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## The relationship between energy industry progressing and financial support

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### ABSTRACT

This paper examined the relationship among financial structure and scale, energy consumption and energy industry output growth on the basis of panel data during the period of 2002-2012 in Chinese energy industry. The empirical analysis shows that the expansion of financing scale benefits energy industry output growth, however, the financing openness degree is constantly declining. And there are obvious differences among financing channels in terms of energy consumption and industrial output contribution. Not only will the domestic loan fail to dramatically promote energy industry output growth, but also it will increase the energy consumption. However, foreign capital could have both two benefits. In addition, issuing bond and stock in the capital market will improve the raising of contribution rate of self-financing for energy industry output growth.

### KEYWORDS

Energy consumption intensity; Energy industry output; Financing structure; Financial support; Empirical analysis.



## INTRODUCTION

China is in the important stage of industrialization and adjusting industrial structure. Currently, China is the second biggest energy consumer in the world with a further energy demand and a predicament of low energy consumption efficiency. As is showed in *International energy outlook 2013*, China's energy consumption intensity is three times over the America's and five times higher compared with the Japan's. Obviously energy efficiency of China is lower than that of developed countries. There is much room for reducing unit GDP energy consumption<sup>[1]</sup>.

Energy industry is a capital-technology intensive and a long term investment industry. Energy enterprises always have capital gaps, as massive funds are invested into exploring and utilizing energy, innovating energy technology and upgrading energy industry. Financial support is presented as financing, which plays a role in regulation of financial leverage, uses credit to support energy industrial construction and guides capital to energy industries with sustainable development nature by credit structure adjustment<sup>[2,3]</sup>.

Currently, there are few literatures studies in the relationship between growth and energy consumption intensity of energy industry and financial support. Hence, this paper analyzes the effect of financial support on the growth and energy consumption, intensity of energy industry theoretically and empirically, in the meantime, give the answers to the following questions: Can financing promote energy industry growth and reduce energy consumption? If possible, which kind of financing can do this?

## LITERATURE REVIEW

Financial support is the core part of financial and industrial development. As noted by Schreft and Smith(1998), the causality between financial development and economic development is suitable for financial support and industry development, while regional financial support is first presented as financing<sup>[4]</sup>. Rajan and Zingales (1998) analyzes the influence of financial development on external financial cost, which is to show financial support plays a key role in the industrial growth<sup>[5]</sup>.

With financial deepening, scholars investigate financial efficiency as enterprise financial channels are pluralistic; furthermore financing efficiency plays the key role in this investigation. Christa N. Brunnschweiler (2006) finds that, from investigation on the relationship between financing and industry development, it is helpful for increasing production value to enlarge financing scale, whereas there are differences in efficiency of financial methods for production value<sup>[6]</sup>. In order to control financial risks, in his opinion, the purpose of financial tends to be transparent and the capital from financial is nearly used in financial projects of which production value efficiency differs. In addition, scholars pay attention to financial ecology gradually in the evolution process of financial development theory. Salazar (1998) holds that finance subject provides production projects with financial support and has an effect on ecological environment<sup>[7]</sup>.

Joy (1995) suggests that great attention should be paid to the use of foreign private capital while the traditional mode of financing cannot meet the financial needs of developing countries in energy development<sup>[8]</sup>. J. P. Painuly etc. (2003) points out that developing countries have great potential to improve energy efficiency but are lack of an appropriate financing mechanism which is an important hindrance. He thinks financial market of energy efficiency should be emphasized in developing countries which should introduce financial capital actively, encourage the establishment of energy service companies and improve energy efficiency of developing countries by the contract energy management mechanism<sup>[9]</sup>.

Regarding the connection between financing and energy consumption, Khokher (2001) thinks that although financing can promote industry development, its effect on energy consumption depends on following factors: financing projects, technology and management level, supervision system and so on<sup>[10]</sup>. Furthermore Cantore (2009) points out financing for improving the energy efficiency can promote enterprise long-term growth effectively and mitigate the negative impact on the ecological environment greatly<sup>[11]</sup>.

## ENERGY INDUSTRIAL DEVELOPMENT AND FINANCIAL SUPPORT: EMPIRICAL STUDY

### Model design, variable declaration and relevant data source

According to the China's energy industrial classification standard, energy industrial sample includes coal mining and selection industry; petroleum and gas extracting industry; power steam water production and supply industry; petroleum processing and coking industry; and gas production and supply industry. When studying the relationship between energy industrial development and financial support, this paper makes an empirical analysis according to the time series of 2002-2012 as it is restricted by statistical data and create models as following<sup>[12,13]</sup>.

$$Y_{i,t} = c + \alpha X_{i,t} + \beta Z_{i,t} + \xi_{i,t} \quad (1)$$

(1)Energy Industrial Development Index ( $Y_{i,t}$ ).  $Y_{i,t}$  is defined as the annual output growth rate of energy industrial sub-trades to explain the effects of financial support on energy industrial development. In this paper, energy consumption is defined as the energy used to produce a unit of industrial added value.

(2)Financial Index ( $X_{i,t}$ ). The independent variables used for investigating financing are central financial budget ( $SBF_{i,t}$ ), domestic loan ( $DL_{i,t}$ ), utilizing foreign capital ( $FC_{i,t}$ ) and self-prepare capital ( $OF_{i,t}$ ). This paper defines the proportion of the capital of  $SBF_{i,t}$ ,  $DL_{i,t}$ ,  $FC_{i,t}$  and  $OF_{i,t}$  accounting for the investment funds of all industries as independent variable in this model in order to depict the consistency of the trend of financing and model data more clearly.

(3)Control Variable ( $Z_{i,t}$ ). There are many factors affecting energy industrial development. It is necessary to control some main variables to explain this model.

All data are from *China Statistical Yearbook*, *China Energy Statistical Yearbook* and *China Industrial Economic Statistical Yearbook*.

**Description of Econometric method**

Based on panel data theory and considering individual members, the general expression of section member equation model including N individual is as following:

$$y_{i,t} = a + X_{i,t} + \mu_{i,t} \quad (i = 1, 2, \dots, N; t = 1, 2, \dots, T) \tag{2}$$

Where,  $y_{i,t}$  is the  $N + 1$  dimensional explained variable vector,  $X_{i,t}$  is  $N \times NK$  dimensional explaining variable block diagonal matrix.  $a$  is  $N \times 1$  constant vector of the intercept term,  $b$  is  $NK \times 1$  dimensional coefficient vector, the value of both of which are effected by different individuals.  $\mu_{i,t}$  is  $N \times 1$  dimensional disturbance term vector which meets the hypothesis about classical econometric model that is the mean value is zero and variance is  $\sigma_{\mu}^2$ .

This paper classifies the panel data model of formula (2) into polymerization least square regression model, fixed effect model and random effect model. Based on F test and Hausman test on sample data, the results show that it is necessary to choose fixed effect model to analyze individual differences of the sample emphatically, which accords with the fact that there are big differences in financing scale and structure, energy efficiency and so on among different energy sub-trades. In order to eliminate singular covariance and simultaneous correlation of stochastic error, feasible generalized least squares estimation method is used in this paper to estimate its transformation weight is uncorrelated.

**Results and interpretation of regression**

Model (1) investigates the relationship between financing and energy industrial growth (TABLE 1).

**TABLE 1 : Regression results of panel data**

Dependent Variable	Independent Variable	EY <sub>i,t</sub> Model(1)	EI <sub>i,t</sub> Model(2)	
Financial Variable	$SBF_{i,t}$	0.240013*** (2.982312)	-0.027962** (-2.600112)	
	$X_{i,t}$	$DL_{i,t}$	0.135462*** (2.793301)	0.295329*** (6.799663)
		$FC_{i,t}$	0.320003*** (4.025732)	-0.058001*** (-3.043213)
		$OF_{i,t}$	0.125131** (2.471102)	-0.048023*** (-8.136539)
Control Variable	$Index_{i,t}$	0.070121*** (8.170355)	0.079896* (0.680032)	
	$Z_{i,t}$	$R \& D_{i,t}$	0.019022*** (3.839992)	-0.510003** (-9.98669)
		$K_{i,t}$	0.060979*** (15.99692)	-0.250012* (-0.480633)
		ADJ R <sup>2</sup>	0.971	0.979
	DW.	2.21	1.83	
	Haisman	0	0	
	Test(p)			

Notes: ‘\*’, ‘\*\*’, ‘\*\*\*’ is used to express statistical values which pass significance test at the level of 10%,5%,1% respectively. Numerical value in bracket is t statistical value.

Estimation results show that when significance level is high, coefficient sign of financial variables is positive, indicating that various sources of funding can promote energy industrial growth. The foreign capital  $FC_{i,t}$  contributes most to the output value growth (0.32) and the least contribution to the output value growth is self-prepare capital  $OF_{i,t}$  (0.125), which shows that the efficiency of utilizing foreign capital is higher than that of self-prepare capital significantly. However, there is an interesting phenomena: during the period of sample study, the proportion of utilizing foreign capital in energy

industry decreases year by year while the proportion of self-prepare capital increases greatly, both indexes were 1.16% and 61.11% separately in 2012(TABLE 2), which the efficiency of using the capital is weakening. Although we cannot obtain continuous data of stocks and bonds of self-prepare capital in energy sub-trades during the period of sample study, it accounts for a small part of self-prepare capital from the data of discontinuous years. Therefore, the main force of financing is the other capital sources of self-prepare capital. Generally speaking, designed size energy industrial enterprises contribute most to local finance. In addition, in order to strive for financial subsidies of central government and under catalysis of GDP doctrine, many local governments continue to invest in energy projects, which can easily lead to low efficiency of investment. In a word, the above analysis shows that the open degree of energy industrial financing is decreasing gradually, self-prepare capital with low efficiency becomes the main channel of energy industrial financing, which undoubtedly increases the market risk of financing and weakens diversification financing channel.

Domestic loan  $DL_{i,t}$  (TABLE 2) as the second capital source of energy industry contributes less to energy industrial output value (0.135), which is slightly higher than half of the self-prepare capital. This is because financial sector with low efficiency is mainly composed of state-owned commercial banks and its support and promotion for energy industry is realized mainly by increasing investment. Besides, the proportion of domestic loan accounting on the whole industry increases year by year but it accounting on energy industry decreases. This index is 29% in 2012 compared to that in 2002 decreased by 40%. This is perhaps because considering energy industrial characteristics (for instance long investment recovery cycle, acute fluctuation of energy price, hoisting capacity of energy efficiency, energy policy and so on), the proportion of energy industrial loan is reduced to control credit risks. Local government strengthens financial support for energy industry, which leads to the reduction of the demand for bank loan. That the coefficient of  $Index_{i,t}$ ,  $R$  &  $D_{i,t}$  and  $K_{i,t}$  is positive reflects their promotion to the growth of energy industrial output value.

**TABLE 2 : Proportion of energy industrial financial structure**

Item Year	Central Budget	Domestic Loan	Utilizing Foreign Capital	Self-prepare Capital
2002	8.21	45.79	3.75	35.03
2006	2.59	34.02	2.51	54.03
2012	3.71	29.12	1.21	60.93

Model (2) investigates the relationship between financing and energy consumption of energy enterprises. Estimation results show that coefficients of central financial budget, utilizing foreign capital and self-prepare capital are negative which suggests that capital input is beneficial to the reduction of energy consumption that is the proportion increases by 1%, energy consumption of unit added value of energy industry respectively decreases by 0.028%, 0.058% and 0.048%. That coefficient of domestic loan is positive shows that while the proportion of loan increases by 1%, energy consumption increases by 0.295% which is much more than the influence of other independent variable on reduction of energy consumption. This is probably because currently the financial institutions in China promote the energy saving and emission reduction by the means of financing totally but extensive development of energy enterprises by capital input. That domestic loan cannot reduce energy consumption shows that most of capital is invested to non-reducing energy consumption industry construction and increases output value. However, model (1) proves that the contribution of domestic loan to energy industrial output value is relatively low. Therefore, financing form of domestic loan cannot increase the energy industrial output value vigorously but increases energy consumption of unit added value. It shows that financial institutions still lack effective supervision and guidance of the fate of loan and capital efficiency of energy enterprises, which highlights some disadvantages of financial reform.

Self-prepare capital is the least efficient factor of the growth of energy industrial output value in financing structure but the main power of reduction of energy consumption. The above analysis shows that the reason why the contribution of self-prepare capital to energy industrial output value is relatively low is mainly that the efficiency of local government investment is low. Does it mean necessary sacrifice of the growth of output value can promote energy efficiency and decrease energy consumption? Actually, it just confirms that investment policy guidance of local government is changing, that is local government carries out financial restraint on high energy consumption and high pollution energy industry, strengthens the investment to energy-saving and environmental protection project and implements green investment police, which is consistent with China new energy strategy since 2000. In addition, central financial budget and utilizing foreign capital are helpful to reduce energy consumption to some extent, which highlights the strategic intention that energy police financial police of central government tends to focus on energy efficient. The use of foreign capital not only increases the output value with high efficient but also brings China energy industry some advanced ideas such as technology upgrade, energy efficiency improvement and attention to ecological environment etc to decrease energy consumption. Moreover, scientific research funds and capital stock per capita can also decrease energy consumption, which is consistent with analysis results of China 29 industrial trades panel data by Liu Chang and Cui Yanhong (2008)<sup>[14]</sup>.

Based on the analysis results of model (1) and model (2), it is easy to find that there is big difference among energy industrial development of different financing structures, which indicates that financing structure is lack of effective

supervision of the direction and efficiency of loan, self-prepare capital should properly weigh the relationship between output value and energy consumption, central financial budget and utilizing foreign capital promote energy industrial development with high efficiency but its proportion is too low. Therefore, it is significant for sustainable development of energy industry to optimize financing structure.

## CONCLUSIONS AND POLICY SUGGESTIONS

The paper revealed the relationship between financing scale and structure by analyzing the effect of financial support as well as the growth of energy industrial output value and energy consumption intensity.

Firstly, all capital sources can promote energy industrial growth. Financing opening degree and capital efficiency decrease as financing scale enlarges.

Secondly, there are obvious differences in the contribution ratio of financing structure from the growth of output value. Utilizing foreign capital efficiency is obvious higher than self-prepare capital efficiency. While the contribution ratio of domestic loan from energy industrial output value is a little low and slightly higher than that of self-prepare capital.

Thirdly, there also exist differences in the effect of various financing structure on energy industrial consumption. Self-prepare capital is the main power to decrease the energy consumption. The more the proportion of domestic loan is, the more the energy consumption is.

Fourthly, increased proportion of stock and bond in self-prepare capital is helpful for self-prepare capital to pull the energy industrial output value growth.

Fifthly, financing scale has a positive significant effect on the growth of output value, total assets and profit. Compared with output value and total assets, profit growth rate is influenced by financing scale most.

Combined with research results in this paper, suggestions were made as following in order to make financing support serve the energy industrial development better.

Firstly, financial institutions should supervise and guide energy industrial credit effectively. Financial institution whose main body is state-owned commercial banks is low efficiency and lack of effective supervision and guidance mechanism because of long-term monopoly position and lack of competition. Therefore, regional financial institutions should be established to break monopoly position of traditional state-owned commercial banks and encourage and attract new commercial banks, non-state-owned commercial banks and foreign banks to set up branches. Meanwhile, energy development bank should be established as soon as possible. Its capital structure mainly consists of huge amount of foreign exchange reserve or operating sovereign fund. Professional energy financial talents are employed. Long-term mechanism which monitors, controls and guides energy project credit is established and improved.

Secondly, financing ability of energy industry at capital market should be enlarged gradually. Energy enterprises are encouraged to issue short-term financing bills, stocks and mid long term bonds, enlarge listed energy enterprise scale and increase the proportion of direct financing. Financing mechanism such as energy trust, energy backed securities, industrial investment fund, venture capital fund and so on should be introduced. Energy industry development investment and financing channels should be expanded. Capital operation such as market selection mechanism, merger and acquisition, replacement and so on allocate capital to high growth and low pollution energy industries.

Thirdly, foreign capital financing proportion should be improved. Energy industrial development should focus on opening market on the basis of energy security, encouraging and guiding foreign financial institutions to support energy construction, utilizing foreign advanced technology and management experience, improving funds environment, increasing capital efficiency and paying attention to ecological effects of energy financing to realize energy industrial sustainable development.

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