

Financing Methods, Capitalized R&D Choice and Firm Value

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Abstract: *Investment activities and financing activities are important financial behavior of enterprises, and good financing structure can provide better support for enterprises' investment activities, so as to create more value for enterprises. Based on 9141 listed companies in Shanghai and Shenzhen A-shares from 2009 to 2015, this paper studies the impact of financing methods on the relationship between capitalized R&D choice and firm value from the perspective of regulatory effects. The results show that: (1) Overall, capitalized R&D choice is conducive to the promotion of firm value. Different financial methods will further affect the value effect of capitalized R&D choice. (2) In particular, the more endogenous financing and debt financing, the stronger the value effect of capitalized R&D choice. On the contrary, the more stock financing, the weaker the value effect of capitalized R&D choice.*

Keywords: regulatory effects, financing methods, capitalized R&D, firm value

1. Introduction

Investment and financing is the two important behavior of enterprises. Under the new economic conditions, investment activities are directly related to the survival and development of enterprises. The financing system is becoming more and more perfect, which can support the enterprise's R&D activities and reduce investment risk^[1]. With the improvement of the capital market system, there are more and more new financing methods, including the internal financing, equity financing and debt financing. Financial innovation can promote research activities, so that it can create more firm value. The newly accounting standards divide the R&D activities into the research stage and the development stage, which stipulates that the R&D expenditure of the research stage will be cost-treated and the R&D expenditure in the development stage will be capitalized and cost-treated. The existing literature has made a lot of research on R&D investment, but it less involves the relationship between capitalization R&D choice and firm value. This paper studies the effect of financing on the relationship between capitalization R&D choice and firm value from the perspective of regulatory effect, so as to provide more reference for the investment activities and financing activities of enterprises.

2. Literature Survey

2.1 The relationship between capitalization R&D choice and firm value

Under the trend of public innovation, it is of great significance for enterprises to improve the efficiency of R&D. Foreign research has tested the dividend plan hypothesis, debt contract hypothesis and political cost hypothesis^[2], which confirm the capitalization of R&D investment can create a positive signal of income^[3]. Lev and Sougiannis^[4] demonstrated the relationship between firm performance and capitalization of R&D expenditure. The results show that capitalization of R&D expenditure is beneficial to improve the performance of

enterprises. Callimaci and Landry^[5] studied the value of R&D expenditure by using the revenue model and the price model, and found that capitalized R&D expenditure could better enhance the enterprise's profit. Han and Manry^[6] with the Korean business as the object of study, Ahmed and Falk^[7] with the Australian business as the object of study have come to the same conclusion. Lev et al.^[8] based on seven industries from 1983 to 2000, discovered that partial capitalization of the R&D expenditure will increase the correlation between R&D expenditure and corporate earnings. Tsoligkas^[9] found that capitalized R&D spending was positively correlated with the stock price, while the cost portion was negatively correlated with the share price. Some domestic scholars have come to the same conclusion. Xu Fang^[10], Wang Liangliang^[11] found that capitalization of R&D investment can significantly enhance the value of the enterprise. Wang Hajun and Kong Yusheng^[12] used the balance panel data of listed companies in China's high-tech industry, found that capitalization of R&D expenditure can create high and new industry profit. Wang Yan Ni and Liu Yan Ni^[13] based on the date of 2007-2012, found that R&D choice is negatively correlated with corporate financial value and positively correlated with market value.

2.2 The impact of financing on the relationship of capitalization R&D choice and firm value

2.2.1 The impact of endogenous financing

Enterprise technology innovation has a high risk and requires huge capital investment, external financing is relatively difficult^[17]. Even if the enterprise can obtain credit funds through bank loans, high interest expenses and principal repayment pressure and the uncertainty of the benefits of technological innovation projects will also make enterprises face greater financial risk. In the multi-financing mode of the enterprise, the cost of endogenous financing is low and the financial risk of the enterprise can be reduced. Brown et al.^[18] argue that endogenous financing has inherent advantages and it can avoid moral and adverse selection. Zhong Li^[19], Ju Xiaosheng et al.^[20-21] has also

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reached the same conclusion. Zhang Yanhui et al.^[22] found that its own R&D investment has a positive influence on the enterprise sales of new products and the number of patent applications. Duan Haiyan^[23] based on the small board listed companies, studied the different sources of financial capital on the impact of R&D investment, founding that endogenous financing has a positive influence on the R&D investment. It can be seen that the more mature enterprises, the more R&D investment, and the greater the capitalization of the motivation and the more conducive to the improvement of corporate value.

2.2.2 The impact of debt financing

In external financing, debt financing and equity financing are two of the most important financing channels. Ross et al.^[24] argue that debt financing is positively related to the value of the firm. He Ying^[25] based on the A-share listed companies from 2008-2013, founding that China's listed companies can reduce the cost of corporate debt financing, improve the value of the enterprise. Sweeney^[26] has found that the scale of corporate debt will affect the corporate R&D options. The higher the debt size of the enterprise, the greater the possibility of financial difficulties. In order to protect their own interests, creditors do not want to invest in more risky projects. So they want to capitalize R&D expenditure. Zong Wenlong et al.^[27] based on the theory of accounting choice, testing the motivation of R&D expenditure capitalization. The study found that the higher the financial leverage of the firm, the greater the intensity of capitalization of R&D expenditure. Wang Yan et al.^[28] argues that the debt contract will affect the proportion of R&D expenditure capitalization of high-tech enterprise. The higher the financial leverage of enterprises, the more inclined to capitalization of R&D expenditure. Wang Yani^[29] also reached the same conclusion. It is generally believed that the more the debt financing, the greater the financial risk of the enterprise, the more reluctant the creditor is willing to invest in the more risky project. Thus more inclined to capitalize the R&D investment, which can promote the improvement of corporate value. And ultimately achieve the purpose of smooth profits.

2.2.3 The impact of equity financing

Equity financing is another important way of financing for enterprises. The development and improvement of the stock market can promote the enterprises to improve R&D investment.^[30] Wang Xiaoya et al.^[31] based on 66 listed companies, founding that most of the companies that implement the equity financing program, their per share, net assets showing negative growth. Lingjiang Huaihe and Hu Wenrong^[32] selected 407 A-share listed companies in Guangdong Province from 2007 to 2010 as the research object, comparing the impact of firm size and financing structure on business performance from the new perspective of traditional industries and strategic emerging industries. The study found that equity financing reduced the performance of traditional industries. Yu Qingsong and Shu Jianling^[33] studied the impact of the three financing methods on R&D investment in the Shanghai and Shenzhen A-share market from 2010-2013, finding that equity financing is not conducive to increasing the R & D investment. It can be seen

that when the company is in the high-speed development stage, the demand of R&D investment is large, and these companies are difficult to raise funds through equity financing due to the level of profitability. With the growing of the company, the demand for R&D investment is gradually stable, and the company's share capital and total assets continue to increase, making the proportion of R&D investment in the total assets relative decline. Ultimately, the equity financing and the company R&D investment is negatively correlated. The company has the small motivation to capitalize the R&D expenditure to improve the current profitability. So they are not inclined to capitalize the R&D expenditure, and it is not conducive to enhance the current value of the enterprise.

3. Problem Definition

The existing literature has made a lot of research on R&D investment, but it less involves the relationship between capitalization R&D choice and firm value.

4. Methodology

4.1 Sample selection and data collection

This paper collects the data of listed A shares companies in Shanghai and Shenzhen from 2009 to 2015, excluding the companies with ST, ST*, and some companies that data are missing. Finally received 9141 sample observations, including 598 in 2009, 1141 in 2010, 1443 in 2011, 1267 in 2012, 1398 in 2013, 1537 in 2014, 1757 in 2015.

In this paper, the date of capitalized R&D investment come from the "development expenditure" of WIND database, and the date of cost of R&D investment come from the "R&D costs" of WIND database. If a company has "development expenditure", then classify it as capitalized companies; if a company only has "R&D costs", then classify it as cost companies. Other financial data also comes from the WIND database. Only the ownership concentration comes from CCER database. Data preprocessing is done in EXCEL, descriptive statistics of variables and regression analysis of models are done in software SPSS19.0.

4.2 Variable design

(1) Dependent variable

Dependent variable is firm value. At present, the indicators of firm value in the literature mainly include the total assets yield, the return on net assets, the stock price and Tobin Q. The total return on assets directly reflects the company's competitive strength and development capability, but also determine whether the company should have more debt. So this paper choose the total return on assets to measure the value of enterprises.

(2) Independent variable

Independent variable is the capitalized R&D choice (CHOICE). If the company has capitalized R&D investment, the value is 1, otherwise it is zero.

(3) Adjust variables

Adjust variables are financing ways. Based on the classification and definition of financing sources in the literature, this paper divides the financing methods into endogenous financing and external financing. Endogenous financing (ENDO) equals to the net cash flow divided by average assets. And the external financing mainly includes debt financing and equity financing. Debt financing (LEV) equals to total liabilities divided by total assets, and equity financing (STOCK) equals to the total of Paid-in capital and capital reserve divided by total assets.

(4) Control Variables

The control variables mainly include the size of the firm (SIZE), and it equals to natural logarithm of the total assets of the firm; The growth of the firm (GROW), and it equals to the growth rate of the business income; The ownership concentration (HERF_5), and it equals to the square of the proportion of the share of the top five shareholders; The type of controller1 (CONT), if the controlling shareholder of a listed company is a state-owned enterprise, the value is one, otherwise it is zero; Annual variables are YEAR1 YEAR2 YEAR3 YEAR4 YEAR5 YEAR6, based on 2009, if the annual is 2010, 2011, 201, 2013, 2014 and 2015, the value is one, otherwise it is zero. The definitions for the variables are shown in Table 1:

Table 1: Variable definition

Type	Symbol	Name	Value and method description
Dependent variable	ROA	Total return on assets	Net profit/Total assets
Independent variable	CHOICE	capitalized R&D choice	If the company has capitalized R&D inputs, the value is 1; otherwise it is 0
Adjust variables	ENDO	Endogenous financing	The net cash flow/ Average assets
	LEV	Debt financing	Total liabilities/Total assets
	STOCK	equity financing	(Total of paid-in capital+ Capital reserve) /Total assets
Control variables	SIZE	the size of the firm	Natural logarithm of the total assets
	GROW	The growth of the firm	(Operating income this year -Operating income last year) /Operating income last year
	HERF_5	The ownership concentration	Square of the proportion of the share of the top five shareholders
	CONT	The type of controller	If the controlling shareholder is a state-owned enterprise, the value is one, otherwise it is zero
	YEAR ₁	Annual variables1	Based in 2009, if the year for 2010, the value of 1, otherwise it is 0
	YEAR ₂	Annual variables2	Based in 2009, if the year for 2011 the value of 1, otherwise it is 0
	YEAR ₃	Annual variables3	Based in 2009, if the year for 2012, the value of 1, otherwise it is 0

YEAR ₄	Annual variables4	Based in 2009, if the year for 2013, the value of 1, otherwise it is 0
YEAR ₅	Annual variables5	Based in 2009, if the year for 2014, the value of 1, otherwise it is 0
YEAR ₆	Annual variables6	Based in 2009, if the year for 2015, the value of 1, otherwise it is 0

4.3 Model building

Based on the four hypotheses of this paper, the following Multiple linearity regression model is constructed:

$$ROA = a_0 + a_1 CHOICE + a_3 CONTROL + e_1 \quad (1)$$

$$ROA = b_0 + b_1 CHOICE + b_2 FINANCING + b_3 CHOICE \times FINANCING + e_2 \quad (2)$$

The model(1) adds the capitalized R&D choice (CHOICE) on the basis of the control variable (CONTROL) to test the relationship between the capitalized R&D choice and the firm value. There are 10 control variables (CONTROL), including the size of the firm (SIZE), the growth of the firm (GROW), The ownership concentration (HERF_5), The type of controller1 (CONT) and six Annual Variables (YEAR1, YEAR2, YEAR3, YEAR4, YEAR5, YEAR6).

On the basis of model(1), model (2) join the FINANCING and CHOICE*FINANCING to further examine the regulation effect of financing on the relationship between capitalized R&D choice and firm value. INANCING includes endogenous financing, debt financing and equity financing. Therefore, regression analysis needs to test the effect of endogenous financing, debt financing and equity financing on the relationship between capitalized R&D choice and firm value. The coefficient (a1,b1) of CHOICE should be significantly positive if the capitalized R&D is conducive to the improvement of the firm's value. The coefficient (b3) of CHOICE*FINANCING should be significant if the financing does have a regulation effect on the relationship between capitalized R&D and firm value.

5. Results & Discussion

5.1 Descriptive Statistics

Table 2: Variable descriptive statistics

Variable Name	Sample	Minimum value	Maximum value	Mean	Standard deviation
CHOICE	9141	0	1	0.23	0.424
ENDO	9141	-0.375	0.727	0.040	0.078
LEV	9141	0.013	0.965	0.431	0.204
STOCK	9141	0.022	2.919	0.393	0.207
ROA	9141	-0.372	0.428	0.040	0.051
SIZE	9141	19.032	28.504	21.938	1.257
GROW	9141	-0.777	16.188	0.197	0.626
CONT	9141	0	1	0.4	0.49
HERF_5	9141	0.001	0.759	0.171	0.118

It can be seen from Table 2 that:(1)The average value of CHOICE is 0.23,which shows that there are few companies that are capitalized companies in sample enterprises.(2) The average value of endogenous financing is 0.040, the average value of debt financing is 0.431, and the average value of equity financing is 0.393, which shows that the listed companies are more preferred to external financing in various financing methods,and the endogenous financing is relatively insufficient.In the external financing mode, the proportion of debt financing is relatively large, followed by equity financing, these two ways of financing accounted for 80% of the total financing of the enterprise.That is, the companies are more preferred for the traditional financing.(3) The average value of the type of controller is 0.4,indicating that the proportion of state-owned enterprises is relatively small.(4)The square of the proportion of the share of the top five shareholders is 0.171, less than 0.25, indicating that the proportion of the top five shareholders is relatively balanced.

5.2 Empirical analysis and results

Using the hierarchical regression method to verify the relationship between capitalized R&D choice and firm value and the Regulatory effects of financing methods on the relationship between capitalized R&D choice and firm value. The regression results are shown in Table 3:

Table 3: Regulatory effects of financing methods on the relationship between capitalized R&D choice and firm value

MODEL	MODEL (1)	MODEL (2)	MODEL (3)	MODEL (4)
Constant	0.022** (2.206)	0.097*** (9.941)	0.099*** (10.201)	0.102*** (10.518)
CHOICE	0.048*** (4.776)	0.030*** (3.888)	0.030*** (3.875)	0.033*** (4.287)
SIZE	0.034*** (2.937)	0.076*** (7.078)	0.074*** (6.822)	0.072*** (6.721)
GROW	0.153*** (15.386)	0.138** (17.700)	0.139*** (17.791)	0.139*** (17.920)
CONT	-0.191*** (-17.325)	-0.092*** (-10.457)	-0.093** (-10.570)	-0.094*** (-10.642)
HERF_5	0.096*** (9.132)	0.033*** (4.037)	0.036*** (4.298)	0.035*** (4.267)
YEAR _i	Included	Included	Included	Included
ENDO		0.232*** (28.436)	0.228*** (28.052)	0.226*** (27.976)
LEV		-0.706*** (-61.563)	-0.706*** (-61.554)	-0.713*** (-62.202)
STOCK		-0.481*** (-40.815)	-0.482*** (-40.907)	-0.494*** (-41.711)
ENDO× CHOICE		0.042*** (5.363)		
LEV× CHOICE			0.033*** (4.333)	
STOCK× CHOICE				-0.065*** (-8.336)
Adj.R2	0.108	0.457	0.457	0.460
F value	101.083***	514.238***	513.014***	519.233***

Note: *, **, ***, level means significantly at 10%, 5%, 1% .t value is in the brackets

In Table 3, Model 1 is the regression result of the relationship between capitalized R&D choice and total asset yield. The results show that the capitalization R&D choice is positively correlated with the total asset yield at 1% level.This shows that enterprises choose to capitalize the R&D investment is conducive to reverse the loss, enhance the current value of the firm.R&D investment in all the cost of processing, is not conducive to improving the current value of the enterprise.The higher the concentration of equity, the more possibility the enterprise make rapid response to the external environment from the company's long-term interests ,so that it can enhance the value of the enterprise. The scale of enterprises and the growth of enterprises are the key factors influencing the enterprise's value.

Model 2 is the result of the regulation effect of endogenous financing on the relationship between capitalized R&D choice and firm value. It can be seen from the table that the coefficient of endogenous financing and capitalized R&D choice is 0.042, and it is significantly positive correlated at 1% level.It shows that the endogenous financing has a positive effect on the relationship between capitalized R&D choice and firm value. The more the endogenous financing is, the stronger the value effect of capitalized R&D choice.The endogenous financing of the enterprise is sufficient, the ability of independent research and development is stronger, and they can use their own surplus for R&D activities without having to rely too much on the higher cost of external financing. Therefore,they are more inclined to capitalize the R&D investment to increase the value of the current business.

Model 3 is the result of the regulation effect of debt financing on the relationship between capitalized R&D choice and firm value. It can be seen from the table that the coefficient of debt financing and capitalized R&D choice is 0.033, and it is significantly positive correlated at 1% level.It shows that the debt financing has a positive effect on the relationship between capitalized R&D choice and firm value. The more the debt financing is, the stronger the value effect of capitalized R&D choice.The debt financing of the enterprise is increasing, the financial risk will increase too.The creditors do not want o invest in a large risk of the project for their own interests.So enterprises are more inclined to capitalize R&D investment in order to smooth the performance, which relative to reduce the risk of enterprises and enhance the current value of enterprises.

Model 4 is the result of the regulation effect of equity financing on the relationship between capitalized R&D choice and firm value. It can be seen from the table that the coefficient of equity financing and capitalized R&D choice is -0.065,and it is significantly negative correlated at 1% level.It shows that the equity financing has a negative effect on the relationship between capitalized R&D choice and firm value. The more the equity financing is, the weaker the value effect of capitalized R&D choice.The more the equity financing, the lower the pressure that the corporate has,and the less dynamic the firms capitalize the R&D expenditure.So the firm is not likely to capitalize the R&D expenditure.

6. Conclusion

Based on 9141 listed companies in Shanghai and Shenzhen A-shares from 2009 to 2015, this paper studies the impact of financing methods on the relationship between capitalized R&D choice and firm value from the perspective of regulatory effects. The results show that: (1) Overall, capitalized R&D choice is conducive to the promotion of enterprise value. Different financial methods will further affect the value effect of capitalized R&D choice. That is, it can pass a positive signal to the market and enhance the value of the firm. (2) Different financing methods have different effects on the relationship between capitalized R&D and firm value. The more endogenous financing and debt financing, the stronger the value effect of capitalized R&D choice. On the contrary, the more equity financing, the weaker the value effect of capitalized R&D choice. The more the endogenous financing, the higher the level of asset-liability ratio of enterprises, the more inclined to capitalize R&D investment. Which is conducive to enhance the value of the enterprise. The more equity financing, the more inclined to cost R&D investment.

7. Future Scope

The research of this paper has enriched the relevant literature about enterprise R&D investment and its accounting treatment in theory, but there are some shortcomings due to the influence of research data and research and development methods. First of all, there are some limitations in the selection of the main variables. Due to the limitation of space, this paper not only selects the other variables that can represent the financial value of the enterprise, but also does not study the relationship between R&D accounting choice and enterprise market value. And this article do not consider the impact of the value of the latter part of the enterprise, so it should be further studied.

According to the conclusion of this paper, the following suggestions are put forward: (1) Standardize the accounting policy of R&D investment and its disclosure. The accounting policy is only principle-oriented and there is no mandatory requirement. Some companies use a more liberal system to deal with the R&D investment so as to achieve more value. Therefore, the authorities should strengthen the management of R&D investment and strict R&D investment procedures and disclosure system to provide more detail information for investors. (2) Optimize the financing structure of enterprises and expand the proportion of endogenous financing. According to the orderly financing theory, enterprises should have endogenous financing first. China's enterprises have high levels of debt. Although it can play the role of debt tax shield, but also it can bring greater financial risk. Therefore, enterprises should raise the awareness of risk of financing decision-making, and gradually increase the proportion of internal financing. When the expansion of corporate assets beyond the scale of the growth rate of internal, the enterprise can have more external financing. With the development and expansion of enterprises. (3) Promoting the organic combination of financing and R&D innovation. Enterprises

should choose a reasonable accounting policy. Enterprises that rely more on endogenous financing and have higher asset-liability ratios and less equity financing, they can choose to capitalize the R&D investment, so as to provide more accurate and detailed information for users. Thus it can promote the transformation and upgrading of enterprises and enhance the value of the enterprise.

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