

## Research on the Influence of Debt Structure on the Investment Efficiency of Coal Listed Companies from the Perspective of Government Regulation

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*Abstract: This paper takes the coal listed companies in China as the research object, selects the 2012-2017 balance panel data, and uses the Richardson residual model to construct the regression model. We study whether the debt structure can suppress irrational investment behavior from two aspects of the debt maturity and the source of debt, and then study how the debt structure affects non-efficiency investment based on the perspective of government regulation. The study found that: Coal listed companies have the problem of inefficient investment. There are both under-investment and over-investment, and the main problem is insufficient investment. Long-term liabilities and short-term liabilities exacerbate the inefficient investment of listed coal companies, and long-term liabilities have a greater negative impact on investment efficiency than short-term liabilities, and short-term liabilities do not exert a binding effect on inefficient investments. The higher the ratio of bank loans to assets, the less inefficient investment behavior exists. The greater the ratio of commercial credit to assets, the more likely the non-efficiency investment behaviors take place. Government regulation policies have a great influence on the investment behavior of listed coal companies. Under the effect of industry tightening policies and monetary policies, the positive correlation between commercial credit and non-efficiency investment of listed coal companies has weakened, and the negative correlation between bank loans and non-efficiency investment of listed coal companies has been strengthened.*

*Keywords: Government regulation; debt structure; inefficient investment; commercial credit.*

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### 1. INTRODUCTION

The coal industry has faced a series of problems such as large market price fluctuations, poor corporate profitability, and difficulties in exporting capacity since 2012. The problems are due to macroeconomic downturn, energy structure adjustment and government regulation. At the same time, the fixed assets investment in the mining industry continued to decline due to the target of 440 million tons of de-capacity in 2016-2017 and 150 million tons of excess capacity in 2018, coupled with a series of credit tightening policies. According to the data in the “Coal

Industry Development Annual Report”, the fixed assets investment of coal mining and selection industry dropped from 528.6 billion yuan to 264.8 billion yuan in 2012-2017, that is, the growth rate dropped from -0.44% to -12.8%. The continuous decline in investment growth rate not only affects the healthy and stable development of the coal industry, but also causes enterprises to deviate from the goal of maximizing value and causing waste of social resources. There are few domestic researches on the investment efficiency of coal enterprises. Sun Wei (2013) [1] pointed out that coal listed companies have excessive investment behavior and proposed important factors affecting investment behavior through qualitative analysis. Liang Qing ping (2015) [2] empirically analyzed the impact of vertical integration on the investment efficiency of coal enterprises. The results show that the higher the degree of forward integration of coal enterprises, the higher the investment efficiency. In addition, some scholars have made a qualitative analysis of the coal market demand and production capacity in the “Eleventh Five-Year Plan” and “Twelfth Five-Year Plan”, and pointed out that there is a significant time lag in the formation and investment of coal production capacity. The excessive investment in the early stage is caused by One of the main reasons for overcapacity.

In general, there are few articles in China that study the efficiency of coal enterprise investment from a holistic perspective. Therefore, this paper studies the impact of debt structure on the investment efficiency of coal enterprises in the context of government regulation, clarifies the non-efficiency investment status of coal enterprises and the relationship with debt structure. The purpose of this paper is to provide theoretical and practical support for coal companies. These supports enable coal companies to use regulatory policies more effectively, optimize debt structures and increase investment efficiency.

## **2. THEORY AND RESEARCH HYPOTHESIS**

The theory of “debt agency cost” believes that there is a conflict of interest between shareholders and managers. The profit-seeking nature of managers makes them more inclined to invest in projects with high risk and high returns. Creditors such as banks will increase the contract and limit the manager’s unreasonable investment motivation in order to avoid the “asset substitution” effect. Zhu He ping and Wang Li juan (2015) [3] analyzed the impact of external governance factors on non-efficiency investment and found that the increase in long-term debt exacerbated excessive investment behavior, and the increase in short-term debt contributed to underinvestment behavior. From the perspective of debt maturity, short-term liabilities bring more repayment pressure to enterprises than long-term liabilities. The “regularity” of short-term loan contracts will further restrict refinancing of enterprises. In order to maintain the credit rating of enterprises and avoid financial crisis, Managers will rationally use free cash flow within the company.

Based on the above analysis, this paper proposes research hypotheses:

Hypothesis 1: Short-term liabilities can inhibit non-efficiency investments of coal listed companies.

Hypothesis 2: Long-term liabilities can exacerbate non-efficiency investments of coal listed companies.

The "bankruptcy threat hypothesis" proposes that the manager and the bank sign a loan contract, and the manager will reduce the inefficient decision-making behavior in order to avoid the risk of bankruptcy liquidation after default. This contract will inhibit moral hazard such as "reverse selection" and improve investment efficiency. Zhu Qing xiang et al (2016) [4] found that the debt scale, short-term debt and commercial credit of listed companies in the manufacturing industry can play a role in suppressing non-efficiency investment. Hua Middle East (2017) [5] reflects the debt structure of listed companies by the ratio of commercial credit to bank loans. Research shows that there is a significant positive correlation between the debt structure of listed companies and investment efficiency. The Chinese banks controlled by the state have higher approval requirements for loan companies, strictly follow the later repayment links, and have a strong supervisory role for debtors. Commercial credit is a kind of "credit behavior" of enterprises. It generally occurs in business dealings with affiliated companies and subsidiaries. It lacks interest constraints and cannot effectively restrain the other party's irrational investment behavior.

Based on the above analysis, this paper proposes research hypotheses:

Hypothesis 3: Bank loans can effectively alleviate the non-efficiency investment of coal listed companies.

Hypothesis 4: Commercial credit cannot effectively constrain the irrational investment behavior of coal listed companies

To develop a socialist market economy, the role of the market and the role of the government are indispensable. The process of economic system reform and structural adjustment is a process of effectively allocating resources. The core of effectively configuring resources is to handle the relationship between the government and the market. China's coal industry is greatly affected by government regulation. Promulgating a series of tightening energy-saving emission reduction policies and credit tightening policies, which will help reduce irrational investment behaviors such as excessive investment by enterprises.

Based on the above analysis, this paper proposes research hypotheses:

Hypothesis 5: Government regulation can constrain the non-efficiency investment of coal listed companies.

### **3. MODEL BUILDING AND VARIABLE SELECTION**

#### **3.1 Sample selection and data sources**

This paper studies the 2012-2017 A-share listed coal companies. In order to ensure the authenticity, reliability and comparability of the research, we excluded ST or \* ST financial anomalies and listed companies with unsound financial information after 2012, and finally obtained 23 companies. The financial data used in this article is from the CSMAR database. The regulatory policies in this article are summarized from China Coal Industry Network, China News Network and other related websites. The statistical software is Spss20.0.

### 3.2 Variable setting

#### (1) Interpreted variables

The Interpreted variables in this paper are non-efficiency investments which is measured using the expected investment residual model of Richardson (2006) [6]. Taking into account the imperfect stock market in China, the company's annual stock return index is excluded, and the following model is established. If the model residual is greater than 0, it is an over-investment sample, and if the model residual is less than 0, it is an under-investment sample.

$$Inv_{i,t} = \alpha_0 + \alpha_1 Growth_{i,t-1} + \alpha_2 Lev_{i,t-1} + \alpha_3 Cash_{i,t-1} + \alpha_4 Size_{i,t-1} + \alpha_5 Age_{i,t-1} + \alpha_6 Inv_{i,t-1} + \sum year + \varepsilon_{i,t} \quad (1)$$

Among them: Inv represents the new investment of the enterprise, which is the difference between the total investment expenditure and the maintenance investment of the enterprise. Growth represents the growth opportunity of the company, expressed by the main income growth rate indicator; Lev is the financial leverage effect, expressed by the asset-liability ratio; cash holdings are measured by the ratio of monetary funds to the total assets at the end; Size represents the size of the enterprise which expressed by the natural logarithm of the total assets; Age represents the listing period of the enterprise; Inv i, t-1 is the new investment amount in the previous period, and year is the annual dummy variable.

#### (2) Explanatory variables

This paper mainly selects explanatory variables from the perspectives of debt maturity structure and debt source structure. Specific indicators are shown in Table 1:

Table 1. Variable description

Variable symbol	Definition and measurement
Long-term debt(LD)	(long-term borrowing + bonds payable) / total assets
Short-term debt (SD)	Short-term borrowings/total assets
Bank borrowing rate (BL)	(long-term borrowing + short-term borrowing + non-current liabilities due within one year) / total assets
Commercial credit ratio (BC)	(Notes payable + accounts payable + advance receipts) / total assets

#### (3) Control variables

The paper considers the impact of government regulation, free cash flow and corporate governance. This paper selects the company's free cash flow, operating income growth rate, asset-liability ratio and the proportion of the top ten shareholders and government regulation and control policies as control variables.

The government's control policies are measured as follows:

According to whether the type of regulation is a austerity policy, if the number of industry tightening policies exceeds 50% of the total annual policy, the “industrial tightening policy” takes the value 1, otherwise it is 0.

From the perspective of regulatory content, policies can be divided into comprehensive policies, monetary policies, and other policies. If the proportion of monetary policy accounts for the total number of annual policies in the year is greater than the proportion of other policies, then “monetary policy” is expressed by 1, “other policies ” is represented by 0.”

### 3.3 Model building

This paper mainly studies the relationship between the debt structure of listed coal companies and investment efficiency, and studies the impact of government regulation on these relationships. The paper introduces the free cash flow reflecting the long-term investment opportunities, the main business income reflecting the recent investment opportunities, and the proportion of the top ten shareholders who share the concentration of the shares, which have important influence on the investment behavior of the companies. Constructing a regression model (2) to verify the impact of the debt structure on non-efficiency investments.

$$In - inv_{i,t} = \beta_0 + \beta_1 LD_{i,t} + \beta_2 SD_{i,t} + \beta_3 BL_{i,t} + \beta_4 BC_{i,t} + \beta_5 Control_{i,t} + \theta_{i,t} \quad (2)$$

In recent years, the Chinese government has issued a series of regulatory policies for the coal industry. These policies have an important impact on the investment and business activities of coal enterprises.as an important factor in measuring the institutional environment. In order to accurately analyze the impact of government regulation on the relationship between debt structure and investment efficiency of coal listed companies, this paper introduces government control variables such as tightening policy and monetary policy. Build model (3) to verify the impact of government regulation on the relationship between debt structure and non-efficiency investments.

$$In - inv_{i,t} = \beta_0 + \beta_1 LD_{i,t} + \beta_2 SD_{i,t} + \beta_3 BL_{i,t} + \beta_4 BC_{i,t} + \beta_5 Control_{i,t} + \beta_6 Policy_{i,t} + \theta_{i,t} \quad (3)$$

## 4. EMPIRICAL ANALYSIS

### 4.1 Descriptive statistics

From Table 2, it can be seen that the standard deviation of non-efficiency investment level is 0.12, the average value is -0.006. Results of Model I: There were 138 data for 23 sample companies in 2012-2017. The over-investment sample group has 59 data, accounting for 42.75%, with an average of 0.074. The under-investment sample group has 79 data, accounting for 57.25%, with an average of -0.059. This shows that the investment efficiency of the sample company is generally insufficient and the difference is not obvious.

The average ratio of long-term debt and short-term debt to total assets of coal listed companies is 15% and 9% respectively. This shows that coal listed companies are more inclined to choose long-term liabilities with less debt pressure due to long mining cycles. In the debt source structure, the ratio of bank loans and commercial credits to total assets is 30% and 17% respectively, which indicates that coal listed companies' debt financing is dominated by

commercial credit and bank loans, and bank loans account for a larger proportion. The average free cash flow is -0.37, indicating that the listed coal company's own cash flow is generally short and most coal companies have insufficient investment, which indirectly shows that free cash flow will seriously affect the company's investment behavior.

Table 2. Descriptive statistics

Variable	average value	standard deviation	median	maximum value	minimum value
In-Inv	-0.006	0.12	-0.01	0.88	-0.21
LD	0.153	0.11	0.14	0.43	0
SD	0.087	0.08	0.06	0.34	0
BL	0.302	0.85	0.2	9.14	0
BC	0.174	0.35	0.12	3.66	0.01
FCF	-0.374	1.04	-0.39	2.12	-4.51
GROWTH	0.187	2.03	-0.05	21.7	-0.63
LEV	0.538	0.14	0.56	0.85	0.08
TOP-10	0.711	0.12	0.7	0.95	0.44

Table 3 shows the regulation policies of the coal industry in 2012-2017, which are organized in accordance with the regulations promulgated by the relevant departments such as the National Development and Reform Commission and the National Energy Administration.

Table 3. Industry regulation policy

	2012	2013	2014	2015	2016	2017
Tightening policy	28.6%	50%	53.8%	38.1%	56.3%	42.9%
Comprehensive policy	31%	60%	58.3%	36.9%	25%	33.3%
Monetary Policy	38%	10%	25%	52.6%	18.8%	14.3%
Other policies	31%	30%	16.7%	10.5%	56.2%	52.4%

In recent years, the proportion of industry tightening policies has generally increased. With the end of the “Golden Decade” of the coal industry, the state has issued a series of industry tightening policies to alleviate overcapacity and weak demand.

The highest proportion of monetary policy is 2015, followed by 2012. China abolished the “two-track system of coal price” in 2012, which greatly promoted the marketization process of the coal industry market. In 2015, the Central Bank reduced the deposit reserve ratio nine times, reduced bank interest rates three times, and coordinated the market with a stable and flexible monetary policy.

#### 4.2 Analysis of regression results of models

From the regression results of Model II in Table 4, it can be seen that:

F is 32.197, which indicate that the relationship between debt structure and non-efficiency investment is more significant. Adjusting the R-square is 0.688, indicating that the debt structure can explain the change in investment efficiency to the extent of 68.8%. The model fits well.

In terms of debt maturity structure, we can see that the VIF of long-term liabilities is 2.780, and the VIF of short-term liabilities is 2.144, both of which are less than 10. There is no

multicollinearity between the two variables. Long-term liabilities are positively correlated with non-efficiency investments, but the relationship is not significant. Hypothesis 2 is established. Short-term liabilities are significantly positively correlated with non-efficiency investments at the 1% level. Hypothesis 1 does not hold. Short-term liabilities do not play a binding role. The coefficient of long-term liabilities is larger than the coefficient of short-term liabilities, which indicates that the long-term liabilities of coal listed companies have a negative impact on investment efficiency than short-term liabilities.

In terms of debt source structure, bank loans are negatively correlated with non-efficiency investments, which indicates that the larger the proportion of bank loans, the more it can inhibit the inefficient investment expenditure of coal listed companies. Hypothesis 3 is established.

There is a significant positive correlation between commercial credit and non-efficiency investment, which indicates that the greater the proportion of commercial credit, the more inefficient investment behavior of coal listed companies is more likely to occur, and the hypothesis 4 is verified.

Among the control variables, the asset-liability ratio is negatively correlated with non-efficiency investments. When enterprises make more use of the funds provided by creditors for business activities, creditors will play a good supervisory role, which is conducive to the improvement of investment efficiency. There is a significant positive correlation between equity concentration and non-efficiency investment. When the equity is more concentrated, the controlling shareholder is more inclined to invest in high-risk projects for their own interests, and intensify the non-efficiency investment behavior.

The data for Model III in Table 4 is the regression result after adding government regulatory variables. Industry tightening policies, monetary policy and other policies are positively related to non-efficiency investments. Policy regulation has a significant impact on the investment efficiency of coal listed companies. Since 2012, relevant policies such as capacity reduction, destocking, and restructuring have been implemented. Under the government's control, coal listed companies are more inclined to abandon the project with a positive net present value and shift to resolving excess capacity. On the one hand, government regulation has exerted a certain restraining effect on excessive investment, but on the other hand, it has also caused coal companies to have insufficient investment in the main business such as coal mining and selection.

## **5. SUMMARY AND STRATEGY**

### **5.1 Summary**

Based on the perspective of government regulation, this paper analyzes the relationship between debt structure and investment efficiency of coal listed companies from two aspects: term structure and source structure. The study found that long-term liabilities and short-term liabilities exacerbated the inefficient investment of coal companies. Under the control of industry policies, the positive correlation between commercial credit and non-efficiency

investment of coal enterprises has weakened, and the negative correlation between bank loans and non-efficiency investment of coal enterprises has strengthened.

Table 4. Regression results of government regulation, debt structure and non-efficiency investment

variable	Model (2)		Model (3)	
	Sig (T)	coefficient	Sig (T)	coefficient
Intercept	0.011 (-2.579)	-0.152	0.000 (-3.692)	-0.258
LD	0.001 (3.532)	0.341	0.000 (4.196)	0.382
SD	0.017 (2.417)	0.293**	0.004 (2.972)	0.339**
BL	0.032 (-2.178)	-0.084**	0.025 (-2.271)	-0.082**
BC	0.000 (5.267)	0.482**	0.000 (5.545)	0.475**
FCF	0.001 (-3.298)	-0.023	0.001 (-3.508)	-0.023
GROWTH	0.447 (-0.763)	0.000	0.331 (-0.978)	0.000
LEV	0.011 (-2.589)	-0.181	0.011 (-2.602)	-0.171
TOP-10	0.020 (2.358)	0.001	0.007 (2.746)	0.002
tighten			0.830 (0.216)	0.004*
currency			0.034 (2.147)	0.056
other			0.000 (3.729)	0.075
Adj-R2	0.688		0.727	
F	32.197		28.293	

## 5.2 Strategies to improve investment efficiency

(1) Coal enterprises should make full use of the “Belt and Road” policy, expand international financing channels, and expand equity financing and corporate bond financing.

(2) Enterprises should optimize the debt structure and improve the corporate asset-liability constraint mechanism. The manager monitors and adjusts the debt structure in real time to avoid the break of the capital chain caused by excessive debt.

(3) Enterprises should scientifically predict capital needs and reduce investment risks. Coal enterprises should further strengthen the feasibility analysis of investment projects, objectively formulate investment plans and improve the risk management and control system throughout the investment process.

(4) Financial institutions should further strengthen loan investigation and demonstration, standardize approval procedures and adhere to dynamic tracking. Financial institutions should also give full play to their financial information advantages, serve coal enterprises and reduce non-performing loans.

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