Multiple Regression Analysis of Management Ability and Enterprise Value in Chinese Manufacturing Industry

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Abstract—With the advent of the era of the knowledge economy, companies have realized that management, as a heterogeneous resource, can help companies form a competitive advantage. This paper takes Chinese manufacturing listed companies from 2011 to 2020 as the research object and uses multiple regression models to analyze the relationship between management ability and enterprise value. The results show that management ability positively affects enterprise value, and equity incentives can enhance the influence of management ability on enterprise value. This paper also provides suggestions for Chinese manufacturing companies from improving management training and assessment systems and equity incentives mechanisms.

Keywords-multiple regression model; management ability; enterprise value; equity incentives

1 INTRODUCTION

With the process of reform and opening up, our country's comprehensive strength has been significantly enhanced, the economy has developed rapidly, domestic and international markets have gradually been integrated into the global economic system. The Fifth Plenary Session of the 19th Central Committee of the Communist Party of China put forward the "Proposals of the Central Committee of the Communist Party of China on Formulating the Fourteenth Five-Year Plan for National Economic and Social Development and the Long-term Goals for 2035". Under the background of the new development pattern of "dual circulation", Chinese enterprises not only face the pressure of competing with domestic enterprises but also participate in the competition among international enterprises. Manufacturing is an important manifestation of corporate competitiveness and national strength. Our country has been working faster to promote high-quality development of the manufacturing industry. However, compared with developed countries' manufacturing industry, we have a significant industrial structure and resource utilization gap. How to build a competitive manufacturing industry and enhance enterprise value is an urgent problem to be solved.

Management ability is the company's core competitiveness which can form the competitive advantages for companies. The separation of the two powers of modern companies makes the company owner appoint an agent to manage the company. The level of management ability will affect the realization of the company's strategic goals. On the one hand, the management can predict the development of the industry, identify internal and external risks, explore the heterogeneous resources of enterprises, and reduce the information asymmetry between enterprises. On the other hand, management plays a central role in mediating and integrating corporate resources. They make better decisions in production, operation, investment, and financing to promote enterprise value. However, the short-sighted self-interest of the management will detract from the enterprise value to a certain extent. Therefore, the research is carried out on whether the management ability will affect the enterprise value, and whether the equity incentives will affect the relationship between the two.

To sum up, this paper integrates management shareholding into the research framework of management ability and enterprise value, clarifies the mechanism of action between the three, helps to understand the governance utility of management ability deeply. This paper provides new evidence for listed companies to improve governance efficiency and provides suggestions for listed companies to improve the construction of management and optimize incentives contract arrangements.

2 THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

2.1 Management Ability and Enterprise Value

According to the Resource-based theory, the main sources of enterprises to obtain and maintain their competitive advantage are heterogeneous resources and the integrated utilization of enterprise resources. Management ability, as a heterogeneous resource, is difficult for competitors to replicate. In the process of enterprise development, management obtains various resources from the market, according to their understanding of the market situation, through the accumulation and allocation of resources, and makes appropriate decisions to enhance the value of enterprises. The upper echelons theory holds that the characteristics of the senior management team, such as gender, age, education, educational background, professional experience, etc. can reflect the management understanding, and management background characteristics will affect the strategic objectives of the enterprise, and thus affect the enterprise value. Management diverse career experiences enable managers to gain more social capital in practice, and increase management ability to make autonomous decisions, expand the scope of management's authority, and facilitate management financial decisions related to enterprise value creation. CEOs are more willing to take risks than non-CEOs, and behavioral characteristics such as CEO optimism and risk aversion are relevant to the company's financial policies, and CEOs may overestimate their abilities, make inappropriate decisions, and affect performance (Graham and Puri, 2013) [1]. Domestic scholars have found that management ability contributes to enterprise value. The higher the management ability, the better company's performance, and the more the management ability can enhance the role of corporate governance in promoting the company's performance (Huiqin He, 2018) [2].

Based on the above analysis, this paper puts forward the H1: Management ability has a positive impact on enterprise value.

2.2 The Moderating Effect of Equity Incentives

The modern separation of powers system leads to the problem of principal-agent, that is, the objectives of principals and agents are not consistent, which leads to conflicts of interest between the two. Agents may have a moral hazard problem, to achieve their own goals, do not try their best to achieve the goals of the enterprise, or make decisions to increase their interests but harm the interests of the enterprise. Modern economic theory holds that the incentives mechanism can solve the problem of entrusting agents in modern enterprises. The principal and agent interests can be tied together through management shareholding, which can alleviate the problem of principal agency. But equity incentives also have a double effect. On the one hand, management shareholdings give managers residual claims, which stimulate managers' sense of ownership, reduce agency costs and improve enterprise value, that is, "the effect of unity of interests". Equity incentives, on the other hand, increase management sensitivity to future stock markets. To avoid disappointment with future earnings, management may engage in earnings management to increase the retention of current revenues (Cheng and Warfield, 2004), that is, the "management defense effect"[3]. Only when management has the appropriate management ability can the optimal contract give full play to the incentives to enable management to make the most rational decisions (Deqiu Chen and Danlu Bu,2015) [4].

Based on the above analysis, this paper puts forward the H2: The stronger the equity incentives are, the stronger the promotion effect of management ability on enterprise value is.

3 RESEARCH DESIGN

3.1 Variable definitions

3.1.1 Explained variable: Enterprise Value (V)

Enterprise value refers to the historical value in the annual financial statements or fair market value. In this paper, The Tobin Q value is selected as the index of enterprise value, which can measure the long-term performance of the enterprise.

3.1.2 Explanatory variable: Management Competence (MA)

Management ability is the ability of managers to allocate resources rationally and create value for the company. There are two main methods to measuring management ability: one is based on management characteristics such as age, gender, professional experience, educational background, etc. The other is to use the DEA-Tobit model to measure management ability (Demerjian, 2012) by input-to-output efficiency model, to avoid the impact of enterprise-level factors on management ability and make data quantification more convincing [5]. This paper refers to Demerjian's method of taking the DEA-Tobit model to measure management ability.

In the first phase, Use the DEA model to calculate company efficiency (θ). Net fixed assets (PPE), net intangible assets (Intan), operating costs (COGS), selling and management expenses (SG&A), research and development expenditure (R&D) are used as input indicators, and operating income (Sales) is used as output indicators. Build Model 1:

$$\max \theta = \frac{Sales}{v_1 PPE + v_2 Intan + v_3 COGS + v_4 SG\&A + v_5 R\&D} \tag{1}$$

In the second phase, Use the Tobit model to calculate management ability. This paper controls company size (Size, ln total assets, listed year (Age, log of listing years), market share (MS, the main business income / total main business income of the industry), market competition (MP, (operating income - operating costs - selling expenses - management expenses) / operating income), free cash flow (FCF, virtual variable, 1if it's not negative, otherwise 0), and uses regression residuals (ε) to measure management ability. Build Model 2:

$$\theta = \beta_0 + \beta_1 Size + \beta_2 Age + \beta_3 MS + \beta_4 MP + \beta_5 FCF + \varepsilon \tag{2}$$

3.1.3 Moderator variable: Equity Incentives (MI)

At present, there are two measurements of equity incentives. One is to measure equity incentives by the proportion of management's shareholding, that is, the proportion of directors, supervisors, and senior managers' shareholdings in the total number of shares of the company, and the other is to take the equity incentives plan as a virtual variable, 1 if it is carried out, otherwise it is 0. Considering the long-term characteristics of equity incentives, this paper chooses the management shareholding ratio to measure equity incentives.

3.1.4 Control variables

To minimize the impact of other factors on enterprise value, this paper selects the following control variables: Company size (Size), different sizes will lead to differences in the value of the enterprise. The number of years of listing (Age), indicates the stability of the company's operations. The asset-liability ratio (Lev), indicates the company's solvency and debt risk situation. The total asset turnover (Turnover), reflects the quality of assets. Increase rate of main business revenue (Growth), which represents the company's ability to grow, reflects operating growth. This paper also controls the impact of time on enterprise value.

3.2 Sample data and sources

This paper selects 2011-2020 China A-share listed manufacturing companies as the initial sample. Selecting the 2011-2020 period is to take into account that China A-share listed companies began to fully implement the equity incentives plan since 2010. Selecting the manufacturing industry as the

Table 1 Variable Definition Table

Type	Name	Code	Explanation
Explained variable	Enterprise value	V	Market value / total assets

	Management ability	MA	DEA-Tobit model residuals
Explanatory variable	Management ability	MA	DEA-Tobit model residuals
Moderator variable	Equity incentives	MI	Number of management shares/number of common shares
Control variables	Company size	Size	Ln (total asset)
	Listed years	Age	Ln (years of listing)
	Asset-liability ratio	Lev	Total liabilities / total assets
	Total asset turnover	Turnover	Operating income / total average assets
	Growth rate of operating income	Growth	(Amount of operating income for the current year – amount of operating income for the previous year)/(Amount of operating income for the previous year).
	Year	Year	Virtual variables

$$V = \beta_0 + \beta_1 MA + \beta_2 Size + \beta_3 Age + \beta_4 Lev + \beta_5 Turnover + \beta_6 Growth + \sum Year + \varepsilon$$

(3)

$$V = \beta_0 + \beta_1 MA + \beta_2 MI + \beta_3 Size + \beta_4 Age + \beta_5 Lev + \beta_6 Turnover + \beta_7 Growth + \sum Year + \varepsilon$$

(4)

$$V = \beta_0 + \beta_1 MA + \beta_2 MI + \beta_3 MA * MI + \beta_4 Size + \beta_5 Age + \beta_6 Lev + \beta_7 Turnover + \beta_8 Growth + \sum Year + \varepsilon$$

(5)

research object: First, based on the DEA method, manufacturing companies have a large number of samples, which can meet the requirements of the index. Second, based on the characteristics of the manufacturing industry, the low production efficiency and unreasonable structure require management to mediate.

The samples are screened in the following order: First, Exclude specially processed samples such as ST and *ST. Second, eliminate samples with missing data and discontinuous data. Third, eliminate samples with abnormal variables. Finally, 828 samples from 2011 to 2020 were obtained, with a total of 8280 observations. The data is from CSMAR and this paper use Excel2010 software to process data, Maxdea8 software to process management ability index, Stata16 software for analysis.

3.3 Model construction

To prove H1, the paper builds Model 3 to examine the impact of management ability on enterprise value.

To prove H2, the paper uses the stratified regression method, equity incentives, the product of equity incentives and management ability are introduced in turn based on model 3 to construct model 4, which is used to test the moderating effect of equity incentives between management ability and enterprise value.

4 EMPIRICAL ANALYSIS

4.1 Descriptive statistics

From Table 2, the average enterprise value (V) is 2.277, the median is 1.796, the minimum is 0.219, and the maximum value is 17.225, indicating that the enterprise value gap of manufacturing listed companies is large. The minimum management ability (MA) is -0.52 and the maximum is 0.440, indicating that there are large differences in management ability in different companies. The average value of equity incentives (MI) is 0.087 less than the median 0.001, indicating that the level of equity incentives of manufacturing listed companies is generally low. The average size of the company (Size) is 22.351, the standard deviation is 1.213, the minimum is 18.162, the median is 22.196, and the maximum value is 27.547, indicating that the overall size of the sample company is more concentrated. The average asset-liability ratio (Lev) is 0.428, the minimum is 0.007 and the maximum is 1.645, indicating that management has a divided attitude towards the risk of borrowing.

Table 2 Variable Descriptive Statistics Table

Variable	Mean	Standard Deviation	Minimum	Median	Maximum
V	2.277	1.532	0.219	1.796	17.225
MA	-.001	0.148	-0.52	-0.010	0.440
MI	0.087	0.158	0.000	0.001	0.897
Size	22.351	1.213	18.162	22.196	27.547
Age	2.770	0.350	2.303	2.833	3.401
Lev	0.428	0.204	0.007	0.424	1.645
Turnover	0.701	0.429	0.006	0.611	5.300
Growth	0.183	1.367	-0.913	0.088	58.842

4.2 Correlation test

From Table 3, management ability (MA) is significantly positively correlated with enterprise value (V), and equity incentives (MI) is significantly positively correlated with enterprise value (V), basically in line with the hypothesis of expectation theory, and the final results need to be further tested.

Table 3 Variable Correlation Table

	(V)	(MA)	(MI)	(Size)	(Age)	(Lev)	(Turnover)	(Growth)
V	1.000							
MA	0.143***	1.000						
MI	0.131***	-0.016	1.000					
Size	-0.366***	0.025**	-0.258***	1.000				
Age	-0.132***	-0.017	-0.541***	0.276***	1.000			

Lev	-0.321***	-0.008	-0.270***	0.451***	0.312***	1.000		
Turnover	-0.038***	0.479***	-0.130***	0.111***	0.174***	0.154***	1.000	
Growth	0.020*	0.047***	0.019*	0.028**	-0.012	0.011	0.029***	1.000

4.3 Regression analysis

Table 4 shows the regression results. Model 3 column shows that management ability is significantly positively correlated with enterprise value, and H1 is proved. Model 4 column is the result of moderating effect of equity incentives, and coefficient of MA*MI is significantly positive at 1%, which means that equity incentives can strengthen the role of management ability to promote enterprise value and H2 is proved.

Table 4 Model Regression Results

V	(Model 3)	(Model 4)	
MA	1.419***	1.426***	1.204***
MI		0.247**	0.242**
MA*MI			2.789***
Size	-0.387***	-0.385***	-0.385***
Age	0.068	0.123**	0.119**
Lev	-1.378***	-1.362***	-1.360***
Turnover	-0.074*	-0.072*	-0.058
Growth	0.031***	0.031***	0.030***
Constant	11.367***	11.147***	11.155***

4.4 Robust test

To prove the robustness of regression analysis, ROA is used as an alternative variable to enterprise value. Table 5 indicates the conclusions are robust.

Table 5 Model Robustness Test

ROA	(Model 3)	(Model 4)	
MA	0.136***	0.135***	0.124***
MI		0.044***	0.044***
MA*MI			0.135***
Size	0.014***	0.015***	0.015***
Age	0.005	0.014***	0.014***
Lev	-0.156***	-0.153***	-0.153***
Turnover	0.041***	0.041***	0.042***
Growth	0.003***	0.003***	0.003***
Constant	-0.239***	-0.290***	-0. 290***

5 CONCLUSION AND SUGGESTION

The research founds that there is a significant positive correlation between management ability and enterprise value. Equity incentives can positively moderate the correlation between management ability and enterprise value.

Based on the conclusions of the paper, the following suggestions are put forward. On the one hand, the company should improve the training and appointment mechanism of management ability, so that management ability is compatible with the company's strategic objectives, and create greater value for the enterprise. The company also should improve the evaluation mechanism of management ability, which can take company efficiency input-output index as management ability appraisal index, pay attention to the improvement of management ability, maximize its value. On the other hand, the company could develop an equity incentives mechanism, which will enable management to link their interests with the long-term development of enterprise, so that the role of equity incentives can be fully realized.

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