Research on the impact of innovation input on enterprise performance in manufacturing enterprises--- Moderating effect based on governance structure

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Abstract: Manufacturing industry is the lifeblood of national economy, and innovation input is the lifeline of manufacturing enterprises. This paper selects the financial data of China's listed manufacturing companies from 2015 to 2019 to study the moderating effect of governance structure on the relationship between innovation input and firm performance. It is found that innovation investment has a negative influence on firm performance with lag. In terms of ownership structure, ownership concentration has a negative moderating effect on the relationship between innovation input and firm performance. The degree of equity balance has a positive moderating effect on the relationship between innovation input and firm performance. According to the conclusion of this study, it is expected to optimize the governance structure of China's manufacturing enterprises and promote industrial development.

1. The Introduction

Manufacturing industry has always been in the leading position in the national economy,is the lifeblood of the national economy,is also the backbone of China's industrialization process. However,the development of manufacturing industry has encountered a bottleneck in recent years, facing many crises and challenges. For example,high labor costs,excessive tax burden, overcapacity and other problems.To improve business performance and gain competitive advantage in the market,manufacturing enterprises not only need to improve their own innovation and research ability,but also a good governance structure is an important link to improve performance.

The contributions of this paper are as follows :(1) The moderating effect of the governance structure of listed manufacturing firms on the relationship between [1]innovation input and firm performance is explored by using hierarchical regression and grouping regression methods. (2) Divide into groups according to the nature of property rights,and further explore the differences between state-owned holding and non-state-owned holding enterprises.(3)Using principal component analysis to construct comprehensive indicators to evaluate enterprise performance can more comprehensively reflect the operating ability of the enterprise.The aim is to improve the governance structure of Chinese manufacturing enterprises,optimize the allocation of enterprise resources,and correct the inefficient investment in innovation.

2. Theoretical analysis and research hypothesis

2.1 The impact of innovation input on firm performance

Enterprise innovation input is not only beneficial to improve the production efficiency and business performance of enterprises, but also helpful to improve the core competitiveness of enterprises.However,the

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innovation input has the characteristics of highly asymmetric information, strong uncertainty,long cycle, lagging returns,etc,which is particularly significant in manufacturing enterprises.It may take many operating years for innovation investment to generate financial returns. Manufacturing enterprises,on the other hand, at the time of innovation investment, are likely to be higher in the research stage and development stage to produce the cost of spending on research and development, management in order to pursue their tenure bring enterprise economic returns,pay more attention to short-term interests,may to a certain extent restrict enterprises innovation investment,not conducive to the long-term development of enterprises in the future.Therefore,the following hypotheses are proposed:

H_1：Innovation input has a negative lag effect on enterprise performance.

2.2 The moderating effect of ownership structure on innovation input and firm performance

2.2.1 The moderating effect of ownership concentration on innovation input and firm performance

In manufacturing enterprises, the phenomenon of "one dominant" still exists. With a high degree of ownership concentration, many small and medium investors may be harmed by controlling shareholders (*Halla,2006*) [1]. The investment in innovation is accompanied by high risk, long cycle and slow effect, which may lead to the situation of unrecoverable costs and huge losses for enterprises.Company executives pay more attention to short-term interests, fail to allocate resources reasonably and effectively,and lack consideration for long-term interests of the enterprise(*Danmeng,2008*)[2].Large shareholders will reduce investment in enterprise innovation activities for the avoidance of risks.High concentration and low dispersion of enterprise ownership will lead to risk concentration,which will inhibit enterprise innovation investment.Therefore,the following hypotheses are proposed:

H_2:Ownership concentration has a negative moderating effect on the relationship between innovation input and firm performance.

2.2.2 The moderating effect of equity balance on innovation input and firm performance.

Equity decentralization alleviates the "encroachment effect" of major shareholders, and the higher degree of equity checks and balances is conducive to mutual supervision among shareholders to avoid damaging the interests of minority shareholders and to improve business performance of enterprises (*Gomes, 2001*)[3].The higher the degree of equity checks and balances,the higher the supervisory role of external shareholders,and the less likely minority shareholders are to be infringed (*Pagano M,1998*)[4].Equity checks and balances can make the major shareholders contain each other,and the small and medium shareholders can get more discourse power.The role of equity balance is conducive to the formation of a good operation mechanism and governance structure inside the enterprise, which helps the management to make effective innovation investment decisions and improve the performance of the enterprise.Therefore, the following hypotheses are proposed:

H_3:The degree of equity balance has a positive moderating effect on the relationship between innovation input and firm performance.

3. The research methods

3.1 Sample selection and data sources

This paper selects the financial data of listed manufacturing companies in China from 2015 to 2019, excluding *ST and ST companies. In the end, 6,700 observations were obtained, including 1,860 state-owned ones and 4,840 non-state-owned ones.

3.2 Variable selection

3.2.1 Explained variables

In order to more comprehensively measure the business operation level of the enterprise,In this paper,13 indicators are selected from debt-paying ability,profitability, operation ability and growth ability to build a comprehensive evaluation system.The comprehensive performance evaluation index of the enterprise is determined as the explained variable, as shown in Table 1:

Table1 Evaluation system of enterprise performance comprehensive indicators

Evaluation of Angle	Name
Debt paying ability	Asset-liability ratio
	Quick ratio
	Cash ratio
Profitability	Return on total assets
	Return on assets
	Net profit rate on sales
	Earnings per share
Operation ability	Accounts receivable turnover
	Shareholder's equity turnover
	Total asset turnover
Growth ability	Growth rate of revenue
	Growth rate of net profit
	Growth rate of earnings per share

Using principal component analysis to determine the comprehensive performance evaluation index,K value is 0.705>0.5,P value is 0,through the significance test, can be done principal component analysis. KMO and Bartlett tests are shown in Table 2:

Table 2 KMO and Bartlett tests

Sampling the Kaiser-Meyer-Olkin measure of adequacy		0.705
Bartlett's test for sphericity	The approximate chi-square	44448.343
	df	78
	Sig.	.000

3.2.2 Explanatory variables

Referring to (*JianrongTang,2014*) [5],this paper uses the ratio of R&D investment to operating income to measure the intensity of enterprise's innovation investment.

Table 3 Variable selection and definition

Variable	Variable name	Symbol	Variable declaration
Explained variable	Enterprise performance	PER	Integrated computation
Explanatory variables	Innovation	RD	Investment/ revenue
Adjust variable	Ownership concentration	C1	Shareholding ratio of the largest shareholder
	Equity balance	ZH	The 2 to 10 largest shareholder shareholding ratio/the largest shareholder shareholding ratio
Control variables	Growth	Growth	Change in operating income/operating income
	Company size	Size	The natural log of total assets
	Asset-liability ratio	Lev	Total liabilities/total assets
	Enterprise age	Age	Year of observation - year of establishment
	Year	Year	Dummy variable, j year is 1, otherwise 0

3.3 Model building

Building a regression model.Introducing adjusting variable $Character_{i,t}$ including ownership concentration($C1_{it}$), Equity balance(ZH_{it}).

$$PER_{it} = \alpha + \beta_1 RD_{i,t-n} + \Sigma\beta_j Control_{it} + \varepsilon_{it} \quad (1)$$

$$PER_{it} = \alpha + \beta_1 RD_{i,t} + \beta_2 Character_{i,t} + \Sigma\beta_j Control_{it} + \varepsilon_{it} \quad (2)$$

$$PER_{it} = \alpha + \beta_1 RD_{i,t} + \beta_2 Character_{i,t} + \beta_3 RD_{i,t} \times Character_{i,t} + \Sigma\beta_j Control_{it} + \varepsilon_{it} \quad (3)$$

$Control_{it}$ represents the Control variable, i t represents the t year of enterprise (n=0,1,2), α is the intercept term, and ε is the random disturbance term.

4. The empirical analysis

4.1 The impact of innovation input on firm performance

As you can see from Table 4,PER and RD、RD_{t-1}、RD_{t-2},the correlation coefficients were -0.106, -0.080 and -0.079.All passed the significance test at the 1% level, and the negative influence showed a decreasing trend year by year.There is a significant lag negative effect between innovation input and firm performance.H_1 is verified.

Table 4 Regression results of innovation input and enterprise performance

Variable	Model 1	Lag phase I	Lag phase II
RD	-0.106*** (-8.734)		
RD_{t-1}		-0.080*** (-6.597)	
RD_{t-2}			-0.079*** (-6.519)
Growth	0.229*** (19.191)	0.241*** (20.067)	0.243*** (20.213)
Size	0.148*** (10.214)	0.148*** (10.139)	0.148*** (10.140)
Lev	-0.194*** (-14.069)	-0.190*** (-13.760)	-0.189*** (-13.735)
Age	0.027** (2.046)	0.033*** (2.469)	0.034** (2.553)
Year	control	control	control
N	6700	6700	6700
cons	-3.214*** （-7.866）	-3.288*** （-8.011）	-3.223*** （-7.908）
F	83.467***	79.464***	79.339***
Adj-R^2	0.100	0.095	0.095

Note: ***, **, * indicate significant at 1%, 5% and 10% levels respectively, the same as below

4.2 Regression analysis of the moderating effect of ownership concentration on innovation input and firm performance

Firstly, the Model 2 and Model 3 were used to conduct the population regression for the whole sample, and then the grouping regression was performed according to the nature of the controlling person.It can be seen from Table 5 that the interaction coefficient of C1 and RD is -0.072, which is significantly negative, indicating that ownership concentration has a negative regulating effect on innovation input and enterprise performance.The negative regulating effect in state-owned holding enterprises is significantly higher than that in non-state-owned holding

enterprises. H_2 is verified.

Table 5 Regression results of ownership concentration, innovation input and firm performance

Variable	All the samples	All the samples	State holding	Non-state holding
	Model2	Model 3	Model 3	Model 3
RD	-0.099*** (-8.157)	-0.038 (-1.289)	0.007 (0.098)	-0.067** (-2.047)
C1	0.069*** (5.814)	0.102*** (5.483)	0.095*** (2.564)	0.093*** (4.241)
C1* RD		-0.072*** (-2.317)	-0.153** (-2.210)	-0.027** (-0.761)
Growth	0.231*** (19.401)	0.232*** (19.457)	0.182*** (8.006)	0.264*** (18.942)
Size	0.134*** (9.179)	0.132*** (9.004)	0.098*** (3.693)	0.146*** (8.740)
Lev	-0.190*** (-13.859)	-0.190*** (-13.835)	-0.138*** (-5.395)	-0.216*** (-13.709)
Age	0.034*** (2.602)	0.034** (2.549)	0.008 (0.333)	0.011 (0.722)
Year	control	control	control	control
N	6700	6700	1860	4840
cons	-3.096** (-7.586)	-3.223*** (-7.908)	-2.360*** (-2.825)	-3.501*** (-7.430)
F	78.870***	72.235***	17.684***	62.921***
Adj-R^2	0.104	0.105	0.090	0.123

4.3 Regression analysis on the moderating effect of equity balance degree on innovation input and firm performance

It can be seen from Table 6 that in the whole sample, the interaction coefficient of ZH and RD is 0.091,which is significantly positive,indicating that the degree of equity balance has a positive regulating effect on innovation input and enterprise performance.Good equity checks and balances can form an effective supervision mechanism inside an enterprise,alleviate the interest conflicts among shareholders and curb the insider control problem.In the grouping regression,the interaction term coefficient passes the significance test in non-state-owned enterprises. However,it is not significant in state-owned enterprises, which may be because the implementation effect of equity balance in non-state-owned enterprises is better,which is more in line with the characteristics of collective decision-making and can improve decision-making efficiency.H_3 is verified.

Table 6 Regression results of equity balance degree, innovation input and enterprise performance

Variable	All the samples	All the samples	State holding	Non-state holding
	Model 2	Model 3	Model 3	Model 3
RD	-0.103*** (-8.536)	-0.158*** (-8.390)	-0.153*** (-4.432)	-0.150*** (-6.612)
ZH	-0.043*** (-3.628)	-0.096*** (-5.238)	-0.064*** (-1.864)	-0.088*** (-4.073)
RD* ZH		0.091*** (3.790)	0.036 (0.823)	0.086** (3.010)
Growth	0.232*** (19.403)	0.233*** (19.492)	0.183*** (8.050)	0.265*** (18.988)
Size	0.149*** (10.268)	0.148*** (10.219)	0.115*** (4.458)	0.156*** (9.384)
Lev	-0.195*** (-14.195)	-0.195*** (-14.178)	-0.145*** (-5.669)	-0.221*** (-14.049)
Age	0.021 (1.552)	0.018 (1.354)	0.001 (0.022)	-0.008 (-0.531)
Year	control	control	control	control
N	6700	6700	1860	4840
cons	-3.134*** (-7.666)	-2.998*** (-7.312)	-2.244*** (-2.693)	-3.288*** (-6.948)
F	76.573***	71.057***	17.444***	61.117***
Adj-R^2	0.101	0.103	0.089	0.120

5. Research conclusions and recommendations

5.1 Research conclusions

Based on China's a-share manufacturing listed companies during 2015-2019 financial data as sample,empirical analysis was carried out on the 6700 valid samples. Build multiple regression model, to investigate the moderating effect of governance structure on innovation input and firm performance.The empirical research has drawn the following conclusions:(1) Innovation input has a lag negative impact on enterprise performance,and may not bring benefits to enterprises in the short term. (2)In terms of ownership structure,ownership concentration has a negative moderating effect on the relationship between innovation input and firm performance;The degree of equity balance has a positive moderating effect on the relationship between the two.

5.2 Recommendations

The research of this paper is of great significance for Chinese manufacturing enterprises to optimize their governance structure, correct their inefficient investment in innovation input,and improve their innovation performance. (1)Enterprises should not only pay attention to the supply of resources invested in innovation,but also pay attention to the improvement of investment decision-making efficiency.(2)Establish a reasonable equity structure,strengthen the role of equity checks and balances, implement effective supervision mechanism for major shareholders, and improve the efficiency of investment decision-making of enterprises.

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