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RESEARCH ON THE INFLUENCE OF R&D INPUT ON FINANCING COST OF HIGH-TECH ENTERPRISES

Abstract:

Enterprises are vital forces that combine technology and economy, research and development innovation is very important, enterprise research and development innovation need investment, in addition to rely on their own capital, financing plays an indispensable role, high-tech enterprises generally encounter financing problems, and the problem of high financing cost, to this, analyze the research and development investment and the enterprise financing cost, is particularly important. According to the report of the 20th National Congress of the Communist Party of China, the current development trend of high-tech enterprises and the relevant documents of the Ministry of Finance, this paper introduces the research background, research significance, core content and the research methods adopted. By sorting out the relevant documents, the r & d investment, equity and debt financing status of high-tech enterprises are introduced. Select the appropriate measurement method, use the abnormal surplus growth model (PEG model) to measure the equity financing cost, and measure the debt financing cost by the relative number method. In this paper, 1486 A-share listed companies from 2018 to 2021 were selected as research samples, and relevant data was collected through CSMAR and CNRDS. In the data processing and analysis section, in this paper, EXCEL and STATA17.0 software were used to process the collected data and conduct related analysis. The connection between r & d investment intensity and enterprise equity financing cost and debt financing cost is deeply discussed. It is found that the equity financing cost; the effect of the equity financing cost is more obvious in state-owned enterprises. Finally, relevant suggestions are put forward for the r & d investment of high and new technology enterprises and the government innovation subsidies.

Keywords:

R&D investment, financing cost, property rights

1.Introduction

The Party's Report to the 20th CPC National Congress emphasizes the importance of innovation. High-tech enterprises are regarded as an important force to enhance national scientific and technological strength. High-tech enterprises usually need a lot of money for R&D activities, and R&D activities often involve sensitive information which makes there is a large information asymmetry between enterprises and investors. It is difficult for investors to accurately evaluate the prospects and potential risks of corporate R&D projects, resulting in investors requiring a higher rate of return.

According to Accounting [2018] No.15 Document, R&D expenses are disclosed separately in the income statement. This enhances the transparency of R&D investment, and reduces information asymmetry. Investors can intuitively understand the R&D level of the enterprise, so as to evaluate its innovation ability and long-term potential. However, whether greater R&D investment can enhance investor confidence, reduce worries about the future development of enterprises, and reduce financing costs will be the focus of this paper.

Taking high-tech manufacturing enterprises as the research object, this paper studies the relationship between enterprise R&D investment and enterprise financing cost from this new perspective, which can provide more decision-making reference for enterprises and investors. it further enriches the related research on R&D investment and enterprise financing cost.

2. Literature review and research hypotheses

2.1 Literature review

A large number of scholars have focused on the positive impact of R&D investment. Wang Ping, Bu Hua and Zhang Chunqiu (2022) expounded that R&D investment can enhance the competitiveness of enterprises[1]. Lin,Hsu (2020) pointed out that R&D investment is the basis for enterprises to maintain survival and ensure growth[2]. Cai Jianhu, Jia Lishuang and Shou Yongyi (2024) show that R&D investment has the characteristics of high cost and high risk, which may lead to increased information asymmetry and make it difficult for investors to evaluate its true value [3].

The current situation and constraints of financing development have also attracted much attention. Yue Feng (2023) found that good quality of internal control helps to ease corporate financing constraints [4]. Niclas,Henrik and Milda (2022) found that high-quality financial reports can reduce information asymmetry and reduce financing costs [5]. Du Yan and Chen Jian (2023) show information disclosure can reduce equity financing cost [6].

The different nature of property rights affects the financing of enterprises. Diao Shuqi (2023) explained that the improvement of the quality of information disclosure helps to alleviate the financing constraints of enterprises, especially non-state-owned enterprises [7]. Zhang Chaoqiong (2021) explained that private enterprises suffered from credit discrimination, making it difficult to obtain financing from banks and asset markets, while state-owned enterprises had easy access to funds because of government support [8].

To sum up, it is found that R&D investment can send positive signals. High-quality internal control and information disclosure can reduce financing cost. The information disclosure of state-owned enterprises is more perfect, and the financing cost is relatively lower. In the existing periodical literature, there is little discussion on the impact of R&D investment on financing costs, and there is little regulation on the nature of property rights. Through empirical analysis, this paper will explore the relationship between R&D investment and financing costs and the regulatory role of the nature of property rights, and provide development suggestions for enterprises.

2.2 Research hypotheses

2.2.1 R&D investment and financing cost

Enterprises need to ensure their own industry competitiveness of innovative R&D information will be highly confidential, it will lead to increased information asymmetry, financing difficulties, reducing information asymmetry can ease financing constraints [9]. According to the signal theory, the higher the R&D investment

intensity of the enterprise is, it will show to the external investors that the enterprise has sufficient funds to invest in R&D innovation and great potential for future development, and investors will have more confidence in the enterprise [10]. Based on the literature review and the above analysis, the following assumptions are put forward:

H1: R&D investment intensity has a significant negative correlation with the cost of equity financing.

H2: R&D investment intensity has a significant negative correlation with the cost of debt financing.

2.2.2 The moderation effect of the nature of property rights

Enterprises have different types of property rights, and the pressure of financing is also different. information asymmetry is an important factor that makes it more difficult for enterprises to carry out financing activities[8]. The government's supervision of enterprises is constantly strengthened. In order to avoid punishment and reputation loss, enterprises will strive to provide high-quality information, especially state-owned companies, whose information disclosure quality is higher than that of non-state-owned enterprises [11]. Based on the literature review and the above analysis, the following assumptions are put forward:

H3: The effect of R&D investment intensity on enterprise financing cost reduction is more obvious in state-owned enterprises.

3. Research and design

3.1 Research samples and data sources

Taking 2018-2021 as the time range, according to the Classification of High-tech Industries (Manufacturing Industries), the Chinese listed companies of high-tech manufacturing industries are selected as the research samples, with a total of 1486 A-share listed companies. The data sources of this paper are CSMAR and CNRDS.

The data screening of this study is as follows: the enterprises marked as ST or *ST during the study period were excluded from the original sample. The samples with missing data of the key variables needed in the study are excluded.

3.2 Selection and measurement of main variables

This paper uses Easton,Peter D (2004) to propose abnormal earnings growth model PEG model to calculate the cost of equity financing [12], and Li Guangzi and Liu Li (2009) to put forward the measurement method of relative cost of debt financing [13]. The ratio of R&D investment to operating income is used as the measure of R&D investment intensity.

Property rights is taken as an adjustment variable to study whether property rights plays a role in the impact of R&D investment on financing costs.

This study selects nine control variables to
control credibility of external disclosure information， solvency, profitability and asset composition.

The variables are shown in Table 3.1 below.

Table 3.1 variable definition

The variable belongs	Paraphrase	Symbol	Data processing
Explained variables	Cost of equity financing	CEF	$\sqrt{\text{forecast EPS}_{t+2} - \text{forecast EPS}_{t+1}}$/Year-end stock closing price of period t
	Cost of debt financing	CDF	Interest expense / Total liabilities
Explanatory variables	R&D investment intensity	RDI	R&D investment / Operating revenue
Moderation variables	Property rights	State	Virtual variable, the value is 1 for state-owned enterprises and 0 for non-state-owned enterprises
Control variables	Current ratio	CR	Current assets / current liabilities
	Proportion of fixed assets	Tangibility	Net fixed assets / total assets
	Asset–liability ratio	Lev	Total liabilities / total assets
	Company size	Size	The natural logarithm of the company's assets ending in the current period
	Return on equity	ROE	Net profit / equity
	Whether the auditor is one of the Big	Big4	Virtual variable, the auditor belongs to the big Four

	Four accounting firms		accounting firm value of 1, otherwise it is 0
	Whether the chairman and the general manager are held by the same person	Dual	Virtual variable, the value of the chairman and the general manager holding concurrently is 1, otherwise it is 0
	The shareholding ratio of the largest shareholder	First	The percentage of the largest shareholder in the total share capital
	Cashflow	Cash	Cash flow from operating activities/ total assets

3.3 Model construction

Establish a regression model 1 for the influence of R&D investment intensity on equity financing cost, as shown below.

$$CEF_{i,t} = \beta_0 + \beta_1 RDI_{i,t} + \beta_2 CR_{i,t} + \beta_3 \text{Tangibility}_{i,t} + \beta_4 \text{Lev}_{i,t} + \beta_5 \text{Size}_{i,t} + \beta_6 \text{ROE}_{i,t} + \beta_7 \text{Big4}_{i,t} + \beta_8 \text{Dual}_{i,t} + \beta_9 \text{First}_{i,t} + \beta_{10} \text{State}_{i,t} + \beta_{11} \text{Cash}_{i,t} + \varepsilon_{i,t}$$

Replaceas $CDF_{i,t}$ the explained variable to the above formula, and establish a regression model 2 for the study on the impact of R&D investment intensity on the debt financing cost.

Establish a multiple regression model 3 on the moderation effect of property rights, as shown below.

$$CEF_{i,t} = \beta_0 + \beta_1 RDI_{i,t}\_State_{i,t} + \beta_2 CR_{i,t} + \beta_3 \text{Tangibility}_{i,t} + \beta_4 \text{Lev}_{i,t} + \beta_5 \text{Size}_{i,t} + \beta_6 \text{ROE}_{i,t} + \beta_7 \text{Big4}_{i,t} + \beta_8 \text{Dual}_{i,t} + \beta_9 \text{First}_{i,t} + \beta_{10} \text{State}_{i,t} + \beta_{11} \text{Cash}_{i,t} + \varepsilon_{i,t}$$

Replace $CDF_{i,t}$ for the explained variable to the above formula, build a multiple regression model 4.

4. Empirical test

4.1 Descriptive statistics

Due to the different ways of defining the explained variables, there are differences in data missing items, resulting in different sample sizes. Table 4.1 shows the descriptive statistical results of the relevant variables in models 1 and 3. There are 2483 valid data. Table 4.2 shows the descriptive statistical results of the relevant variables in models 2 and 4. There are 1984 valid data. In the sample data, the individual difference of R&D investment is obvious.

4.2 Regression results and analysis

4.2.1 R&D investment intensity and financing cost

Based on the time fixed effect regression analysis of panel data, the results of Table 4.3 are as follows. It can be seen that the regression coefficient of the explanatory variable RDI in model 1 is -0.016, which is significantly negatively correlated with the explained variable CEF at the level of 1%, which is the same as hypothesis 1.

In model 2, the association between RDI and CDF did not reach a statistical significant level and cannot support hypothesis 2.This may be due to the long-term nature of R&D investment and the nature of intangible assets. It does not match the characteristics that creditors will pay more attention to the value of short-term assets.

4.2.2 The moderation effect of property right

In order to verify hypothesis 3, the multiplicative term RDI_State of RDI and State is used as the explanatory variable, and the multiple regression analysis of models 3 and 4 is as follows. In the regression model 3, the coefficient of the explanatory variable RDI_State is-0.172 and reaches a statistically significant level of 1%.The effect of the growth of R&D investment on the reduction of equity financing costs of state-owned enterprises is more obvious than that of other types of enterprises. In the regression model 4, the coefficient does not reach the statistically significant level.

4.3 Robustness test

The explanatory variable to measure the intensity of R&D investment is changed to the ratio of R&D expenditure to total assets, and multiple regression analysis is carried out (Model 5). The results show that the regression coefficient of RDI is negative and significant at 1% level, which is consistent with the conclusion of the original model and verifies the stability of the study.

Due to the changes in the format of financial statements issued by the Ministry of Finance in 2018, the sample time window was extended from 2018-2021 to 2013-2021, and the regression analysis of new samples was carried out (Model 6). The regression results of the new sample (4819 items) show that the sign and

significance of the regression coefficient of RDI are consistent with the original model, which further proves the robustness of the study.The results of regression model is shown in Table 4.3.

Table 4.1 models 1, 3 descriptive statistics

Variables	Mean	Sd	Min	Max
CEF	0.129	0.0677	0.0129	0.558
RDI	0.0765	0.355	0.00004	17.22
CR	3.310	3.792	0.169	48.75
Tangibility	0.190	0.127	0.00137	0.733
Lev	0.356	0.180	0.0198	0.976
Size	22.16	1.129	19.69	26.83
ROE	0.0871	0.571	-27.59	0.717
Big4	0.0568	0.231	0	1
Dual	0.391	0.488	0	1
First	0.318	0.139	0.0287	0.827
State	0.190	0.392	0	1
Cash	0.0681	0.0692	-0.322	0.580
RDI_State	0.0101	0.0279	0	0.299

Table 4.2 models 2, 4 descriptive statistics

VARIABLES	Mean	Sd	Min	Max
CDF	0.160	0.686	1.06e-09	21.50
RDI	0.0615	0.0509	0.000484	0.588
CR	2.569	2.531	0.193	45.91
Tangibility	0.198	0.120	0.00356	0.675
Lev	0.388	0.181	0.0143	2.128
Size	22.16	1.147	19.69	26.77
ROE	0.0231	0.795	-27.59	1.429
Big4	0.0484	0.215	0	1
Dual	0.355	0.479	0	1
First	0.313	0.137	0.0287	0.827
State	0.225	0.418	0	1
Cash	0.0574	0.0627	-0.153	0.488
RDI_State	0.0112	0.0262	0	0.261

Table 4.3 results of regression analysis

VARIABLES	CEF(1)	CDF(2)	CEF(5)	CEF(6)
RDI	-0.016***	1.958	-0.133***	-0.014***
	(-22.38)	(0.99)	(-2.62)	(-4.60)
CR	-0.002***	-0.025	-0.001***	-0.000
	(-2.96)	(-0.70)	(-3.53)	(-0.55)
Tangibility	-0.019	-0.014	0.088***	0.003
	(-0.48)	(-0.05)	(6.69)	(0.16)
Lev	0.016	-0.573**	0.043***	0.027**
	(0.51)	(-2.17)	(4.06)	(1.97)
Size	-0.009	-0.090	0.002	0.002
	(-1.09)	(-1.41)	(1.56)	(0.58)
ROE	-0.005***	-0.002	-0.004***	-0.005***
	(-6.35)	(-0.32)	(-6.27)	(-8.82)
Big4	0.058*	0.005	-0.012*	0.008
	(1.71)	(0.08)	(-1.90)	(0.67)
State	-0.008	-0.018	-0.011***	-0.024***
	(-0.38)	(-0.32)	(-2.77)	(-3.51)
Cash	0.006	0.171	0.003	-0.005
	(0.16)	(0.31)	(0.13)	(-0.22)

Table 4.4 results of regulatory regression analysis

VARIABLES	CEF(3)	CDF(4)
RDI_State	-0.172***	-0.967
	(-2.70)	(-1.06)
CR	-0.001***	0.035*
	(-3.57)	(1.82)
Tangibility	0.089***	0.085
	(6.83)	(0.78)
Lev	0.042***	-0.218**
	(3.98)	(-1.99)
Size	0.003*	-0.090***
	(1.72)	(-5.62)
ROE	-0.004***	-0.001
	(-6.00)	(-0.27)
Big4	-0.014**	0.067*
	(-2.18)	(1.92)
State	-0.002	0.068
	(-0.27)	(1.59)
Cash	-0.003	0.006
	(-0.14)	(0.02)

*** p<0.01, ** p<0.05, * p<0.1

5. Conclusions and recommendations

5.1 Conclusion

Based on the data of 1486 listed high-tech manufacturing companies from 2018 to 2021, this paper studies the relationship between R&D investment intensity and financing cost. The conclusions are as follows:

(1)The R&D investment intensity is negatively correlated with the equity financing cost of high-tech enterprises. Increasing R&D investment can enhance the competitiveness and long-term growth potential of enterprises, send positive signal to investors. (2) There is no significant correlation between R&D investment intensity and debt financing cost. There may be other unknown variables that may affect the debt financing. Studying this impact mechanism may need to consider collateral.Creditor type and market environment also affect debt financing cost. (3) In state-owned enterprises, R&D investment plays a more significant role in reducing the cost of equity financing. More than private companies, investors trust state-owned enterprises and are willing to

invest at lower costs. The nature of property rights has no significant adjustment effect on the debt financing cost.

5.2 Recommendations

(1)Encouraging high-tech enterprises can increase their investment in R&D. the more they invest in R&D, the more their returns will increase. at the same time, it can give investors confidence and reduce the cost of equity financing to a certain extent. (2) It is suggested that the subsidy for scientific and technological innovation of high-tech private enterprises should be increased to improve the intensity of enterprise innovation. The government can increase policy incentives to enterprises, encourage enterprises to increase R&D investment in innovation. Policy incentives can effectively help it speed up development and increase R&D input and output.

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