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The Impact of Innovation Investment on the Performance of Chinese High-tech Enterprises - Regulatory Effect based on Debt Financing

Qiulan Yu, Xiaodong Fu*

Nanjing Normal University, Nanjing, Jiangsu 210023
*fxdong@njnu.edu.cn
**Author to whom correspondence should be addressed.*

Abstract: ***High-tech enterprises are the leading agents of economic development, study the relationship between their innovation investment and enterprise performance, and guide enterprises to develop independent innovation strategies, improve independent innovation capabilities, and then promote China's further transformation into an innovative country. Major. Funds are the material basis for innovation investment. The cultivation and development of high-tech enterprises cannot be separated from the support of funds. As an important way of corporate financing, debt financing not only has the role of tax shield, but also can expand the financing channels of listed companies and optimize the allocation of financial resources. However, the credit financing of China's high-tech enterprises is generally at a low level. This paper finds through empirical research that debt financing has a negative adjustment effect on innovation investment and corporate performance, and further divides debt financing into corporate bonds, long-term and short-term loans and business. After credit, explore the different effects of the three on the innovation investment and performance of the enterprise, and finally draw conclusions and policy recommendations.***

Keywords: High-tech enterprises; Innovation investment; Enterprise performance; Debt financing.

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1. Introduction

With the gradual integration of the world's economy, technological innovation has become the main driving force for economic growth. Under the environment of increasingly fierce market competition, enterprises need to increase investment in innovation if they want to survive and establish their position in the industry. Investment in innovation can not only bring new products, new inventions and new patents to the enterprise, but also help improve the core competitiveness of the enterprise. However, from another perspective, while increasing the investment in technological innovation of enterprises, due to the large Uncertainty will also increase corporate financial burden accordingly. Financing is a practical starting point for ensuring innovation investment, improving innovation performance, and promoting economic growth. As a non-negligible method of corporate financing, debt financing not only has the role of a tax shield, but also can expand the financing channels of listed companies and optimize the allocation of financial resources. In the existing theory and practice, debt financing has often neglected the innovation investment and corporate performance Regulating role, it is also rare to further subdivide debt financing. Therefore, it is very important to study the regulating role of debt financing on innovation input and corporate performance.

This paper takes innovation investment as the starting point and adds the moderator variable of debt financing to study the issue of corporate performance. This paper selects the financial data of high-tech listed companies from 2010 to 2018 for relevant empirical research: first, the role of innovation investment in corporate performance is tested; second, debt financing is added as a moderator, and debt financing is further divided into bond financing, long-term Short-term loans and commercial credit are used to explore the effect of different debt financing adjustment effects; finally, corresponding conclusions and policy recommendations are drawn.

2. Literature Review

2.1 Research on the relationship between innovation investment and corporate performance

With the development of scientific and technological innovation, companies have paid more and more attention to innovation activities, and scholars have also enriched related research. The related research conclusions can be divided into three categories: one is that there is a positive correlation between innovation investment and corporate performance; there is a negative correlation between investment and corporate performance. Third, there is no correlation between innovation investment and corporate performance.

Most scholars have found that innovation investment is positively correlated with corporate performance. Foreign studies on innovation investment and corporate performance mainly take the US market as the research object, and corporate performance indicators mainly select the Tobin Q value. Most studies in this area can reach agreement. Sougiannis (1996) used the Ohlson model to verify the positive correlation between innovation input and corporate profits, and concluded that the creation of residual income comes from the expenditure part of innovation input. Booth (2005) used this model to study the listed companies in the United States from 1999 to 2004 and came to the same conclusion: R & D expenditure can increase the company's future cash flow and market value. Relatively speaking, the country started late in this field, but in recent years, China has paid more and more attention to scientific and technological innovation, and many scholars have carried out relatively rich research on innovation. It is generally believed that the innovation investment of high-tech enterprises is positively related to corporate performance. (Yong Du et al. 2014 ; Mingqi Zhu and Fuxiang Zhang, 2018).

Some scholars have concluded that there is a negative correlation between innovation investment and corporate performance. Foreign scholars Hitt and Hoskisson (1994) researched the relevant data of 191 U.S. industries from 1970 to 1986. The results show that with the increase of scientific research investment, the performance level of enterprises has declined. There is a negative correlation. Brown (2009) used 30 large American, European, and Japanese multinational electronic and electrical high-tech companies from 1978 to 1990 as the research sample, with operating income growth and profit as the dependent variable, R & D investment as the independent variable, and a regression model. The final research results show that R & D investment has increased by 3-5 times, but the sales revenue growth rate is only 11% at the highest. This is due to the inconsistency between the increase in operating income and the expanding scale of innovation investment. Therefore, the "acceleration trap" theory of innovation investment is proposed. Yangyang Ding and Zhiyong Guo (2013) took listed companies on the SME board from 2011 to 2012 as research objects, used research and development expenditure as explanatory variables, and took current financial performance and market performance as explained variables. The regression analysis of listed companies on the SME board The conclusion that R & D expenditure and financial performance have a negative relationship.

Some scholars have concluded through research that the correlation between innovation investment and corporate performance is not significant. Foreign scholar Scherer (1965) selected the relevant data of 448 Fortune 500 industrial companies in the United States in 1955, and mainly studied the impact of the number of patents on the profitability and sales growth rate from 1955 to 1960. The results show that the number of patents can promote the increase in sales of enterprises, but its impact on profitability is not obvious. Xingang Zhao, Keyi Wang, and Haiyang Sun (2012) took the relevant data of 91 listed companies in Shanghai and Shenzhen manufacturing industries from 2007 to 2011 as research objects, and conducted a two-way fixed effect to analyze the lagging effect of technological innovation investment on corporate performance. The results show that the impact of innovation investment on corporate performance is not obvious.

On the whole, the research conclusions of positive correlation between innovation input and corporate performance dominate. Considering that some scholars' research conclusions are negatively related and irrelevant, the main reasons are as follows: (1) The specific analysis objects are different. The research on enterprise classification is not detailed enough. Relevant data on technological innovation of Chinese enterprises has not been fully disclosed, and it is difficult to collect data, which makes it difficult to divide the industry in detail to fully study the correlation between the innovation input of different enterprises and the performance of enterprises. (2) Research methods and index selection are different. There are differences in the analysis indicators used by different scholars in their research. When the research is centered on the relationship between innovation input and corporate performance, most scholars choose to rely solely on R & D expenditures or R & D expenditures as a proportion of sales revenue when selecting indicators for innovation input, which limits the research space and cannot fully examine enterprise innovation Investment situation.

2.2 Research on the Moderating Effect of Debt Financing on Innovation Input and Enterprise Performance

In the existing theory and practice, the regulatory effect of debt financing on innovation input and corporate performance is often ignored, and the debt financing is also further subdivided. Most studies have found that the adjustment of debt financing to innovation investment and corporate performance The role is very important. Generally speaking, there are three main sources of debt financing, namely bond financing, bank borrowing and commercial credit. This article mainly studies the role of debt financing and its three sources in regulating innovation investment and corporate performance.

2.2.1 Moderating effect of bond financing on innovation input and corporate performance

Foreign scholars KimS, LeeH, and KimJ (2016) all believe that the characteristics of bond financing in terms of liquidity, maturity characteristics, and financing costs can better match corporate innovation activities, and can also improve the freedom of decision-making of corporate managers, and through Incentives improve innovation performance. Cutillas (2014) believes that by evaluating the fundraising purpose, credit rating, maturity, interest rate and other information disclosed during the issuance of corporate bonds, bond investors can screen companies with higher credit ratings and better matching of risks and returns for investment. And less intervention in the company's specific operating process. With the development of China's capital market, the bond information disclosure system requires bond issuers to accurately disclose the company's major events, solvency, and credit ratings. Based on this, bond investors will make more objective and scientific investment decisions, and then promote corporate innovation performance by increasing the freedom of innovation. In China, scholars' research on financing structure has long focused on equity financing. With the gradual improvement of China's capital market in recent years, many scholars have begun to study the direction of bond financing. Dongliang Luo, Jun Sun (2017) used listed companies that issued bonds as a sample. By comparing the impact of bank loans and corporate bonds on corporate innovation input and corporate performance, it was concluded that although bank loans and corporate bonds are not concerned about corporate innovation Investment, but bank borrowing eventually became a disadvantage to the company, while corporate bonds did not. Therefore, the development of corporate bonds by management is conducive to corporate decisions. However, some scholars hold different opinions. Lijuan Chang and Xiong Yue (2011) concluded through empirical research that corporate bonds have certain managerial incentives and constraints, prompting managers to abandon risky innovation investment projects, and it plays a negative role in regulating corporate performance.

2.2.2 Moderating effect of long-term and short-term borrowing on innovation investment and corporate performance

Foreign scholars Schiantarelli and Srivastava (1997) have pointed out that there is a correlation between the debt maturity structure and corporate value. With the extension of the debt maturity, the development of the company is also getting better and better. Long-term borrowing can increase the growth opportunities of the company.

Innovation investment and corporate performance have a positive regulating effect. However, Grossman and Hart (1986) concluded through research that the short-term debt maturity time is relatively short and the settlement time is relatively concentrated. The more short-term liabilities of a company, the more likely it is to cause liquidity risk, and the probability of corporate bankruptcy will also increase. Large, management may be loyal to their duties because they are worried that a company's bankruptcy will harm their own interests, reduce invalid investment behavior, and stabilize business performance. Arslan (2006) and Titman and Wessels (1988) conducted empirical research using the annual financial data of listed companies in Germany, France, and the United Kingdom as a sample, and concluded that there is no significant difference in the debt maturity structure and growth of the companies in the three countries. The related relationship also reflects that long-term and short-term borrowing have nothing to do with corporate performance. Domestic scholar Dou Wenlu Dou (2015) research shows that the debt maturity structure and innovation performance have an inverted "U" structure, and there is an optimal debt maturity structure interval. Hongan Mao and Jingjing Li (2010) pointed out that the company's debt maturity structure and its growth were positively correlated at the level of 1%. This shows that in order to avoid bankruptcy and liquidation risks, high-growth companies are more inclined to use long-term debt to alleviate the shortage of funds. Their research has confirmed from the side that debt maturity has a positive regulating effect on innovation investment and corporate performance.

2.2.3 Moderating effect of business credit on innovation input and corporate performance

Scholars at home and abroad have done little research on the moderating role of business credit between innovation investment and corporate performance, and they have mainly focused on the research between them.

1) Correlation between business credit and innovation investment.

A study by foreign scholar Wilson (2002) found that when a company cannot obtain external financial support or is difficult to obtain during the R & D process, the enterprise will obtain funds through external financing channels such as commercial credit, thereby alleviating financing constraints. Guariglia and Mateut (2006) found that commercial credit can ease the financing constraints faced by corporate investment. Domestic scholars Xinmin Zhang, Yan Wang, and Jigao Zhu (2012) show that the scale of business credit represents the ability of an enterprise to use business credit to promote its business activities, and to some extent reflects the bargaining power of the enterprise in the industry. This is because the more a business obtains commercial credit, the greater its market advantage, and thus the higher its bargaining power. The companies with strong bargaining power have relatively weak incentives to obtain competitive advantages through innovative activities to reduce costs, improve efficiency, and expand the market, which is reflected in lower innovation input. However, Jian Han and Bing Yan (2013) believe that innovation investment is more dependent on external financing, but the financial system, which is dominated by bank borrowing, makes corporate innovation suffer from a large funding bottleneck. Commercial credit, as an important financing method existing in an imperfect financial system, helps to alleviate the financing constraints of innovation investment, thereby increasing innovation investment.

2) Correlation between business credit and corporate performance

Foreign scholars Peterson and Rajan (1997) pointed out in their research that those small and medium-sized enterprises that are subject to bank credit are more likely to use commercial credit for debt financing in the process of purchase and sale due to the availability and flexibility of commercial credit, which can effectively promote enterprises. Improved performance. Allen (2005) pointed out that China's financial system is still not perfect, and the ability of commercial credit to support the economy may exceed bank borrowing. Commercial credit not only eases corporate financing constraints, but also improves corporate performance. Domestic scholars have a variety of research conclusions on the relationship between business credit and corporate performance. Xiaojun Shi and Shunming Zhang (2010) concluded through in-depth research that commercial credit can improve scale efficiency by reducing financing pressure, and that resource allocation mechanisms can achieve higher efficiency than bank borrowing, and higher efficiency can promote the improvement of corporate performance.

2.2.4 Literature review on the moderating effect of debt financing on innovation input and corporate performance

In view of the current research status of scholars at home and abroad, this paper considers the following deficiencies: (1) treats debt financing as homogeneous in the research content, ignores the impact of different debt financing channels on the research conclusions, and only discusses debt financing as a whole. The impact on corporate performance is bound to be inadequate. (2) The research around the relationship between corporate innovation investment, debt financing, and corporate performance. The existing literature pays more attention to the two-to-two relationship, and seldom conducts in-depth research on the relationship between the three, and ignores it. Regulatory role of debt financing.

Therefore, on this basis, this article will comprehensively explore the relationship between various sources of debt financing and innovation input and corporate performance. Therefore, based on the research of previous scholars, based on the research purpose of this article, this paper studies the adjustment effect of high-tech enterprise debt financing on innovation input and corporate performance from the perspective of debt financing, in order to improve the existing research.

3. Theoretical Analysis and Research Hypotheses

3.1 The relationship between innovation investment and corporate performance

High-tech enterprises mainly obtain core competitiveness through technological innovation, occupy market share and rely on this competitive advantage to enhance market value. Technological innovation is the fundamental foundation for the sustainable development of high-tech enterprises, and has a direct impact on the survival and performance of enterprises. The investment of enterprises in innovation is a necessary condition to ensure that technological innovation can be implemented. Without sufficient innovation investment, it is difficult to carry out

technological innovation activities.

Reading past literature on the relationship between innovation investment and corporate performance, most scholars believe that there is a significant positive correlation between the two. On the one hand, the company reduces the cost of the original product by optimizing the technical level, improves the competitive advantage of the enterprise, and forms a new growth point of corporate profits; on the other hand, technological innovation will enable the company to manufacture new products and differentiate the company in the market Competitiveness, which can play a role in improving corporate performance. Based on this, this article proposes Hypothesis 1:

H1: The innovation investment of high-tech enterprises has a positive correlation with corporate performance.

3.2 Moderating effect of debt financing on innovation input and corporate performance

Based on the analysis above, we have drawn the hypothesis that innovation input has a positive impact on corporate performance, but will the positive impact be strengthened by adding the moderator variable of debt financing? This article discusses as follows.

First of all, from the perspective of creditors, when an enterprise supports innovation investment by means of debt financing, creditors can only obtain interest income from innovation investment and have no right to enjoy the innovation investment. The creditor will ask the company for a high debt interest rate, which will increase the financing cost of the company. Therefore, when faced with the choice between lending to an innovative investment project or a plant and equipment project, creditors prefer the latter.

Secondly, from the perspective of the company, a high debt capital structure means that the company has a higher financial risk. The company is facing greater pressure on interest repayment, and the repayment of debt interest requires stable cash flow support. Putting a lot of funds into innovation investments with high risks and long payback periods makes it difficult to guarantee the return of funds, which will increase the business risks of the enterprise and seriously threaten the survival of the enterprise. In addition, high debt will also put the operator into greater profit pressure. Large innovation investment, lagging profits, and lower current profits will threaten the stability of the job position. Therefore, the operator lacks debt to support innovation investment. Of motivation. Therefore, even if the company can recognize the importance of innovation investment for the cultivation of the company's core capabilities and enhance its competitive advantage, the high debt financing structure will force the company to survive first and then develop. Consider and are unwilling to support innovation investment with debt financing. Based on this, this article proposes Hypothesis 2:

H2: The increase in the scale of debt financing of high-tech enterprises has a negative regulatory effect on innovation investment and corporate performance.

Debt financing includes bond financing, bank borrowing, and commercial credit. In order to study the regulatory effect of debt financing in more detail, this article compares the three financing methods above to determine the size of the regulatory effect among the three financing methods.

3.2.1 Comparison of the adjustment effect between bond financing and bank borrowing

From the perspective of an enterprise, bank loans are “locked in” once they are injected into the enterprise. Even if the loan is misappropriated by the company for other purposes, the bank cannot effectively monitor and control. When the enterprise is unable to repay the bank loan, the bankruptcy mechanism is not sound and the government's support for enterprises has enabled the contracts signed between banks and enterprises to be fulfilled. The decentralization of corporate bond holders makes it more difficult for companies to negotiate with creditors again. In addition, bonds are issued publicly on the market. On the one hand, bonds can be sold at any time, which reduces the “lock-in” effect of investment. On the other hand, the financing and investment status of enterprises will be reflected through bond prices, which reduces information asymmetry between the two parties. This constitutes a "hard constraint" on the innovation investment activities of enterprises. Therefore, this article believes that corporate bonds have stronger supervision over debt investment than bank borrowing. Based on this, this article proposes Hypothesis 2-1:

H2-1: For high-tech enterprises, compared with bank borrowing, the increase in the scale of bond financing has a more significant negative regulating effect on innovation investment and corporate performance.

3.2.2 Comparison of the adjustment effect of long-term and short-term borrowings

Borrowing financing is a very important source of financing for enterprises, but in borrowing financing, the choice of long- and short-term borrowing is also an important financing decision. Long- and short-term borrowing affects the agency costs of enterprises. Compared with long-term borrowing It can more effectively suppress the underinvestment and overinvestment of enterprises, thereby reducing agency costs. At the same time, it is affected by the theory of signal transmission, which affects corporate performance:

(1) Compared with long-term borrowing, short-term borrowing has a shorter maturity date, which can reduce creditors' share of investment project income, thus weakening the underinvestment motivation of managers and investors. The long-term loan repayment time is relatively long, and it is likely to participate in the distribution of investment project income and damage the shareholders' rights and interests. At this time, the shareholders will abandon high-risk investment opportunities from their own interests. (2) When the total debt level of the enterprise does not fluctuate greatly, higher short-term borrowing can slow down the investment risk appetite of managers and shareholders, resulting in a reduction in agency costs. The short-term loan repayment period is shorter than the long-term loan, and the pressure on the company to repay the principal and interest is higher than the long-term loan. Then, for some high-yield and high-risk projects, managers and shareholders will carefully consider it, so the asset replacement will be reduced. behavior. Based on this, this article proposes Hypothesis 2-2:

H2-2: For high-tech enterprises, compared with short-term borrowing, the increase in the scale of long-term borrowing financing has a more significant negative regulating effect on innovation investment and corporate performance.

3.2.3 Comparison of the role of commercial credit and bank borrowing

Compared with bank loans, commercial credit has fewer restrictions on enterprises. Commercial credit is a liability that is formed naturally in the process of business management. It is characterized by a short term, no need to pay interest, and scattered creditors. These characteristics determine that creditors of commercial credit have no binding force on the use of corporate funds.

However, bank borrowing has the characteristics of large amount and interest payment during the use of credit period. Therefore, it relatively restricts the debtor, that is, the enterprise, than commercial credit. In addition, banks and suppliers have a greater degree of participation in enterprises. In most cases, banks are the main representatives of creditors' participation in corporate governance, and they have the ability to interfere with the operation of enterprises and protect creditor assets. Therefore, its restraint on enterprises is stronger than commercial credit. Based on this, this article proposes Hypothesis 2-3:

H2-3: For high-tech enterprises, compared with commercial credit, the increase in bank borrowing financing scale has a more significant negative regulating effect on innovation investment and corporate performance.

4. Empirical Research

4.1 Study Design

Jin Liyang, director of the Shenzhen Stock Exchange Comprehensive Research Institute, once said that high-tech enterprises are mainly distributed on small and medium-sized enterprises and GEM. Therefore, the research sample in this article is the GEM and listed companies on the small and medium-sized enterprises from 2010 to 2018. In this paper, the following companies are excluded: (1) Because the accounting treatment of the financial industry is different from other industries, the financial industry data are excluded. (2) ST companies are excluded because ST companies may cause some errors in the structure; (3) Companies with missing financial data. A total of 1,604 sample companies were found to be eligible. The relevant data of the sample companies are mainly from the Guotai'an database (CSMAR) and Wind database. The R & D expenditure is collected from Juchao Information Network. The regression analysis in this article uses STATA14.0. The software Excel2007 is used for statistics and processing of data.

4.2 Model Design

4.2.1 Research on the Impact of Innovation Input on Enterprise Performance

Build a regression model based on the above assumption 1 and variable selection:

$$ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 SIZE_{it} + \beta_3 OM_{it} + \beta_4 Growth_{it} + \beta_5 BPS_{it} + \varepsilon \quad (1)$$

Among them, β0 constant terms, βi (i = 1, 2, 3, 4, 5) are coefficients, and ε is a random error term. The meanings of other variables are shown in Table 1

Table 1: Variable definition table

Variable type	Variable name	Variable code	Variable description
Explained variable	Return on Assets	ROA	Net profit / total assets at the end of the year
Explanatory variables	R	RDit	Logarithm of R & D investment in the year
Moderator	Assets and liabilities	LEV	Total liabilities for the current year / total assets at the end of the year
	Corporate bond size	BOND	Bonds payable for the year / total assets at the end of the year
	Bank loan ratio	BD	(Short-term borrowing of the year + long-term borrowing of the year) / total assets at the end of the year
	Long term loan	LD	Long-term borrowings for the current year / total assets at the end of the year
	short-term loan	SD	Current short-term borrowings / year-end total assets
	Commercial credit	TC	(Account payable for the current year + bills payable for the current year + advance receipts for the current year) / total assets at the end of the year
Control variable	Enterprise size	SIZE	Natural logarithm of total assets at the end of the year
	OPE	OM	Main business profit / Main business income
	Business growth ability	GROWTH	(This year's operating income-last year's operating income) / last year's operating income
	Net assets per share	BPS	Shareholders' equity / total shares

4.2.2 Moderating effect of debt financing on innovation input and corporate performance

Based on model (1), this study adds the adjusted variable asset-liability ratio (LEV) and its interaction term with innovation input (LEV * RDit) to build a model to verify hypothesis 2:

$$\begin{cases} ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 LEV_{it} + \beta_3 SIZE_{it} \\ \qquad + \beta_4 OM_{it} + \beta_5 GROWTH_{it} + \beta_6 BPS_{it} + \varepsilon \quad ① \\ ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 LEV_{it} + \beta_3 LEV_{it} * RD_{it} \\ \qquad + \beta_4 SIZE_{it} + \beta_5 OM_{it} + \beta_6 GROWTH_{it} + \beta_7 BPS_{it} + \varepsilon ② \end{cases} \quad (2)$$

In the same way, BOND, BD, TC, LD, SD, and the interaction terms with R & D investment RDit are built in order. The specific model is as follows:

$$\begin{cases} ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 BOND_{it} + \beta_3 SIZE_{it} \\ \qquad + \beta_4 OM_{it} + \beta_5 GROWTH_{it} + \beta_6 BPS_{it} + \varepsilon \quad ① \\ ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 BOND_{it} + \beta_3 BOND_{it} * RD_{it} \\ \qquad + \beta_4 SIZE_{it} + \beta_5 OM_{it} + \beta_6 GROWTH_{it} + \beta_7 BPS_{it} + \varepsilon ② \end{cases} \quad (3)$$

$$\begin{cases} ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 BD_{it} + \beta_3 SIZE_i \\ \qquad + \beta_4 OM_{it} + \beta_5 GROWTH_{it} + \beta_6 BPS_{it} + \varepsilon \quad ① \\ ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 BD_{it} + \beta_3 BD_{it} * RD_{it} \\ \qquad + \beta_4 SIZE_{it} + \beta_5 OM_{it} + \beta_6 GROWTH_{it} + \beta_7 BPS_{it} + \varepsilon ② \end{cases} \quad (4)$$

$$\begin{cases} ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 LD + \beta_3 SIZE \\ \qquad + \beta_4 OM + \beta_5 GROWTH + \beta_6 BPS + \varepsilon \quad ① \\ ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 LD_{it} + \beta_3 LD_{it} * RD_{it} \\ \qquad + \beta_4 SIZE_{it} + \beta_5 OM_{it} + \beta_6 GROWTH_{it} + \beta_7 BPS_{it} + \varepsilon ② \end{cases} \quad (5)$$

$$\begin{cases} ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 SD_{it} + \beta_3 SIZE_{it} \\ \quad + \beta_4 OM_{it} + \beta_5 GROWTH_{it} + \beta_6 BPS_{it} + \varepsilon \quad ① \\ ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 SD_{it} + \beta_3 SD_{it} * RD_{it} \\ \quad + \beta_4 SIZE_{it} + \beta_5 OM_{it} + \beta_6 GROWTH_{it} + \beta_7 BPS_{it} + \varepsilon \ ② \end{cases} \tag{6}$$

$$\begin{cases} ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 TC_{it} + \beta_3 SIZE_{it} \\ \quad + \beta_4 OM_{it} + \beta_5 GROWTH_{it} + \beta_6 BPS_{it} + \varepsilon \quad ① \\ ROA = \beta_0 + \beta_1 RD_{it} + \beta_2 TC_{it} + \beta_3 TC_{it} * RD_{it} \\ \quad + \beta_4 SIZE_{it} + \beta_5 OM_{it} + \beta_6 GROWTH_{it} + \beta_7 BPS_{it} + \varepsilon \ ② \end{cases} \tag{7}$$

The hypothesis 2-1 is verified by comparing the interaction term coefficients of models (3) and (4), and the correlation coefficients of comparison models (5) and (6) are used to verify hypothesis 2-2. The correlation coefficient is used to verify the hypothesis 2-3.

4.3 Analysis of Empirical Results

4.3.1 Descriptive Statistics

Table 2 lists the minimum, maximum, mean, standard deviation, and median of the relevant variables. From the statistical analysis results in Table 2, it can be known that the standard deviation of the ROA of the total assets of the research sample from 2010 to 2018 is 4.645%, which indicates that the differentiation of corporate performance is more serious. By observing the index RDit, it can be inferred that the average value of R & D investment is less than the median, indicating that the R & D investment of most high-tech enterprises in China has reached an average level, and enterprises pay more attention to R & D investment.

Table 2: Descriptive statistics

variable	Minimum value	Maximum value	Mean standard	Standard deviation	Median
ROA	-138.734	86.312	4.645	7.296	4.794
RDit	0	22.867	15.991	5.072	17.366
LEV	0.752	168.526	33.579	18.974	31.075
BOND	0	37.474	0.939	3.315	0
BD	0	75.154	10.653	11.771	6.874
LD	0	67.796	2.125	4.793	0
SD	0	75.154	8.528	10.034	5.031
TC	0	74.493	14.062	10.461	11.669
SIZE	18.523	27.741	21.516	0.971	21.411
GROWTH	-99.865	14543.41	27.329	248.209	12.697
BPS	-4.831	55.021	5.251	3.148	4.577
OM	-33088.9	173.786	5.492	323.845	10.024

Table 3: Variable correlation analysis

	ROA	RDit	LEV	BOND	BD	LD	SD	TC
ROA	1							
RDit	0.019**	1						
LEV	-0.331***	0.059***	1					
BOND	-0.091***	0.061***	0.274***	1				
BD	-0.256***	-0.001	0.709***	0.072***	1			
LD	-0.116***	-0.006	0.412***	0.073***	0.541***	1		
SD	-0.245***	0.0026	0.636***	0.049***	0.916***	0.157***	1	
TC	-0.133***	0.046***	0.577***	-0.005	0.064***	0.008	0.071***	1

Note: ** represents a significant correlation at the 5% level, and *** represents a significant correlation at the 1% level.

By observing the adjustment variables LEV, BOND, BD, LD, SD, and TC, it is found that the differences in debt financing between different companies are relatively large, and the average level of each variable is relatively low, indicating that the debt financing ratio of high-tech enterprises in China is not high. Among them, the average BOND of bond financing is 0.939%, the average of bank borrowing BD is 10.653%, and the average value of commercial credit TC is 14.062%, which indicates that the vast majority of high-tech enterprises in China choose commercial credit for debt financing, followed by bank borrowing. Finally, financing for bonds.

By observing the control variables SIZE, GROWTH, BPS, OM. From the perspective of company size indicator SIZE, the average level of company size reaches 21.516, and the standard deviation is approximately 1, indicating

that there is only a small difference in the size of high-tech enterprises in China. From the growth indicator GROWTH, the average value is 27.329%, the maximum value is 14543.41%, the minimum value is -99.865%, the standard deviation is 248.209%, and the median is 12.697%, which reflects the high technology in China. Listed companies of companies are in a stage of rapid development, but there are also large differences in growth between companies, and some companies are far behind the average. From the perspective of BPS per share, the difference between the maximum value and the minimum value is relatively low compared with several other control variables, and the average value is greater than the median value, indicating that the net assets per share of most enterprises is higher than the average level. From the perspective of the main business profit margin indicator OM, the difference between the maximum value and the minimum value is relatively large, and the average value is 5.492%, which is lower than the median of 10.024%, indicating that the profitability of the main business of most high-tech enterprises in China It has not reached the average level and the profit margin of the main business is low.

4.3.2 Correlation Analysis

Before performing regression analysis, you need to understand the closeness of the relationship between independent variables, dependent variables, and adjusted variables. Therefore, this article first analyzes the correlation of each variable.

From Table 3, we can see that there is a significant positive correlation between innovation input and corporate performance, and a significant negative correlation between moderator variables and corporate performance. In general, the relationship between the variables initially meets the assumptions of this article.

4.3.3 Regression Results and Analysis

After correlation analysis, we have a preliminary understanding of the relationship between the variables, and further regression analysis to get the specific form of the relationship between variables.

(1) Innovation input and corporate performance

This section performs a linear regression on the innovation input and performance indicators of high-tech enterprises from 2010 to 2018. The regression results are shown in Table 4. It can be seen from the table that the coefficient of R & D investment is positive, indicating that there is a positive correlation between innovation investment and corporate performance. The Sig values of all indicators are less than 0.01, indicating that the correlation between innovation investment and corporate performance has reached a significance level of 1%. The regression results confirm Hypothesis 1. In addition, the value of each regression independent variable VIF is greater than or equal to 1 and far less than 10, which indicates that the problem of collinearity between each variable is small. The F-test of the regression model of the impact of high-tech enterprise innovation investment on corporate performance can test whether the linear relationship of the regression model established is significant. In the table, F is the statistical value of F, and Sig. Is the value of the actual significance level P. The F value of the model is 122.04, and the Sig value is 0.000 less than 0.01. Therefore, the linear relationship of this regression model is considered significant.

Table 4: Empirical results of the impact of high-tech enterprises' innovation investment on corporate performance

variable	Standard coefficient	T	Sig.	Collinear diagnosis	
				Tolerance	VIF
RDit	0.0040	3.39	0.001	0.954332	1.05
SIZE	0.0853	-8.22	0.000	0.937958	1.07
GROWTH	0.0003	4.60	0.000	0.980822	1.02
BPS	0.0248	21.24	0.000	0.992111	1.01
OM	0.0002	8.97	0.000	0.998671	1.00
F	122.04		0.000		

(2) Moderating effect of debt financing on the relationship between innovation input and corporate performance
Use stratified regression to test whether the modulating variables have a regulating effect. In the first step, the moderator is introduced as the independent variable (model ①); in the second step, the cross-term of innovation input and the moderator is introduced as the independent variable (model ②). Before each step of regression, determine whether there is colinearity between the variables. By observing the VIF values in Table 5, all the VIF values of the variables are lower than 10, it can be considered that the correlation between the variables is weak. The details are shown in the following table.

Table 5: VIF values

variable	model(2)		model(3)		model(4)		model(5)		model(6)		model(7)	
	①	②	①	②	①	②	①	②	①	②	①	②
RDit	1.05	7.43	1.04	1.91	1.05	2.34	1.05	2.01	1.05	1.46	1.05	3.50
LEV	1.46	2.55										
BOND			1.07	7.20								
BD					1.05	2.53						
SD							1.10	2.23				
LD									1.10	3.30		
TC											1.09	1.87
SIZE	1.47	1.47	1.12	1.12	1.07	1.07	1.12	1.12	1.17	1.17	1.14	1.14
GROWTH	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.05	1.02	1.02
BPS	1.10	1.10	1.02	1.02	1.06	1.06	1.06	1.06	1.01	1.01	1.02	1.02
OM	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
LEV*RDit		8.71										
BOND*RDit				7.83								
BD*RDit						3.72						
SD*RDit								3.09				
LD*RDit										3.65		
TC*RDit												4.34

Table 6: Regression model and results test

variable	model (2)		model (3)		model (4)		model (5)		model (6)		model (7)	
	①	②	①	②	①		①	②	①	②		
β0	-12.5***	-13.222***	20.271***	-13.222***	20.271***	-13.222***	10.169***	-13.222***	19.071***	-13.222***	12.51***	-13.222***
RDit	0.006*	0.064***	0.014***	0.017***	0.010***	0.025***	0.010***	0.021***	0.013***	0.016***	0.013***	0.028***
LEV	-0.16***	-0.133***										
BOND			-0.042***	-0.033**								
BD					-0.127***	-0.103***						
SD							-0.169***	-0.146***				
LD									-0.067***	-0.119***		
TC											-0.088***	-0.072***
SIZE	0.965***	0.945***	-0.855***	0.854***	-0.583***	0.577***	-0.305***	0.035***	-0.797***	-0.443***	-0.447***	-0.451***
GROWTH	0.002***	0.002***	0.001***	0.001***	0.001***	0.002***	0.001***	0.001	0.001***	0.002***	0.002***	0.002***
BPS	0.283***	0.288***	0.511***	0.511***	0.412***	0.413***	0.408***	0.025***	0.513***	0.512***	0.497***	0.498***
OM	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.001***	0.002***	0.002***	0.002***	0.002***
LEV*RDit		-0.002***										
BOND*RDit				-0.0005								
BD*RDit						-0.0013***						
SD*RDit								-0.0012***				
LD*RDit										-0.002**		
TC*RDit												-0.0008***
F	111.44***	95.57***	184.49***	159.95***	183.08***	158.22***	97.84***	96.94***	112.59***	96.94***	117.02***	107.98***

Note: ***, **, * indicate significant at 1%, 5%, and 10% levels, respectively.

From Table 6, we can see that the linear regression of debt financing and corporate performance in model (2) is significantly negative at the level of 1%. Hypothesis H2 is verified. It can be seen in model (3) that bond financing has a significant negative impact on corporate performance at the level of 1%, although the interaction term coefficient between bond financing and innovation input in model (3) is -0.0005, which shows that innovation The negative regulating effect of inputs and corporate performance, but not significant, shows that bond financing is not a regulating variable. Assumption 2-1 has not been verified. From model (4), it can be obtained that borrowing

financing is significantly negatively related to corporate performance, and the interaction term between innovation input and borrowing financing is significantly negative at the level of 1%, indicating that the increase in borrowing financing has a relationship with innovation investment and corporate performance. To the negative regulatory effect. In model (5) and model (6), the interaction coefficients of short-term borrowing and long-term borrowing are -0.0012 and -0.002, respectively. It can be obtained that the negative regulating effect of long-term borrowing is shorter than short-term borrowing. Hypothesis 2-2 is verified. Finally, through comparison, it is found that the interaction term coefficient of loan financing is -0.0013, and the interaction term coefficient of commercial credit is -0.0008 (significant at the level of 5%). It can be obtained that the negative adjustment effect of loan financing is negative than that of commercial credit financing. The regulatory effect is more pronounced, and Hypothesis 2-3 is verified.

5. Research Conclusions

This paper uses the panel data of Chinese high-tech enterprises from 2010 to 2018 to examine the relationship between innovation input and corporate performance and the regulatory effect of debt financing on innovation input and corporate performance. Through descriptive statistics on the innovation input of high-tech enterprises, we can find that there is a large gap in innovation input among different companies, and even more, no innovation input. Through empirical research, it is found that innovation input has a significant positive impact on corporate performance, and debt financing has a significant negative regulatory effect on innovation input and corporate performance. Later, debt financing was further divided into bond financing, long-term and short-term borrowing, and business. Credit, by observing the correlation coefficient of the above variables, it is found that although bond financing has a negative regulatory effect, it is not significant. This may be because most high-tech companies have a bond financing rate of 0, so the relationship between innovation investment and corporate performance The adjustment effect is not obvious; by observing the correlation coefficient between borrowing financing and commercial credit financing, it is found that borrowing financing has a more significant negative regulating effect than commercial credit financing. After further observing the correlation coefficient between long-term and short-term borrowing, it is found that long-term borrowing is more negative than short-term borrowing. The regulation effect is more significant. Therefore, this article proposes that when high-tech enterprises carry out debt financing, the financing sequence is: commercial credit financing, short-term borrowing, and long-term borrowing.

Based on the findings of this article, we propose the following policy recommendations: First, increase investment in innovation reasonably. If high-tech enterprises want to become a fast-growing market player, they must focus on improving business efficiency, maintaining healthy and rapid growth, and increasing their investment strength in innovative activities. If high-tech enterprises can maintain the continuous growth of their sales income and net profit, they will have sufficient potential and financial strength to invest in innovation activities and enhance their innovation capabilities. Conversely, an increased investment in innovation by an enterprise can improve its performance and bring greater benefits to shareholders, thereby prompting more potential investors to invest in the enterprise, accelerating its growth, and achieving a virtuous circle. Second, regulate the use of business credit. From the research conclusions in this paper, we can see that commercial credit has the smallest negative regulation effect on corporate innovation investment and corporate performance. However, the use of commercial credit in China's enterprises is still not standardized. This is one of the reasons for negative regulation of commercial credit. The state should formulate relevant policies to help enterprises standardize the use of commercial credit and enhance the positive regulatory role of commercial credit in the process of corporate investment in innovation. Third, adjust the long-term and short-term loan structure of enterprises. An empirical analysis of the long-term and short-term borrowings of banks found that the negative adjustment of short-term borrowings is smaller than long-term borrowings. The main reason for this result is that short-term borrowings are more effective in suppressing underinvestment and overinvestment of enterprises than long-term borrowing Behavior, thereby reducing agency costs. Although the negative regulation effect of short-term borrowings is smaller, enterprises should still adjust the long- and short-term borrowing structure according to their own conditions, and the government should also strengthen the debt restraint mechanism. Fourth, cultivate an active bond market and establish a sound corporate credit evaluation system. Empirical research has found that most high-tech companies have zero bond financing. Therefore, the government is obliged to continue to promote the establishment and improvement of relevant systems in the bond market. (1) Simplifying the approval process for corporate bonds issuance, which has a direct positive effect on shortening the issuance declaration time and improving efficiency, and can also play a good role in enhancing the liquidity and activity of the bond market. (2) Provide greater support and preferences to companies that purchase bonds in the policy system, and encourage companies to conduct benign bond financing.

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