



# Stock Governance and SME R&D Input

Bei Ye\*

Hubei SME Research Center, Wuhan University of Science and Technology

\*Corresponding author. Email: yeb323@sina.com

## ABSTRACT

SMEs are the backbone of technological innovation. Equity finance and the related governance arrangement are of great significance to R&D activities of SMEs. With SMEs listed in China as examples, the paper tries to study the effects of equity finance, ownership nature and concentration on R&D input. The empirical results suggest that equity finance significantly promotes R&D input; state ownership and management shareholding significantly improve R&D investment despite the insignificant effect of general legal person shareholders; ownership concentration is significantly and negatively associated with R&D input. To push forward R&D activities of SMEs, it is important to facilitate equity financing, encourage state-owned institutions to invest in SMEs, push forward managerial stock incentive schemes and prevent over-concentration of ownership.

**Keywords:** SME; R&D input; stock governance

## 1. INTRODUCTION

Innovation is of great significance for SMEs. However, the uncertainty of innovation activities and lack of tangible assets lead to financing difficulties, and force SMEs to rely heavily on equity financing, with a small proportion of debt financing<sup>[1-2]</sup>.

Equity capital not only provides funds, but also is an important governance tool, which affects innovation.

Firstly, the nature of shareholders may affect highly uncertain strategic decisions such as R&D activities. Previous study shows that in China government shareholders may have insufficient supervision over strategic decision-making<sup>[3]</sup>. However, they could provide valuable resources for R&D investment<sup>[4]</sup>. Secondly, ownership concentration may affect innovation decisions as well. Some scholars analyzed the impact of ownership concentration and executive incentive on corporate innovation and found that excessive concentration of equity hinders innovation, while the check-and-balance in ownership helps innovation activities<sup>[5]</sup>. In short, governance factors such as capital structure, shareholder nature and ownership concentration may affect corporate innovation behavior. For SMEs equity capital is not only a stable source of funds, but also plays an important role in governance. The optimization of stock governance arrangements helps stimulate innovation vitality and improve innovation efficiency.

In view of this, the paper takes small-and-medium sized A-share listed companies as a sample to study the impact of stock governance on R&D activities of SMEs, so as to provide reference for enhancing their innovation capability and competitiveness.

## 2. HYPOTHESES DEVELOPMENT

### 2.1 Equity financing and R&D input

R&D activities involve high risk, considerable input and long payback periods. Due to information asymmetry, financing these projects is either difficult or expensive owing to higher risk premium. As a result, R&D is very dependent on equity financing. Lots of empirical studies show that compared with debt financing, equity financing is more conducive to innovation activities and helps improve corporate R&D input and efficiency<sup>[6]</sup>. Among various enterprises, SMEs are faced with more financing constraint. On the one hand, SMEs engaged in innovation activities face the risk of R&D failure; on the other hand, due to the small operation scale, lack of mortgage assets and low risk tolerance, the possibility of obtaining debt financing in the external market is very limited. Therefore, equity financing is even more important for their R&D. Thus the following hypothesis is proposed:

H1. Equity financing promotes R&D input of SMEs.

## 2.2 Shareholder nature and R&D input

The nature of shareholders may have certain impacts on long-term strategic decision-making.

### 2.2.1 State-owned shares and R&D input

The state-owned shares of listed companies in China are divided into two categories: national shares and state-owned legal person shares. From the perspective of corporate governance, there may be the problem of "absence" of owners of state-owned shares, and the state-owned assets regulatory agencies tend to be short-sightedness, which may hinder R&D investment. However, some studies show that government shareholders could provide valuable resources for enterprises in China<sup>[7]</sup>. To some extent, it makes up for the above-mentioned defects. Compared with other shareholders, state-owned institutions, departments and units enjoy more favorable treatment in external financing, and show higher risk tolerance in R&D activities. In recent years, in order to promote the high-quality development of enterprises, the State-Owned Assets Supervision and Administration Commission has increased the assessment and incentive for scientific and technological innovation of state-owned enterprises so that state-owned shareholders have a stronger motivation in R&D investment. Thus, the following hypothesis is put forth:

H2. There is a positive correlation between state-owned shares and SME R&D input.

### 2.2.2 General legal person shares and R&D input

The term "general legal person" is used in contrast with "natural person". It is generally believed that natural person shareholders care more about short-term reward and lack sufficient supervision ability; large shareholding by natural persons may weaken firms' motivation in R&D. Instead general legal person shareholders seem more rational. They focus more on long-term development and have better expertise. They are more interested in intellectual property, and could more easily form strategic alliances with executives<sup>[8]</sup>. Therefore the general legal person shareholding may promote long-term strategic R&D investment, and the following hypothesis is put forth:

H3. The ratio of general person shareholding is positively related to R&D input.

### 2.2.3 Management shareholding and R&D input

There have been different views on whether management shareholding can increase corporate R&D investment. Management shareholding provides long-term incentive which better aligns their personal interests with shareholders<sup>[9]</sup>. However, some studies show that in

companies with dispersed ownership excessive management shareholding enhances managers' control which brings them more private benefits. In that case, management shareholding could hardly promote R&D investment<sup>[10]</sup>. Therefore, two alternative hypotheses are proposed:

H4a. Management shareholding promotes R&D investment.

H4b. Management shareholding inhibits R&D investment.

## 2.3 Ownership concentration and R&D input

Generally speaking, higher shareholding by major shareholders may alleviate the agency problem between managers and shareholders, which is beneficial for R&D activities; but it can also entail potential interest conflict between large and small shareholders. Given imperfect legal system, major shareholders tend to maximize private benefits. This is more evident in companies with higher ownership concentration<sup>[11]</sup>. Therefore the effect of ownership concentration is still uncertain. We put forth two alternative hypotheses:

H5a. Ownership concentration promotes R&D investment of SMEs.

H5b. Ownership concentration hinders R&D investment of SMEs.

## 3. RESEARCH DESIGN

### 3.1 Sample and data

Companies listed on A-share SME board and GEM board of China are used as samples, and the data observation period is 2015-2020. As usual, financial companies, companies listed for less than one year, and companies in abnormal operation status were excluded. Missing observation values of research variables were deleted. Furthermore, continuous type variables were tailed up and down 1% to reduce the influence of extreme values. The financial or corporate governance data are collected from RESSET Database and CSMAR Database.

### 3.2 Model and variable

To test the aforementioned hypotheses, a regression model was constructed as follows:

$$rd_{i,t} = a_0 + b_1 equ_{i,t} + b_2 shrn_{i,t} + b_3 con_{i,t} + \sum_m b_m X_{i,t} + \varepsilon_i \quad (1)$$

#### 3.2.1 Explained variable

The explained variable *rd* refers to R&D investment. As in previous study, the proportion of R&D expenditure to operating income was used to measure the investment

in innovation activities<sup>[12]</sup>. An alternative measure, the proportion of technological staff number to total staff number, is used for robustness check.

### 3.2.2 Explanatory variable

The equity financing variable *equ* is measured by the proportion of equity financing in the capital structure.

The nature of shareholders variable *shr* describes the nature of shareholders, measured by the proportion of state-owned shares, legal person shares and management shareholding respectively.

The ownership concentration variable *con* is

measured by the shareholding ratio of the largest (h1), the top five (h5) and the top ten shareholders (h10) and z index respectively. The larger the value of this variable, the higher the equity concentration of the company.

### 3.2.3 control variable

In Model (1), *X* represents a series of control variables that may affect R&D input based on previous research<sup>[13]</sup>, including Tobin's Q, return on assets, growth opportunities, free cash flow, firm size, firm age etc.

The definition and measurement for these variables are shown in Table 1.

**Table 1.** Variable definition and measurement

Category	Variable name	Notation	Measurement
Explained variable	R&D expenditure	rdr	R&D expenditure / operating revenue
	R&D staff	rdp	Number of R&D staff / total staff
Explanatory variable	Equity financing	equ	Equity financing / total assets
	Shareholder nature	sta	Proportion of state-owned shares
		lps	Proportion of legal person shares
		msh	Management shareholding
	Ownership concentration	h1	Square of the first largest shareholder's shareholding
		h5	Sum of square of shareholding by the top five major shareholders
		h10	Sum of square of shareholding by the top 10 shareholders
z		Shareholding by the first shareholder/sharedholding by the second shareholder	
Control variable	Tobbin's Q	Q	Firm market value / total assets
	Return on assets	roa	Net income /total assets
	Growth	gro	Increase rate of business revenue
	Free cash flow	fcf	Annual free cash flow / total assets
	Firm size	size	Natural logarithm of the total assets
	Firm age	age	Number of years of operation

## 4. EMPIRICAL RESULTS AND ANALYSIS

### 4.1 Descriptive statistics

Table 2 shows the descriptive statistics of the variables.

On average, the R&D expenditure was 6.24% of the operating revenue. About 19.99% of the staff were technological professionals, but the data has a wide swing with a standard deviation of 14.64%.

The average proportion of equity financing was

64.13%, which was significantly higher than that of listed companies on the main board of China. Due to smaller size and opaque information, it is difficult for SMEs to raise funds through the lending market. This shows that equity financing is of great significance for SMEs.

**Table 2.** Descriptive statistics of variables

variable	mean	median	Std error	Min	max
rdr	6.242	4.690	5.106	0.080	27.390
rdp	19.991	15.750	14.640	0.510	73.130

equ	64.129	65.791	17.640	19.083	94.090
sta	1.163	0.000	6.492	0.000	57.736
lps	8.376	0.000	17.001	0.000	92.510
msh	0.102	0.020	0.135	0.000	0.488
h1	0.108	0.081	0.092	0.008	0.619
h5	0.129	0.106	0.090	0.017	0.629
h10	0.131	0.108	0.090	0.019	0.630
z	4.730	2.770	5.507	1.000	36.120
Q	2.251	1.920	1.137	0.981	7.782
roa	4.495	4.745	8.022	-28.282	29.718
gro	17.013	12.543	33.257	-48.634	166.616
fcf	-0.011	0.000	0.120	-0.391	0.312
size	21.757	21.682	0.958	19.368	24.350
age	19	19	5	6	66

In terms of shareholders, the average proportion of state-owned shares is 1.16% and that of legal person shares is 8.38%. Compared with the listed companies on

the main board, the sample companies have a lower proportion of state-owned shares, while a higher proportion of legal person shares. Historically, most listed companies on the main board were transformed from large state-owned enterprises, so the proportion of state-owned shares is generally higher; in contrary SMEs were mostly transformed from private companies, so the proportion of legal person shares is higher. The average shareholding ratio of the management is 0.10% and 24% of the sample companies have no management shareholding, indicating that the practice of management incentive is not very common.

#### 4.2 Empirical results and analysis

We first used the proportion of R&D expenditure *rdr* as the dependent variable. The fixed effect regression of panel data was conducted using stata 15.0. The results are shown in column (1)-(4) of Table 3. The multicollinearity test showed that the VIFs used in the regression were all significantly less than 10, suggesting no serious problem of multicollinearity.

**Table 3.** Regression results

	rdr				rdp			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
equ	0.0636***	0.0637***	0.0637***	0.0637***	0.108***	0.108***	0.108***	0.108***
	(15.910)	(15.930)	(15.940)	(15.890)	(9.590)	(9.614)	(9.617)	(9.587)
sta	0.0220**	0.0229***	0.0229***	0.0171*	0.023	0.0273	0.0274	0.00983
	(2.501)	(2.598)	(2.595)	(1.956)	(0.930)	(1.101)	(1.103)	(0.400)
lps	0.003	0.004	0.004	0.000	-0.0172*	(0.015)	(0.014)	-0.0238**
	(0.931)	(1.094)	(1.100)	(0.063)	(-1.661)	(-1.395)	(-1.383)	(-2.331)
msh	0.750*	0.758*	0.758*	0.820*	2.801**	2.777**	2.774**	3.154**
	(1.700)	(1.719)	(1.718)	(1.856)	(2.259)	(2.241)	(2.239)	(2.542)
h1	-3.104***				-6.529***			
	(-4.845)				(-3.626)			
h5		-3.264***				-8.033***		
		(-4.905)				(-4.297)		
h10			-3.260***				-8.064***	
			(-4.863)				(-4.282)	
z				-0.0242**				0.0423
				(-2.373)				(1.476)
fcf	-0.531	-0.545	-0.549	-0.530	(0.656)	-0.677	-0.685	-0.827
	(-1.036)	(-1.065)	(-1.071)	(-1.032)	(-0.456)	(-0.470)	(-0.476)	(-0.573)
roa	-0.0866***	-0.0853***	-0.0853***	-0.0911***	-0.0810***	-0.0764***	-0.0762***	-0.0889***
	(-9.638)	(-9.471)	(-9.463)	(-10.17)	(-3.208)	(-3.019)	(-3.011)	(-3.534)
size	0.205***	0.194***	0.193***	0.209***	0.189	0.164	0.164	0.162
	(2.953)	(2.795)	(2.793)	(3.003)	(0.972)	(0.843)	(0.842)	(0.829)

Q	0.910***	0.908***	0.907***	0.911***	1.580***	1.575***	1.574***	1.561***
	(16.100)	(16.060)	(16.050)	(16.080)	(9.941)	(9.917)	(9.911)	(9.811)
gro	-0.0067***	-0.0068***	-0.0067***	-0.0063***	0.0109**	0.0106**	0.0106**	0.0120**
	(-3.542)	(-3.578)	(-3.574)	(-3.349)	(2.062)	(2.000)	(2.003)	(2.257)
age	-0.0586***	-0.0590***	-0.0590***	-0.0598***	-0.157***	-0.157***	-0.157***	-0.161***
	(-5.200)	(-5.231)	(-5.238)	(-5.300)	(-4.940)	(-4.948)	(-4.954)	(-5.091)
Con	-6.430***	-6.115***	-6.109***	-6.656***	-2.72	-1.892	-1.871	-2.905
	(-3.665)	(-3.482)	(-3.478)	(-3.788)	(-0.552)	(-0.383)	(-0.379)	(-0.589)
Industry&Year	Controlled							
Obs	6,078	6,078	6,078	6,078	6,078	6,078	6,078	6,078
R <sup>2</sup>	0.287	0.287	0.287	0.285	0.314	0.315	0.315	0.313
Adj R <sup>2</sup>	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31

Note: \*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10% respectively. Values in brackets are the t-statistics.

As shown in Column(1)-(4) of Table 3, the coefficients of equity financing are all positive at 1% significance level, indicating that equity financing has a significant positive effect on R&D investment, which is consistent with hypothesis H1. Due to the characteristics of SMEs themselves, equity financing has always been the main financing channel. Due to the large investment amount, long cycle and uncertain outcome of R&D activities, it is usually difficult to obtain external debt financing. Thus the high proportion of equity financing helps SMEs raise more stable long-term funds and enables them to invest in high-risk R&D projects.

In terms of shareholder nature, the ratio of state-owned shares showed a significant positive impact on R&D investment, which provides support for the aforementioned hypothesis H2. SMEs with large proportions of state-owned shares are more inclined to invest in R&D projects because state-owned shareholders enjoy more financing resources. In the regression results, the management shareholding was positive at the significance level of 10%, indicating that it had a relatively significant role in promoting R&D investment. This is consistent with the aforementioned hypothesis H4a. It indicates that due to the better synergy between management and shareholders, companies with more management shareholding are more conducive to long-term value improvement via R&D activities. As the management shareholding ratio of the sample companies is generally low (on average 0.10%), the managerial entrenchment motivation is not significant in our study. The coefficient of the ratio of legal person shares is positive but not significant. This differs from our expectation that legal person shareholders are usually more rational and have positive effects on R&D activities. However it should be pointed out that in reality the composition of legal person shareholders is very complex, including financial institutions, venture capital and other bodies. Some of them such as venture capital has rich knowledge and expertise, some does not. Different

legal person shareholders may have different interest orientations and investment return requirements. However the available data right now could not well distinguish between them.

Our study adopted h1, h5, h10 and Z index as measures of ownership concentration. The regression results show that all of them are negatively and significantly related to R&D investment, suggesting that ownership concentration tends to inhibit R&D input as proposed by previous hypothesis H5b. As SMEs in China have relatively higher ownership concentration than large companies, the incentive effect of ownership concentration is somewhat weakened; instead it gives major shareholders more opportunities for embezzlement, possibly causing decrease of long-term R&D investments.

As for control variables, roa, growth and firm age are all negatively related with R&D input at 1% significance level; firm size and market opportunity variable Q are both positively related with R&D input at 1% significance level; whereas free cash flow has no significant impact. The results show that the main source of R&D investment is not profit or free cash flow; fast growing firms are not active in conducting R&D activities. Instead, younger companies, bigger companies or companies with more market opportunities are more interested in research and development. The results are generally consistent with previous studies<sup>[14]</sup>.

#### 4.3 Robustness test

For robustness test, we used the variable *rdp* as an alternative measure of R&D input. The regression results are shown in Column (5)-(8) of Table 3. Considering possible lag effect, we also used the first order lag term of explanatory variables in the regression. The results are omitted but available upon request. And they are generally consistent with the results in 4.2.

## 5. CONCLUSION

Taking China's small and medium-sized listed companies in 2015-2020 as an example, the paper studies the impact of equity financing, shareholder nature and ownership concentration on corporate R&D investment.

The results show that: (1) Equity financing has a significant positive effect on R&D investment of SMEs; (2) The proportion of state-owned shares is significantly and positively related to R&D input; SMEs with more state holdings are more active in R&D; management shareholding has a significant incentive role in promoting R&D input; (3) Ownership concentration tends to hinder R&D input. The reason may be that when ownership is very concentrated, the major shareholders tend to have more embezzlement motives. In addition, the study found that bigger, younger companies or companies with more market opportunities tend to be more active in R&D activities. Fast growing or profitable companies are more focused on existing businesses and had relatively low R&D intensity.

The results provide important implications for understanding stock governance role in R&D of SMEs. SMEs are important force for national innovation. In order to boost R&D investment, it is necessary to provide more equity financing facilities and other stable financing sources, encourage state owned institutions to invest in SMEs and help push forward R&D activities. Also, it is beneficial to carry on management stock incentive scheme, so that managers' interests become better aligned with shareholders, and carry out more R&D activities which are good for firms' long-term development. Finally, in firms with highly concentrated ownership, it is necessary to introduce more check and balance mechanisms to avoid embezzlement by the major shareholders.

## ACKNOWLEDGMENTS

This work was supported by Hubei SME Research Center (HBSME2019B05).

## REFERENCES

- [1] J. D. Vicente-Lorente, Specificity and opacity as resource-based determinants of capital structure: evidence for Spanish manufacturing firms[J]. *Strategic Management Journal*, 2001, 22:157-177.
- [2] Y. Wu, L. Tian, H. Dai et al., The impact of external equity financing on the R&D efficiency of small and medium-sized enterprises: based on the research of GEM listed companies[J]. *China Market*(in Chinese), 2014 (20): 39-43.
- [3] S. Mei, H. Wei, Senior executive share-holding: interest alignment or entrench-ment?[J]. *Scientific research management* (in Chinese), 2014 (7): 116-123.
- [4] X. Zhang, Research on the impact of Chinese firm ownership structure on R&D investment[J]. *Management Journal*(in Chinese), 2013, 10(10):1492-1501.
- [5] Y. Zhang, X. Zhang, Q. Chang et al., The influence mechanism of ownership structure and executive incentives on firm innovation and empirical research[J]. *Scientific Management Research*(in Chinese), 2018, 36(02):67-70+75.
- [6] H. Li, Y. Tang, J. Zuo, Innovation with your own money or with other people's money: research based on the financing structure and corporate innovation of listed companies in China [J]. *Financial Research*(in Chinese), 2013,(02):170-183.
- [7] W. Li, M. Yu, Equity structure and enterprise innovation of privatized enterprises [J]. *Management world* (in Chinese), 2015, (04):112-125.
- [8] H. D. Park, H. K. Steensma, When does corporate venture capital add value for new ventures[J]. *Strategic Management Journal*, 2012, 33(1):1-22.
- [9] M. Marianna, P.J. Lane, L.R. GomezMejia, CEO incentives, innovation and performance in technology-intensive firms: a reconciliation outcome and behavior-based incentive schemes[J]. *Strategic Management Journal*, 2006,27( 11) : 1057-1080.
- [10] C. Chin, Y. Chen, G. Kleinman et al., Corporate ownership structure and innovation: Evidence from Taiwan's electronics industry[J]. *Journal of Accounting, Auditing & Finance*, 2009, 24( 1) : 145-175.
- [11] Z. Deng, P. S. Hofinan, A. Newman, Ownership concentration and product innovation in Chinese private SMEs[J]. *Asia Pacific Journal of Management*, 2013,30( 3):717 -734.
- [12] C. Li, Y. Li, M. Li, Equity pledge of controlling shareholders and firm innovation investment [J]. *Financial Research*(in Chinese), 2018 (07): 143-157.
- [13] Y. Pan, J. Pan, Y. Dai, Patent tort litigation and firm innovation [J]. *Financial Research*(in Chinese), 2016 (08): 191-206.
- [14] J. Li, H. Su, Management shareholding and R&D investment: Mathematical Analysis and Data Inspection: with GEM companies as an example [J]. *Business Research*(in Chinese), 2016 (11): 123-135.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

