of 2010-2015 relative index. In order to reduce the length of the paper, the calculation of environmental governance index only shows the calculation steps and results.Using SPSS22.0 software, using “discriminant analysis",two factors were extracted, and the variance contribution rates respectively.were 94.9092% and 5.0908%,the structural equation shown by the two factors yields the following equation:

y1 =0.0738x1+0.2557x2+0.0653x3+0.479x4+0.185x5+0.1073x6+0.0869x7-0.0513x8

y2 =0.938x1-0.387x2+0.524x3+0.3422x4-0.0171x5+0.173x6+0.29x7+0.418x8

The use of SPSS22.0 software conversion function to calculate the y value as follows:

2010-2015 y1 were: 1.1815、1.1797、1.1533、1.1429、1.1415、1.1327

2010-2015 y2 were: 2.0494、2.0886、2.1383、2.0290、1.9681、1.9121

Select the variance contribution rate of 94.9092%,5.0908%, respectively, as the weight of y1, y2, composed of Y equation as follows:

y=94.9092%×y1+5.0908%×y1

2010-2015 y values were 1.2257 (94.9092%×1.1815+5.0908%×2.0494, the rest of residual data computation analogy), 1.2260, 1.2034, 1.1880, 1.1836, 1.1724.

In 2010, y (1.2257) as the base, after obtained during the year of 2011-2015 fixed base ratio,1 ÷each year fixed base ratio = each year environmental governance index (EnviGo). See Table 2 below:

Table 2 environmental governance index

Project	2011	2012	2013	2014	2015
environmental governance index（EnviGo）	0.9998	1.0165	1.0317	1.0356	1.0455

From table 2, China environmental governance index increased year by year, up from 0.9998 in 2011 to 1.0455 in 2015. This shows that the Chinese government's regulation and control has been strengthened in the aspects of restricting the excessive growth of coal production capacity, environmental pollution control and energy consumption reduction.

3 Model design and application of environmental governance index and economic benefit of coal enterprises

3.1 Regression model design and variable definition

The economic benefits of enterprises are related to the external environment of economic development, but also related to the investment and operation of the enterprise. The design idea of the regression model is that the economic benefit of the enterprise is variable to be explained, the environmental governance index is the explanatory variable, and the relevant indicators of the internal investment and operation of the enterprise are the control variables: $\Pr ofG = \alpha_0 + \alpha_1 EnviG0 + \alpha_2 Assets + \alpha_3 LEV + \alpha_4 TurCA + \alpha_5 Cost$ （Model 2）

Model 2 variables are defined in table 3:

Table 3 Variable Settings and Definitions

Variable name		Symbol	Variable definition
Variable being Explained	Change Rate of Total Profit	ProfC	Rate of current total profits to total profits of the previous period
Explanatory Variable	Environmental Governance Index	EnviGO	Table 2 environmental governance index in 2011—2015
Control Variable	Change Rate of Total Assets	Assets	Rate of current total Assets to total Assets of the previous period
	Leverage Ratio	LEV	Ratio of total liabilities to total assets at the end of term
	Change rate of Turnover of Current Assets	TurCA	Rate of current turnover of current assets to turnover of current assets of the previous period
	Change rate of Costs	Cost	Rate of current costs to costs of the previous period
Dummy Variable	Type of Enterprise	Indus	Coal industrial enterprises above designated size in china 1;State-owned and state holding coal industry enterprise2;Private coal industry enterprise3;Coal industry enterprise with Hong Kong ,Macao,Taiwan and Foreign Funds by Region4
	Year	Year	2010 is 1;2011is 2;2012is 3;2013is 4;2014is 5;2015is 6

3.2 regression model sample data

Quote "Chinese Statistical Yearbook" 2011-2015 annual summary data, a total of four samples: (1) Annual summary data of industrial enterprises of mining and washing of coal above designated size in china (hereinafter referred to as "all coal industrial enterprises ") ; (2) Annual summary data of state-holding industrial enterprises of mining and washing of coal (hereinafter referred to as "state coal industrial enterprises ");(3) Annual summary data of private industrial enterprises of mining and washing of coal (hereinafter referred to as "private coal industrial enterprises");(4) Annual summary data of coal industry enterprise with Hong Kong ,Macao,Taiwan and Foreign Funds in china(hereinafter referred to as "foreign coal industrial enterprises ").

3.2.1 Sample data of variable being explained（ProfC）

The change of the economic benefit of Chinese coal industry enterprises is usually reflected by the total profit rate (ProfC). In 2010-2015,all coal industry enterprises were 9016, 7695, 7869, 7975, 6850, the average of 7555. First of all, to calculate change rate of total profit of all coal industry enterprises, and then calculate change rate of total profit of state coal industrial enterprises, private coal industrial enterprises, foreign coal industrial enterprises.

3.2.2 Data for the explanatory variable (EnviGo)

Model 2 explanatory variables (EnviGo) are reflected in table 2. 2010-2015 environmental governance index respectively were 1, 0.9998, 1.0165, 1.0317, 1.0356.

3.2.3 Control variable sample data

The control variable is the variable of enterprise to create economic benefit. 4 indicators of 2010-2015 economic benefit model of application of "China Statistical Yearbook" (published in order to avoid the collinearity of the change rate of total profit,economic indicators of the National Bureau of statistics to make minor adjustments), including: change rate of total assets;change rate of turnover of current assets;change rate of costs;leverage ratio(LEV).

3.3 Application of regression model

SPSS22.0 software was used to model the application of the model according to the type of enterprise: Descriptive Statistics - collinearity test - correlation analysis - linear regression analysis(method of "delete"). The total sample correlation analysis is shown in table 4:

Table4 Pearson Correlation of Variable

		Change Rate OfTotal Profit	Environmental Governance Index	Change Rate of Total Assets	LEV	Change rate ofTurnover of Current Assets	Change rate of Costs
Change Rate of Total Profit	Pearson Correlation	1.000					
	Sig. (2-tailed)	0					
	N	24					
Environmental Governance Index	Pearson Correlation	-.849***	1.000				
	Sig. (2-tailed)	0.000					
	N	24	24				
Change Rate of Total Asset	Pearson Correlation	.689***	-.805***				
	Sig. (2-tailed)	0.000	0.000				
	N	24	24	24			
Change Rate of Total Assets	Pearson Correlation	-.631***	.693***	-.443**	1.000		
	Sig. (2-tailed)	0.001	0.000	0.030			
	N	24	24	24	24		
LEV	Pearson Correlation	.548***	-.503**	0.205	-.416**	1.000	
	Sig. (2-tailed)	0.006	0.012	0.336	0.043		
	N	24	24	24	24	24	
Change rate of Turnover of Current Assets	Pearson Correlation	.822***	-.867***	.785***	-.546***	.754***	1.000
	Sig. (2-tailed)	0.000	0.000	0.000	0.006	0.000	
	N	24	24	24	24	24	24
Change rate Of Costs	Pearson Correlation	0.000	0.000				
	Sig. (2-tailed)	24	24	24			
	N	-.631***	.693***	-.443**	1.000		

*:Correlation is significant at the 0.10 level (2-tailed); **:Correlation is significant at the 0.05 level (2-tailed); ***:Correlation is significant at the 0.01 level (2-tailed).

As can be seen from table 4, there is a significant correlation between the independent and the dependent above 1%. Reliability of regression analysis.The regression equation for all the samples is as follows (independent select Delete"R" method):

$\Pr ofG = 0.902 - 0.849EnviGo + 0.689Assets - 0.631LEV + 0.548TurCA + 0.822Cost$ The regression equation is analyzed and the following conclusions are drawn:

（1）Regression analysis of environmental governance index。 Environmental governance index (EnviGo) of China coal industry and economic benefits (ProfC) negative correlation (equation coefficient -0.849, significant coefficient (sig.)is0.000), that Chinese government environmental governance strength increases.

China coal industry economic benefit is poor. By 2015 all the coal industry related indicators: change rate of total assets of 1.0281, LEV of 0.6870, change rate of turnover of current assets of 0.7494, change rate of costs of 0.7667, select the table 2 2015 environmental governance index 1.0455, is substituted into the above equation: Economic benefits in 2015=0.902-0.849×1.0455+0.689×0.6790-0.63×0.6870+0.548×0.7974-0.822×0.7667=1.3301 If the environmental governance index rose by 1 percentage points in 2015 to 1.055955 (1.0455×1.01), the: Economic benefits of changes in 2015=0.902-0.849×1.055955+0.689×0.6790-0.63×0.6870+0.548×0.7974-0.822×0.7667=1.3213The calculation results show that the environmental governance index rose 1 percentage points, the economic benefits of the coal industry dropped 0.66 percentage points [(1.3213÷ 1.3301) -1=0.66%].

（2） LEVanalysis. LEV of coal industry enterprises is negatively related to the economic benefits (the equation coefficient is -0.631), which shows that the more the LEV is, the worse the economic benefit will be.

（3） Other control variables analysis. The change rate of total assets, change rate of cost , the change rate of turnover of current assets and economic benefits positive correlation (correlation equation coefficients were 0.689, 0.548, 0.822), that Chinese coal industry enterprises under the background of the external environmental governance to maintain a modest increase in the total assets, reasonable cost control level, accelerate the turnover of current assets, will improve the economic benefits of enterprises[14].

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Date set

Summary data of all coal industrial enterprises

year	Number of Enterprises(unit)	EnviGo	ProfG	Assets	LEV	TurCA	Cost
2010	9016	1.0000	1.5607	1.2586	0.5817	1.0163	1.3304
2011	7695	0.9998	1.3233	1.2670	0.5946	1.0695	1.4043
2012	7869	1.0165	0.8350	1.1811	0.6072	0.9700	1.1395
2013	7975	1.0317	0.6223	1.0830	0.6403	0.8918	0.9413
2014	6850	1.0356	0.6010	1.0782	0.6619	0.9249	1.0021
2015	5924	1.0455	0.2844	1.0281	0.6870	0.7494	0.7667

Summary data of state coal industrial enterprises

year	Number of Enterprises(unit)	EnviGo	ProfG	Assets	LEV	TurCA	Cost
2010	856	1.0000	1.5988	1.2138	0.5980	1.0124	1.2633
2011	882	0.9998	1.2505	1.2474	0.6019	1.1166	1.4106
2012	976	1.0165	0.8230	1.1506	0.6042	1.0549	1.1747
2013	1000	1.0317	0.5909	1.1000	0.6440	0.8542	0.9073
2014	955	1.0356	0.3496	1.0730	0.6706	0.9390	1.0300
2015	937	1.0455	-0.6655	1.0724	0.7041	0.6981	0.7541

Summary data of private coal industrial enterprises

year	Number of Enterprises(unit)	EnviGo	ProfG	Assets	LEV	TurCA	Cost
2010	5531	1.0000	1.6826	1.4351	0.5134	0.9407	1.4679
2011	4420	0.9998	1.1474	1.1919	0.5496	1.0347	1.2989
2012	4472	1.0165	0.8759	1.2449	0.5885	0.8232	1.0569
2013	4540	1.0317	0.6721	1.1186	0.6143	0.8630	0.9781
2014	3865	1.0356	0.9239	1.0608	0.6292	0.9142	0.9610
2015	3229	1.0455	0.7283	0.9376	0.6377	0.8560	0.8161

Summary data of foreign coal industrial enterprises

year	Number of Enterprises(unit)	EnviGo	ProfG	Assets	LEV	TurCA	Cost
2010	36	1.0000	1.7476	1.4343	0.5420	1.4962	1.9156
2011	40	0.9998	1.4982	1.7033	0.6805	0.6432	1.4341
2012	41	1.0165	1.1148	1.1914	0.7018	1.1406	1.3855
2013	41	1.0317	0.7795	1.0511	0.7247	1.1164	1.2378
2014	41	1.0356	0.8213	1.1041	0.7086	0.9755	1.0514
2015	37	1.0455	0.4773	0.9171	0.6926	0.7101	0.6383

Cover Letter

In recent years, the Chinese government has increased the intensity of environmental governance, the most prominent is to purify the air, reduce coal consumption, to reduce the economic benefits of coal. It is necessary to study the relationship between China's environmental governance and the economic benefits of coal industry enterprises. This paper uses empirical method to get a new conclusion.

Highlights

1.Innovation of research content。 Search database Emerald (management, engineering), to now, foreign economic articles involving "coal" title only 88 articles, research content and focus on the relationship between coal recycling economy and energy efficiency evaluation, coal consumption and economic growth, the research found no coal economic benefits articles, and experts and scholars in Chinese a few years has focused solely on the research and development of total coal economy. However, since 2012, China's coal economy continued to decline, the coal industry enterprise economic benefits of research is very urgent, become the topic of this paper.

2.New entry pointin the research topic. In the past, when studying the economic benefits of the general industrial enterprises, only pay attention to the application of the relevant indicators of the economic benefits of the enterprise,do not consider or rarely consider the application of national macro-control indicators.One of the important reasons for the decline of China's coal economy in recent years is the implementation of government environmental governance. It limits the development of coal industry enterprises in many ways.Therefore, the innovation in the research topic is to collect Chinese government planning documents and the actual data, quantifies the "environmental governance index" as the starting point of economic benefits evaluation of coal industry enterprises, reflects a new perspective.

3.The combination of positive and dialectic. The positive law pays attention to the existence and the research of reality, and the dialectical method stresses the internal and external factors of the reality. The coal industry economic benefits (total profit) changes as the dependent variables (variable being explained), the "environmental governance index" as external independent variables (explanatory variables), the coal industry as the input indexes of internal invariables (control variables), regression analysis model of the design, embodies the philosophy "external" and "internal" good combination, which is different from previous studies focus only on internal factors (internal input index) of the one-sided approach, this building is an innovation in the coal economy model.

4. T**horoughdata mining in regression analysis.**For example, analysis of "environmental governance index" and "economic benefits" relationship, not simply describe the "negative correlation", but data mining that more focus the conclusion:the external environmental governance intensity index increased by 1%, and the internal economic benefits of the coal industry decreased by 0.66%.The conclusion of this refinement is a breakthrough in academic circles, which can be used by future researchers.