

Study of Coal Industry De-Capacity Stickiness Mechanism — Empirical Evidence Based on Listed Companies

Cailing Xu^{1,*}, Xiuqin Zhong²

¹Xinhua College of Sun Yat-Sen University, Guangzhou, Guangdong 510520, China

²Business School of Sun Yat-Sen University, Guangzhou, Guangdong 510275, China

*Corresponding author. Email: Cailingxuzhong@163.com

ABSTRACT

At present, how to effectively resolve overcapacity when the business volume declines has become the biggest problem for coal enterprises. Taking China's coal listed companies from 2013 to 2018 as samples, this paper studies the mechanism of de-capacity stickiness in the coal industry. The results indicates that there is de-capacity stickiness in coal listed companies, and the stickiness of state-owned enterprises is more significant than that of non-state-owned enterprises; the return on net assets is inversely related to de-capacity stickiness; labor intensity is positively related to de-capacity stickiness. The results indicate that how to make good use of resources to improve the return on net assets and reduce labor intensity through intelligent and automation are effective means to reduce de-capacity stickiness.

Keywords: coal enterprises, de-capacity stickiness, overcapacity, return on net assets, labor intensity

I. INTRODUCTION

The healthy development of energy is significant for the promotion of China's economic development and energy is also an important material foundation for people's survival. From 2003 to 2012, under the influence of macro-economy, people's demand for energy had increased rapidly. The average annual growth rate of coal production in China was over 10%, from 1.55 billion tons to 3.95 billion tons. In those ten years, the business income scale of coal enterprises in China increased by more than 15 times. It is known as the Golden Decade. After 2012, with the decrease of China's economic growth rate, the change of energy production and consumption structure, coal resource consumption and carbon emissions have led to increasingly prominent environmental pollution problems. Coal prices have soared and imported coal has slowly occupied China's coal market by virtue of preferential prices, which has greatly impacted many coal enterprises, causing many coal enterprises unable to sell coal and have large surplus. The coal market was in a downturn for a time, and coal enterprises were in difficult operation. Many small-scale coal enterprises suffered serious losses and even could not continue their operation. Finally, they have to quit the market.

According to the survey report of the development research center of the State Council in 2015, coal, cement, photovoltaic, ship-building, electrolytic

aluminum, petrochemical, wind power and flat glass were industries with over-capacity, and their capacity utilization rate was 79% - 83%, lower than the industry satisfaction standard. In 2016, the State Council publicized the Opinions of the State Council on the Solution of the Excess Capacity of the Coal Industry. The coal industry has become the focus of the national supply side reform, and de-capacity was the development trend of coal enterprises in recent years.

Because of the particularity of the coal industry, products often need to use specific equipment for production, so the production capacity of coal enterprises mostly depends on fixed assets. This paper defines the phenomenon that the market demand decreases while the capacity reduction is ineffective. In other words, the asymmetry of production capacity changes is caused by the change of fixed assets. Nowadays, the economic situation of the coal industry is increasingly severe but there is little research on the de-capacity stickiness. Under this circumstance, this paper studies the de-capacity stickiness and its influencing factors of the coal industry. This paper enriches the theory of de-capacity stickiness, further expands the perspective of de-capacity research, and has a certain reference for the policy adjustment of coal industry and other industries with excess capacity.

II. THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

Anderson et al. (2003) found that the increase of enterprise's sales revenue caused by the increase of expenses is greater than the asymmetry of the decrease of expenses caused by the decrease of sales revenue [1], which confirms the existence of cost stickiness. According to the contract theory, in order to make profits, enterprises must reduce costs and sign long-term contracts, and the contract costs are sunk costs. When the business volume decreases, the actual benefits are not signed, and the expectation is optimistic, so the cost needs to be adjusted. However, this cost can only be apportioned to the future period and cannot be adjusted in time, resulting in the asymmetry of business volume and cost reduction cost stickiness. This paper studies the sticky cost from different perspectives.

There is a positive correlation between macroeconomic growth rate and cost stickiness [2][3]. There is a correlation between inventory turnover rate, fixed asset turnover rate and cost stickiness [4]. The cost stickiness of different industries is different. The debt level and asset density have a positive correlation with the cost stickiness of the coal industry [5].

The stickiness of coal, steel, automobile and other manufacturing industries and information technology industries are higher than those of real estate industries [6], and there are differences among different regions [7]. The cost stickiness of the western region is the strongest, the eastern region is the weakest, and the central region in the middle [8]. According to the theory of opportunism, if the company's executives' expectations are optimistic, it will have a cost stickiness phenomenon, which changes in the same direction as the optimistic expectations of senior executives [9].

From the perspective of capacity utilization rate, research shows that there are overcapacity in textile industry, coal industry, metallurgy industry, etc.[10]. Production capacity mainly refers to the quantity of products that can be produced by fixed assets investment, or the quantity of raw materials that can be processed. For the coal industry, capacity refers to the number of coal mines formed by fixed assets investment and the coal output (tons) it produces. The coal industry is an industry with high capital density, requiring the use of advanced technology and equipment in the early stage, so the investment in fixed assets in the early stage is huge. These investments can affect the profitability of each period through depreciation, but still have the nature of sunk cost. On the other hand, when the sales revenue of the enterprise rises, the increased fixed assets can improve the production efficiency, but the business volume decreases. At the same time, due to the influence of management self-interest behavior and other factors,

the enterprise cannot timely dispose of fixed assets, which leads to asymmetric changes between enterprise cost and business volume. Referring to Anderson et al. (2003) "ABJ" cost stickiness model, the definition of de-capacity stickiness, in this paper, is that the increase of fixed assets with business volume is greater than that of fixed assets with business volume.

In practice, how to allocate resources more effectively is a problem that every enterprise needs to solve. Enterprise executives need to manage resources according to the length of economic downturn. When facing temporary decline in business volume, if enterprise reduces the scale immediately and dispose of inefficient capacity, it will increase the disposal cost of the enterprise and the replacement cost will also increase; however, executives are unable to judge the economic and market situation in time and dare not dispose of excess capacity easily. Therefore, the power of de-capacity is limited, which is also reflected by the resource management theory of efficiency theory.

The cost stickiness of private enterprises is less than that of state-owned holding enterprises [11] [12]. Generally, private enterprises have less connection with the government, and they do not have focus and care from the government. In the process of operation, they pay more attention to the operating efficiency. When the enterprises are in a state of loss due to poor management, executives will actively change the capacity strategy according to the changes of market environment, actively resolving the overcapacity, and maximizing the interests of enterprises. Therefore the De-capacity stickiness of non-state-owned enterprises is small. The state-owned enterprises are the core of China's economy and have a strong political connection with the government. When enterprises are in difficulties or in trouble, they can always get great support and help of the government, which makes the enterprises turn from loss to profit and maintain the most basic operation, but it hinders the surplus capacity from exiting the market. At the same time, since the state-owned enterprises have certain responsibilities in stabilizing employment and increasing taxes, they cannot timely adjust the production capacity strategy when there is excess capacity. Cost stickiness exists in central enterprises [13]. Overcapacity industries such as steel, coal, cement, petrochemical industry, photovoltaic, shipbuilding, electrolytic aluminum, wind power and flat glass not only have de-capacity stickiness, but also show that state-owned enterprises have greater capacity reduction stickiness, compared with non-state-owned enterprises[14]. In addition, in the relatively large-scale state-owned enterprises, the introduction of private capital is not enough in quantity and proportion, so the private capital is relatively small and successfully entered the management level, and the resources of enterprises are not efficiently allocated, so

the de-capacity stickiness is large. Based on the above analysis, the following hypothesis is put forward:

H1: Coal enterprises have de-capacity stickiness and the state-owned enterprises have stronger de-capacity stickiness, compared with non-state-owned enterprises.

China's economy used to maintain the development mode of heavy industry, and fixed asset investment promoted the rapid economic growth, which led to the strong demand for coal. As an energy industry, the coal industry invested too much in the past. However, with the slow economic growth in recent years, the demand for energy decreased, resulting in the decline of sales volume. More and more production equipment was stopped. Due to enterprises' failure of to adjust their production capacity in the short term, the coal industry was unable to adjust its production capacity. As a result, the excess capacity cannot be released in time and the utilization rate of production energy is not high [15]. However, idle resources make enterprises unable to achieve the expected economic benefits, and thus affect their income, make their cost stickiness relatively high. That is, the energy industry cost stickiness and enterprise benefits are negatively related.

According to the index of capacity utilization, the capacity utilization rate of the coal industry in 2015 was 64.5%, significantly lower than the internationally recognized reasonable ratio (79%-83%) [16]. The capacity utilization rate is directly related to the enterprise benefit: the capacity utilization rate increased by 1%, and the return on net assets increased by about 1.002% [10]. The higher the capacity utilization rate, the faster the asset turnover rate and the higher the return on net assets of the enterprise. Listed manufacturing companies have demonstrated that ROE significantly reduces cost stickiness [17]. The fixed assets ratio of the coal industry is high and the asset specificity is strong. When the enterprise income decreases, the cost of assets formation still needs to be amortized. Due to the excess capacity, the product sales did not meet the target, the asset turnover rate was low, and the capacity utilization rate could not reach the recognized reasonable ratio. Because of this, the return on net assets was also low, and the self-interest behavior of managers existed, which lead to low profitability and high de-capacity stickiness. On this basis, the following hypothesis is put forward:

H2: The return on net assets is negative related to de-capacity stickiness.

Anderson et al. (2003) pointed out that labor cost was sticky. Labor intensity was positively correlated with cost stickiness[18][19][20], and labor-intensive enterprises had higher cost stickiness[21].The coal industry, as a labor-intensive industry, needs a large number of labor in the production process. There will be a certain amount of labor surplus in the process of

de-capacity, which may lead to a large number of workers losing their jobs. After the implementation of the new labor law, employees are more protective. Therefore, enterprises need to maintain a certain scale of production capacity to provide certain salary guarantee for employees. This maintenance process in turn will hinder the ability of enterprises to dispose of surplus capacity. For enterprises, the number of employees will restrict the disposal of excess capacity, which will lead to the decline of enterprises' capacity to de-capacity and form de-capacity stickiness. On this basis, the following hypothesis is put forward:

H3: There is a positive relationship between labor intensity and de-capacity stickiness.

III. RESEARCH DESIGN

A. Sample selection and data sources

This paper takes the data of coal listed companies from 2013 to 2018 as the research object, and the data comes from Tong Hua Shun IFind database. Excluding the ST and *ST listed companies and the companies with incomplete financial data, 155 samples data are finally obtained as the research object to study the de-capacity stickiness and its influencing factors. Microsoft Excel and SPSS.21 statistical analysis software were used to obtain the relevant data.

B. Research model and variable definition

- First order model

Based on Anderson et al. (2003) cost stickiness model, this paper studies the asymmetry between the increase of business volume and the increase of fixed assets and establishes the model (1) to study the de-capacity stickiness of coal enterprises.

$$\begin{aligned} \ln\left(\frac{Fixed_Asset_{i,t}}{Fixed_Asset_{i,t-1}}\right) &= \beta_0 + \beta_1 \times \ln\left(\frac{Re v_{i,t}}{Re v_{i,t-1}}\right) \\ &+ \beta_2 \times Dec_{i,t} \times \ln\left(\frac{Re v_{i,t}}{Re v_{i,t-1}}\right) + \sum Year + \varepsilon_{i,t} \end{aligned} \quad (1)$$

$\ln(Fixed_Asset_{i,t}/Fixed_Asset_{i,t-1})$ is the difference between the natural logarithm of the fixed assets at the end of the current period and that at the end of the previous period, indicating the changes in the scale of production capacity. Under relatively stable prices, the original value of fixed assets represents the level of material technology and equipment of the enterprise. The use of natural logarithm does not change the nature of the data. $\ln(Re v_{i,t}/Re v_{i,t-1})$ is the difference between the natural logarithm of the operating revenue at the end of the current period and that at the end of the previous period, which represents the changes in the scale of business volume (or revenue, the same below). Year stands for the time of a year; $\varepsilon_{i,t}$ for the error term;

$Dec_{i,t}$ for dummy variable. This paper starts from two aspects: the business volume of the current period increases and decreases compared with the previous period. When the business volume increases, $Dec_{i,t}$ takes 0, otherwise it takes 1.

According to the definition of regression coefficient of ABJ model, in model (1), β_0 represents a constant term; β_1 represents that when the virtual variable is taken as 0, the fixed assets increase by $\beta_1\%$ when the business volume increases by 1%; and $(\beta_1+\beta_2)$ represents that when the virtual variable is taken as 1, the fixed assets decrease by $(\beta_1+\beta_2)\%$. Therefore, if the coal enterprises have de-capacity stickiness, then $(\beta_1+\beta_2)\% < \beta_1\%$, that is, β_2 coefficient is negative and then H1 passes the test.

- Second order model

There are many factors that affect the de-capacity stickiness of enterprises. This paper uses the method of Banker et al. (2006) for reference, and introduces the factors that significantly affect the de-capacity stickiness into model (1) to participate in regression and establish a second-order model (model 2):

$$\begin{aligned} \ln\left(\frac{Fixed_Asset_{i,t}}{Fixed_Asset_{i,t-1}}\right) &= \beta_0 + \beta_1 \times \ln\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) \\ &+ a_1 \times ROE_{i,t} \times Dec_{i,t} \times \ln\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) \quad (2) \\ &+ a_2 \times Labor_Intensity_{i,t} \\ &\times Dec_{i,t} \times \ln\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) + \sum Year + \varepsilon_{i,t} \end{aligned}$$

$ROE_{i,t}$ is the rate of return on net assets of enterprises, the main indicator of profitability quality. Since fixed costs are fixed for a certain period of time, it is easy to increase fixed assets when the business volume is adjusted upward. But it is not easy to dispose of it when the business volume is adjusted downward. However, it is still necessary to amortize its cost, resulting in a decrease in profitability and an increase in de-capacity stickiness. So, the return on net assets is negatively proportional to the de-capacity stickiness.

$Labor_Intensity_{i,t}$ refers to the labor intensity of the enterprise, which is expressed by the difference between the number of employees and the natural logarithm of the operating income of the enterprise. The coal industry is a labor-intensive industry. When the business volume is adjusted upward, it needs to increase labor force. However, when the business volume is adjusted downward, it is not easy to handle due to various factors. At least, severance payment is still required. So, the greater labor intensity, the stronger de-capacity stickiness.

The variable symbols and related information in model (2) are shown in "Table I".

TABLE I. VARIABLE DEFINITION TABLE

Variable Name	Variable Symbol	Variable Definition
Capacity change	$\ln(Fixed_Asset_{i,t} / Fixed_Asset_{i,t-1})$	the natural logarithm difference between the original value of fixed assets at the end of the current period and that at the end of the previous period
Changes in business volume	$\ln(Rev_{i,t} / Rev_{i,t-1})$	the difference between the natural logarithm of the operating income of the current period and that of the previous period
Property right nature	$SOE_{i,t}$	1 for state-owned enterprises, 0 for non-state-owned enterprises
Return on net assets	$ROE_{i,t}$	net profit /shareholders' equity
Labor intensity	$Labor_Intensity_{i,t}$	$\ln(Employee_{i,t} / Rev_{i,t})$, $Employee_{i,t}$ refers to the number of employees
Current operating income decreased	$Dec_{i,t}$	If the operating revenue of the current year is greater than that of the previous year, take 0; otherwise, take 1.

IV. EMPIRICAL TEST

A. Descriptive statistics

By use of the SPSS 21.0 software, the descriptive statistics of related variables are shown in "Table II".

TABLE II. DESCRIPTIVE STATISTICS OF RELATED VARIABLES

Item	N	Minimum Value	Maximum Value	Average Value	Standard Deviation
$\ln(\text{Fixed_Asset}_{i,t} / \text{Fixed_Asset}_{i,t-1})$	155	-0.88	4.17	0.13	0.48
$\ln(\text{Rev}_{i,t} / \text{Rev}_{i,t-1})$	155	-0.73	4.05	0.06	0.50
$\text{ROE}_{i,t}$	155	-2.79	0.27	-0.01	0.30
$\text{Labor_Intensity}_{i,t}$	155	-15.35	-11.63	-13.36	0.88
$\text{Dec}_{i,t}$	155	0.00	1.00	0.48	0.50
Effective N	155				

The average value of capacity change of coal listed companies in China is 0.13, greater than the average value of business volume change of 0.06, indicating that the speed of fixed assets increase is faster than the speed of business volume increase, which is likely lead to the phenomenon of de-capacity stickiness. The average value of ROE is -0.01, showing that the current ROE of coal industry is generally low, the maximum value is 27.00%, but the minimum value is -279.00%, which shows that there are great differences in the utilization of capital invested by shareholders in China's coal listed companies. The average value of labor intensity is -13.36, the maximum value is -11.63, and the minimum value is -15.35, indicating that the coal industry is a high labor-intensive industry, and there is little difference between enterprises. For changes in

operating income, the average value of the sample of the declining current operating income ($\text{Dec}_{i,t}$) is 0.48, indicating that 48% of the sample enterprises' operating income has decreased.

B. Model regression analysis

The samples are divided into state-owned enterprises and non-state-owned enterprises. SPSS 21.0 statistical analysis software is used to conduct regression analysis on various factors of de-capacity stickiness. If the regression coefficient obtained is positive, it means that the factor helps to reduce the enterprise's de-capacity stickiness; if it is negative, it means that the factor will enhance the enterprise's de-capacity stickiness, and the greater the absolute value, the stronger the de-capacity stickiness.

TABLE III. REGRESSION RESULTS OF EXISTENCE AND INFLUENCING FACTORS OF DE-CAPACITY STICKINESS

Variable/Item	Model(1)		Model(2)	
	Co-efficient	P Value	Co-efficient	P Value
β_0	-0.046	0.070** (-1.828)		
β_1	0.918	0.000*** (14.637)		
β_2	-1.688	0.000*** (-8.440)		
$\ln(\text{Rev}_{i,t} / \text{Rev}_{i,t-1})$			0.834	0.000*** (12.167)
$\text{Dec}_{i,t} \times \ln(\text{Rev}_{i,t} / \text{Rev}_{i,t-1})$			-5.093	0.002*** (-3.089)
$\text{ROE}_{i,t} \times \text{Dec}_{i,t} \times \ln(\text{Rev}_{i,t} / \text{Rev}_{i,t-1})$			1.333	0.000*** (4.383)
$\text{Labor_Intensity}_{i,t} \times \text{Dec}_{i,t} \times \ln(\text{Rev}_{i,t} / \text{Rev}_{i,t-1})$			-0.358	0.004*** (-2.942)
Statistics F	172.620		96.199	
Adjusted R ²	0.770		0.712	
N	155		155	

^a Remarks: The level of ** is significant, and the level of * is significant at the level of 5%. The same below.

TABLE IV. REGRESSION RESULTS OF DE-CAPACITY STICKINESS BETWEEN STATE-OWNED ENTERPRISES AND NON STATE-OWNED ENTERPRISES WITH MODEL (1)

Variable/ Item	Model(1)			
	SOE=0		SOE=1	
	Co-efficient	P Value	Co-efficient	P Value
β_0	-0.154	0.533 (-0.656)	-0.034	0.103 (-1.639)
β_1	1.580	0.002*** (4.663)	0.749	0.000*** (13.295)
β_2	-2.390	0.268 (-1.203)	-1.477	0.000*** (-8.904)
$\ln(\text{Rev}_{i,t}/\text{Rev}_{i,t-1})$				
$\text{Dec}_{i,t} \times \ln(\text{Rev}_{i,t}/\text{Rev}_{i,t-1})$				
$\text{ROE}_{i,t} \times \text{Dec}_{i,t} \times \ln(\text{Rev}_{i,t}/\text{Rev}_{i,t-1})$				
$\text{Labor_Intensity}_{i,t} \times \text{Dec}_{i,t} \times \ln(\text{Rev}_{i,t}/\text{Rev}_{i,t-1})$				
Statistics F	11.953		216.164	
Adjusted R2	0.709		0.818	
N	10		145	

TABLE V. REGRESSION RESULTS OF DE-CAPACITY STICKINESS BETWEEN STATE-OWNED ENTERPRISES AND NON STATE-OWNED ENTERPRISES WITH MODEL (2)

Variable/ Item	Model(2)			
	SOE=0		SOE=1	
	Co-efficient	P Value	Co-efficient	P Value
β_0				
β_1				
β_2				
$\ln(\text{Rev}_{i,t}/\text{Rev}_{i,t-1})$	1.580	0.005*** (4.320)	0.665	0.000*** (10.302)
$\text{Dec}_{i,t} \times \ln(\text{Rev}_{i,t}/\text{Rev}_{i,t-1})$	-1.978	0.756 (-0.325)	-4.904	0.001*** (-3.506)
$\text{ROE}_{i,t} \times \text{Dec}_{i,t} \times \ln(\text{Rev}_{i,t}/\text{Rev}_{i,t-1})$	-15.248	0.945 (0.072)	1.288	0.000*** (5.028)
$\text{Labor_Intensity}_{i,t} \times \text{Dec}_{i,t} \times \ln(\text{Rev}_{i,t}/\text{Rev}_{i,t-1})$	-0.409	0.946 (-0.071)	-0.357	0.001*** (-3.467)
Statistics F	6.838		109.350	
Adjusted R ²	0.661		0.751	
N	10		145	

It can be seen from "Table III", the P value of stickiness coefficient β_2 of de-capacity is far less than 5%, indicating that there is a strong significant relationship between the change of fixed assets scale and business volume; after adjustment, $R^2 > 0.5$ indicates that the goodness of fit of the model is high, $R^2 = 0.770$, indicating that 77.00% of the change in fixed assets scale is caused by business volume, that is, those two have strong linear relationship. When the operating income increases by 1%, the fixed assets increase by 0.918%, the operating income decrease by 1%, and the fixed assets decrease by 0.77% (1.688% - 0.918%). It indicates that the increase of fixed assets with business volume is greater than that of fixed assets with business volume. The significance is $p < 0.001$, which is significant at the level of 1%. Therefore, China's coal industry has de-capacity stickiness, and the stickiness level is -1.688. The coal industry is the industry with high asset density. When the business volume increases, the fixed assets increase because the fixed assets can improve the production efficiency of the enterprise to a certain extent, so as to increase the benefits of the enterprise; but when the business volume

decreases, due to the specificity of the assets, it is not easy to reduce or dispose of the fixed assets, so the coal industry has de-capacity stickiness.

Based on model (1) (see "Table IV"), for the sample of state-owned enterprises, the fixed assets will increase by 0.749% for every 1% increase in operating income, and 0.728% for every 1% decrease in operating revenue. Meanwhile, the stickiness coefficient is -1.477, which is significant at the 1% level. It proves that the state-owned enterprises have the de-capacity stickiness, while the non-state-owned enterprises have the stickiness coefficient of -2.390 without passing significance test.

Based on model (2) (see "Table V"), for the sample of non-state-owned enterprises, the influencing factors of de-capacity stickiness are not significant; while the stickiness coefficient of return on net assets of state-owned enterprises is 1.288, the influence coefficient is positive, and the significance is $p < 0.001$. When the return on net assets changes 1%, the impact on the de-capacity stickiness is 1.288%; the absolute value of labor intensity coefficient is 0.357, the influence

coefficient is negative, and the significance is $p < 0.001$. The empirical results show that the return on net assets and labor intensity of state-owned enterprises have an impact on de-capacity stickiness. That is, the lower the ROE or the higher the labor intensity, the stronger the de-capacity stickiness. Therefore, hypothesis H1 holds.

Generally, the property rights of non-state-owned enterprises are private. Relatively, they do not have to take greater social responsibility and their political connection is relatively low. The local and the state government give less "special care" to the non-state-owned enterprises. At the same time, due to the weak political connection of non-state-owned enterprises, their loan difficulty is relatively large, and the financing constraints are high. Therefore, under the situation of overcapacity, the non-state-owned enterprises have a relatively high degree of financial constraints. Some enterprises are unable to obtain high amount of financing and actively adjust their production capacity in order to alleviate the difficulties under financing constraints and maintain the operation of enterprises. For state-owned enterprises, their political connection is strong. They are more "preferred" by local governments and banks, and their financing constraints are relatively low. Therefore, under the situation of overcapacity, although the operating conditions of state-owned enterprises have declined, they still can have sufficient cash flow and government support. So, state-owned enterprises often have low desire and motivation for capacity adjustment.

The effect of ROE on de-capacity stickiness coefficient is 1.333, significant $P < 0.001$, so it is significant at the level of 1%, indicating that the lower the ROE of coal industry listed companies, the stronger de-capacity stickiness, consistent with the previous H2. So, H2 is tenable. As a high asset industry, when the business volume increases, fixed assets need to be increased. When the business volume decreases, due to the specificity of the assets, it is not easy to reduce or dispose of the fixed assets, which will result in low asset turnover rate, low capacity utilization rate, low ROE and strong de-capacity stickiness. Therefore, the coal industry's ROE and de-capacity stickiness are of great significance negative correlation.

The decisive coefficient of influencing factors of labor intensity is -0.358, significant $P < 0.05$. That is, it is significant at the level of 5%. This factor will increase the stickiness of coal listed companies, which means that the higher the labor intensity is, the higher the level of enterprise's de-capacity stickiness. So, H3 is tenable. As a high labor-intensive industry, when the business volume increases, more labor needs to be employed to meet the employment needs. However, when the business volume decreases, it is not easy to lay off employees and reduce wages due to the

restriction of labor law. Moreover, even if employees are dismissed, there are still severance payments, which makes the labor force and business volume rise and fall in different degrees. Thus the coal industry has the de-capacity stickiness. Therefore, for the coal industry, there is a positive correlation between labor intensity and de-capacity stickiness.

C. Robustness test

The nature of de-capacity is to dispose of excess and backward capacity. However, the use value of new fixed assets and excess fixed assets is not the same. When the amount of new fixed assets of an enterprise is more than that of disposal of fixed assets, it cannot be judged that the enterprise has insufficient power to de-capacity. The fixed assets quota before the disposal of backward capacity is not eliminated. After eliminating the disposed backward capacity, the original value of fixed assets is obtained as the dependent variable of the model. Under the condition that other independent variables and control variables remain unchanged, the robustness test is carried out. The empirical results show that the motivation of state-owned enterprises to reduce production capacity is still weaker than that of non-state-owned enterprises, and the de-capacity stickiness of state-owned enterprises is stronger, which is consistent with the previous conclusions. The hypothesis and test are reasonable and the conclusion is stable.

V. CONCLUSION

This paper takes the coal listed enterprises from 2013 to 2018 as the research sample, studying the de-capacity stickiness of coal enterprises and its influencing factors, and draws the following conclusions: (1) Coal listed companies have de-capacity stickiness. Moreover, due to the "care" of the government and the social responsibility of the state-owned enterprises, the loss-making enterprises are in a dilemma. As a result, the state-owned enterprises invest a lot in the production capacity, leading to the overcapacity being unable to be solved by the market adjustment in time. Therefore, the state-owned enterprises have stronger de-capacity stickiness. (2) The coal enterprise is an asset intensive industry. When the business volume is large in the early stage, the asset investment is large, and then the business volume decreases and the assets cannot be disposed in time, which leads to low capacity utilization rate, low asset turnover rate and poor profitability, resulting in low return on net assets and high de-capacity stickiness. (3) At the same time, coal enterprises are also labor-intensive industries. When the business volume increases, more employees are employed. However, when the business volume decreases, the speed of personnel reduction is not proportional to the decline rate of business volume, resulting in de-capacity

stickiness. That is, the greater the labor intensity, the stronger de-capacity stickiness.

According to the above conclusions, the paper puts forward the following suggestions.

Improving the efficiency of production capacity and increasing the rate of return on net assets are the technical requirements to reduce the capacity stickiness. Firstly, in the process of capacity reduction, enterprises should strictly control the new capacity, eliminate the backward capacity, optimize the industrial structure, and form new effective supply, so as to improve the efficiency of production capacity. Secondly, enterprises should encourage enterprise merger and reorganization, such as continuing to merge and reorganize the upstream and downstream enterprises in the coal, steel, electric power, transportation and other industrial chains, so as to improve the industrial concentration, realize greater scale economy, and complement each other's advantages to achieve industrial synergy, so as to reduce costs and enhance efficiency. Finally but not the least, efforts should be made to introduce private capital to allocate resources more effectively, so as to resolve excess capacity and improve capacity utilization.

To improve the degree of intelligence and automation, and to reduce labor intensity is an important means to effectively reduce the de-capacity stickiness. Coal enterprises can use the mode of "Internet plus" and "Made in China 2050". They can not only reduce costs, improve efficiency, and promote the output of excess domestic coal capacity, but also encourage the production process of coal enterprises to implement automation, informatization and intelligent mining technology, such as integrated monitoring technology, equipment development and application, and so on, so as to promote digitalization, automation and intelligence in coal industry. It can be upgraded.

The government should improve the social security mechanism to provide support for the reduction of return on net assets and labor intensity of enterprises; and should increase financial expenditure, give tax policy support to industries with overcapacity, including coal industry, such as tax reduction and subsidies during the transformation period; should require local governments to adopt special subsidy funds, discount loans and other means to encourage enterprises to accelerate technological transformation and promote the transformation and development of enterprises. For employees from de-capacity enterprises, the government should provide re-employment training and cost subsidies; for enterprises that absorb de-capacity workers at one time, the government should give employment subsidies. In addition, in the process of enterprise transformation, in addition to improve the skills of internal personnel, it is

also necessary to introduce high-quality talents and replace labor with machinery and equipment, so that the enterprise has a reasonable talent structure, which helps to control the labor intensity.

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