

Research on Commercial Credit, Financial Development and R&D Investment of Listed Companies

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Abstract: R&D investment is an indispensable step in innovation activities, and how to ensure the stability of capital chain is an important problem to be solved in R&D investment. Compared with external indirect financing, commercial credit in the form of installment payment and down payment, which is directly related to commodity trading, has become one of the financing channels with low cost and high efficiency. This paper takes the listed companies from 2010 to 2020 as samples, from the perspective of R&D investment, introduces financial development into the research, and studies the impact on the commercial credit of listed companies from macro and micro levels. Furthermore, the cross-product term is introduced to empirically test the influence of different financial development levels on the relationship between R&D investment and commercial credit acquisition and provision. The results show that the higher the level of financial development, the greater the role of technological innovation investment in promoting enterprises to obtain commercial credit, and the improvement of financial development level can alleviate the reverse relationship between R&D investment and commercial credit provision.

1. Introduction

Economic transformation means the optimal allocation of all resources and the regeneration of production capacity, while the regeneration of production capacity depends on the innovation activities of individual enterprises. According to this research viewpoint, the purpose of commercial credit is to increase the liquidity of enterprises, rather than technological innovation, which indirectly leads to the investment of R&D funds. Literature [1] takes China's transition economy as the research background, and finds that commercial credit in the form of informal finance is an important financing source for Chinese enterprises' R&D investment. Different from the degree of information asymmetry of enterprises under the level of financial development, the difficulty of financing is different, which affects the provision and acquisition of business credit of enterprises. The improvement of financial development level promotes the growth and competition of financial institutions, which makes it easier for enterprises to obtain monetary funds and credit from financial institutions, and has sufficient funds to provide commercial credit. Therefore, this paper argues that commercial credit has a double impact on R&D investment of enterprises. In addition, enterprises are living organizations, and the market environment they face from birth to maturity is different, which will lead them to adopt different strategies for R&D investment [2].

On the basis of domestic and foreign scholars' research, this paper takes the data of listed companies in China from 2010 to 2020 as research samples, establishes a multiple regression model, and studies the influence of R&D investment and financial development on commercial credit through empirical analysis, and also focuses on the moderating effect of financial development level on the relationship between them. By summarizing the results of empirical analysis, this paper puts forward policy suggestions for listed companies from different angles, and analyzes the shortcomings of this study and prospects for future research.

2. Theoretical basis and research hypothesis

2.1. Theoretical basis

(1) Mercantile credit

Commercial credit refers to the credit provided by enterprises in the form of deferred payment and down payment, which is directly related to commodity trading. Generally speaking, the main function of commercial credit is to expand sales and meet business needs. As a form of natural financing, commercial credit has no financing cost if there is no cash discount or interest payment, so it becomes a convenient and efficient financing method.

The redistribution theory of commercial credit refers to the redistribution of monetary funds, in which enterprises that can obtain more bank credit pass their own bank credit to enterprises that need funds through the business motivation and financing motivation of commercial credit. Literature [3] found that commercial credit financing can alleviate the financial constraints of enterprises and effectively increase the investment in R&D funds of small and medium-sized scientific and technological enterprises. Literature [4] finds that there is a significant positive correlation between commercial credit obtained by listed companies and their R&D investment, which is more obvious in private listed companies and monetary tightening period.

(2) Financial development

Shaw put forward the financial deepening theory [5]. The key of the financial deepening theory is the growth of savings and investment and the improvement of financial efficiency, which can be interpreted from two aspects. First, in developing countries, the government should reduce the intervention in financial markets and let them give full play to the function of resource allocation. On the other hand, with the continuous development of financial markets, investment and savings are increasing, capital formation is accelerating and national income is increasing. The theory of financial function was put forward by Merton and Bodie in 1990s. In the process of economic development, the influence of financial system on the improvement of economic level is mainly manifested through its function.

(3) R&D investment

R&D investment is an important investment activity of enterprises, which plays an important role in improving the competitiveness of enterprises. When studying R&D investment, scholars at home and abroad find that rational creditors will reduce their investment in R&D activities because of the high risk of R&D, which leads to such a situation that the asset-liability ratio of enterprises with high R&D intensity is relatively low. As one of the sources of liabilities, the relationship between commercial credit and R&D investment is controversial. Literature [7] pointed out that compared with bank credit, it is more difficult for commercial credit to provide a source of funds for high-risk R&D investment because of its small single fund and scattered distribution, and R&D investment is negatively correlated with commercial credit; Literature [8] points out that compared with bank credit, commercial credit can alleviate information asymmetry to a certain extent because of its comparative advantage in financing, so it can be a better source of financing for R&D investment.

2.2. Research hypothesis

Hypothesis 1: R&D investment can positively promote commercial credit.

On the indirect impact of R&D investment on commercial credit, some scholars believe that the relationship between R&D investment and commercial credit is affected by the third factor, and they are not a simple linear relationship. Literature [9] points out that from the perspective of price discrimination theory, commercial credit is a relatively expensive short-term financing method compared with modern banking, so enterprises only use commercial credit when they need more short-term external financing than financial institutions provide. In other words, R&D investment has little impact on commercial credit when there is little or no financing constraint.

Hypothesis 2: There is a significant positive correlation between financial development level and commercial credit provision.

From the perspective of providing commercial credit, the influence of financial development on

the provision of commercial credit is mainly based on the relationship between financial development and bank credit and the redistribution theory of commercial credit. With the improvement of financial development level, enterprises can obtain more bank loans, and higher credit supply level means that enterprises can provide more funds for commercial credit. Studies have found that under the condition of the development of financial market, listed companies provide more commercial credit.

Hypothesis 3: The level of financial development alleviates the reverse relationship between R&D investment and commercial credit provision.

Enterprises with higher investment in technological innovation have a strong position relative to customers due to their high financing demand and competitive advantage of products brought by innovation, and will choose to provide less commercial credit to customers. From the customer's point of view, the higher the financial development, the more timely the information transmission, the higher the degree of product market development, the lower the switching cost of customer procurement, and their bargaining power is also enhanced, which can win the game with suppliers.

3. Research design

3.1. Sample selection

The variable data used in this paper comes from CSMAR database, taking the non-financial A-share companies, GEM companies and small and medium-sized board listed companies in Shenzhen and Shanghai from 2010 to 2020 as samples, and then excluding ST companies and companies with missing data, 2 130 observed values are obtained.

3.2. Variable selection

3.2.1. Interpreted variable

Commercial credit refers to the trade between enterprises and upstream suppliers and downstream customers through accounts receivable and payable, which includes two mechanisms: obtaining commercial credit and providing commercial credit.

Commercial credit acquisition refers to the credit that an enterprise obtains from a supplier by taking up the supplier's payment in the form of deferred payment, which is indicated by AP in this paper. Commercial credit is the capital provided by enterprises to downstream customers by allowing customers to delay payment, and it is the credit provided by enterprises to customers, which is represented by AR in this paper.

3.2.2. Explanatory variable

(1) R&D investment

R&D investment is the recombination of production factors and production conditions. R&D investment in technological innovation is the beginning and power source of enterprise innovation activities, and it is also an important content of economic and accounting research on technological innovation. In this paper, RDS is used.

(2) Financial development

In this paper, the financial development is measured with reference to the data in document [8], and the sub-index "Marketization of Financial Industry" under the index "Development Degree of Factor Market" is adopted. The financial industry marketization index consists of two indexes: "Competition of Financial Industry" and "Marketization of Credit Fund Distribution". In this paper, FIN is used.

3.2.3. Control variable

(1) Enterprise nature

Introducing virtual variables, when the actual controller of the enterprise is state-owned, $STATE = 1$; When the actual controller of the enterprise is not state-owned, $STATE = 0$. This

article is represented by *STATE* .

(2) Enterprise scale

In this paper, the natural logarithm of the total assets of an enterprise is selected to measure the scale of an enterprise. Commercial credit will be more easily obtained as the scale of the enterprise becomes larger, and enterprises with the same scale will be able to provide more commercial credit. In this paper, *SIZE* is used.

(3) Enterprise life

This paper uses the year of enterprise balance sheet report minus the year of enterprise establishment to measure the years of enterprise. This paper is expressed by *AGE* .

(4) Enterprise growth

Measure the growth of enterprises with the growth rate of business income. In this paper, *GROWTH* is used.

(5) Profitability

This article uses the company's net sales margin to measure the company's profitability. This article uses *PROFIT* to express.

(6) Debt level

In this paper, the debt level of an enterprise is measured by its asset-liability ratio, which can reflect its financial risks to a certain extent. In this paper, *LEV* is used.

(7) Inventory level

Inventory turnover rate is the ratio of business cost to average inventory balance, which can reflect the turnover rate of inventory. In this paper, *INV* is used.

3.3. Model building

This paper constructs a model 1 to verify research hypothesis 1:

$$RDS = \alpha_0 + \alpha_1 FIN + \alpha_2 FIN^2 + \alpha_3 SIZE + \alpha_4 PROFIT + \alpha_5 GROWTH + \alpha_6 FIN + \alpha_7 LEV + \varepsilon \quad (1)$$

In order to test Hypothesis 2 and investigate the relationship between financial development and commercial credit acquisition and provision, Model 2 is established as follows:

$$AP/AR = \alpha + \alpha_1 FIN + \alpha_2 STATE + \alpha_3 SIZE + \alpha_4 AGE + \alpha_5 GROWTH + \alpha_6 PROFIN + \alpha_7 LEV + \alpha_8 INV + \varepsilon \quad (2)$$

In order to test Hypothesis 3 and examine the moderating effect of financial development on the relationship between R&D investment and commercial credit acquisition and provision, Model 3 is established as follows:

$$AP/AR = \alpha + \alpha_1 RDS + \alpha_2 FIN + \alpha_3 RDS * FIN + \alpha_4 STATE + \alpha_5 SIZE + \alpha_6 AGE + \alpha_7 GROWTH + \alpha_8 PROFIN + \alpha_9 LEV + \alpha_{10} INV + \varepsilon \quad (3)$$

In the above formulas (1), (2) and (3), *AP* represents commercial credit acquisition, *AR* represents commercial credit provision, and α is a constant term, which is independent of various factors. ε is the random error term.

4. Empirical results and analysis

4.1. Descriptive statistic

Descriptive statistics are made on the main variables in this paper. The statistical results are shown in Table 1, which mainly include the number, maximum value, minimum value, mean value and standard deviation of variables.

Table 1 Descriptive system of main variables

Variable	Maximum	Minimum value	Mean value	Standard deviation
<i>AP</i>	25.36	0.88	9.34	6.63
<i>AR</i>	20.25	0.62	7.78	5.52
<i>RDS</i>	5.11	0.03	1.49	1.66
<i>FIN</i>	10.20	3.6	6.88	1.87
<i>STATE</i>	1	0	0.24	1.02
<i>SIZE</i>	22.36	18.96	20.14	0.87
<i>AGE</i>	20	-27.24	14.31	3.31
<i>GROWTH</i>	-25.01	-14.36	12.08	9.92
<i>PROFIT</i>	31.24	-11.66	5.88	9.17
<i>LEV</i>	12.40	12.73	40.27	15.67
<i>INV</i>	14.83	0.55	3.99	4.02

According to descriptive statistics, the maximum value of commercial credit acquisition (*AP*) is 25.36%, the minimum value is 0.88%, and the average value is 9.34%, while the maximum value of commercial credit provision (*AR*) is 20.25%, the minimum value is 0.62%, and the average value is 7.78%. This shows that the commercial credit level of listed companies is low, which can not give full play to the financing function and promotion function of commercial credit.

R&D investment (*RDS*) has a maximum value of 5.11%, a minimum value of 0.03% and an average value of 1.49%. There is little difference in R&D investment intensity among different listed companies, and the level of technological innovation is relatively consistent. This shows that China's listed companies have low investment in technological innovation, and most companies lack the awareness and ability of technological innovation.

The financial development level (*FIN*) has a maximum value of 10.20 and a minimum value of 3.6, indicating that there are significant differences in the financial development level among provinces and cities in China.

4.2. Correlation analysis

Correlation analysis is carried out among variables of sample data, and the analysis results are shown in Table 2.

According to the results of correlation coefficient:

The correlation coefficient between R&D investment (*RDS*) and commercial credit acquisition (*AR*) is 0.090, which is significantly positively correlated at the level of 10%, which is consistent with the expectation of H1 in this paper.

The correlation coefficient between financial development (*FIN*) and commercial credit acquisition (*AP*) is 0.496, which is positively correlated at the level of 1%, which is consistent with the expected direction of H2 and H3 in this paper.

In this paper, the correlation coefficients between other control variables are relatively small, all less than 0.4, indicating that there will be no serious multicollinearity problem between other control variables.

4.3. Regression analysis

As pointed out in the previous theoretical analysis, financial development and commercial credit can effectively improve the R&D expenditure level. Table 3 shows the grouping regression results.

It can be seen from Table 3 that when the financial development and commercial credit of commercial banks are separately investigated on the investment in the research stage, there is no significant difference between the results and the above results, and they are all positively related, that is, both commercial banks and commercial credit are important capital sources for enterprises to invest in research activities.

Table 3 Regression results of financial development, commercial credit and r&d investment

Variable	AP		AR	
	Coefficient	P value	Coefficient	P value
<i>RDS</i>	0.83***	0.00	-0.41***	0.001
<i>FIN</i>	1.13***	0.00	1.47***	0.00
<i>RDS * FIN</i>	0.37***	0.00	0.21***	0.82
<i>STATE</i>	-2.01	0.71	-0.16	0.12
<i>SIZE</i>	2.16***	0.00	-0.47	0.46
<i>AGE</i>	-0.02***	0.86	0.05	0.55
<i>GROWTH</i>	0.02***	0.00	-0.006	0.58
<i>PROFIT</i>	-0.16	0.00	0.03	0.51
<i>LEV</i>	-0.01***	0.27	0.01	0.46
<i>INV</i>	-0.55	0.00	-0.19***	0.07

By the same token, when the financial development and commercial credit of commercial banks are separately investigated, both commercial banks and commercial credit are important capital sources for enterprises to invest in development activities. It can be found that although the overall positive correlation has not changed, there are subtle differences in their roles. Just as the author mentioned in the hypothesis that commercial banks finance enterprises through credit policies, the higher the development degree of financial markets, the better the R&D investment level.

4.4. Robustness test

In order to verify the robustness of the research conclusion, this paper uses the ratio of accounts payable to total assets as a substitute variable of commercial credit financing. In addition, the enterprise scale is represented by the natural logarithm of the total number of employees instead of the natural logarithm of the total assets of the enterprise, and the regression results are basically the same, which supports H1, H2 and H3, indicating the robustness of this research conclusion.

5. Conclusion and suggestion

5.1. Conclusion

The research results of this paper mainly include:

(1) Cash flow generated by listed companies is one of the important capital sources of R&D investment, and large-scale enterprises have stronger innovation power and strength, and with the improvement of R&D investment tendency, the R&D investment degree also deepens.

(2) Commercial credit has a significant positive effect on R&D investment of listed companies. The more commercial credit a listed company obtains, the more R&D investment it has.

(3) The level of financial development plays a regulatory role in the relationship between R&D investment and commercial credit acquisition and provision. The higher the level of financial development, the greater the role of technological innovation investment in promoting enterprises to obtain commercial credit. With the improvement of financial development level, the relationship between R&D investment and commercial credit provision will be alleviated.

5.2. Suggestion

According to the above research conclusions, this paper puts forward the following three suggestions:

(1) When it is difficult for the internal resources of enterprises to provide capital support for R&D activities continuously, the government should focus on promoting the marketization level of commercial banking financial industry and diversifying the financing channels for R&D investment of enterprises.

(2) Commercial credit has become a more effective financing method for listed companies. Among listed companies, the average level of commercial credit in total assets is lower than that of

state-owned listed companies.

(3) Establish a sound financial market development and promote the balance of financial development in various regions. The level of financial development will affect the provision and acquisition of business credit. It is necessary to promote the reform of financial system, promote the development of financial market, improve the level of financial development, speed up the process of marketization of financial industry and make the financial market benign.

5.3. Research deficiency and prospect

In the research process, there are some shortcomings due to various objective factors, which need to be improved in future research. For example, due to the update of the database of Chinese industrial enterprises, the time span of selecting more samples is short, and the data problems of the database of industrial enterprises may cause some errors in the research conclusions of this paper. There may be some missing variables in the selection of control variables.

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Table 2 Correlation analysis results

	<i>AP</i>	<i>AR</i>	<i>RDS</i>	<i>FIN</i>	<i>STATE</i>	<i>SIZE</i>	<i>AGE</i>	<i>GROWTH</i>	<i>PROFIT</i>	<i>LEV</i>	<i>INV</i>
<i>AP</i>	1										
<i>AR</i>	0.63***	1									
<i>RDS</i>	0.08*	-0.23***	1								
<i>FIN</i>	0.46***	0.71***	-0.22***	1							
<i>STATE</i>	0.15***	0.26***	0.74	0.24	1						
<i>SIZE</i>	0.12**	-0.18***	0.23**	-0.15	0.11**	1					
<i>AGE</i>	-0.03	-0.007	-0.18***	-0.02	0.03	0.17**	1				
<i>GROWTH</i>	0.17***	-0.08*	-0.006***	-0.09	-0.17**	-0.13**	-0.18	1			
<i>PROFIT</i>	-0.08*	-0.05**	-0.008	-0.13***	-0.21**	0.11	-0.008***	0.14*	1		
<i>LEV</i>	0.16***	0.14***	-0.22**	0.005***	0.29	-0.06	0.07**	0.06*	-0.34***	1	
<i>INV</i>	-0.33***	-0.31***	-0.16**	-0.33***	-0.20**	0.14	-0.001**	0.11**	-0.22**	-0.06***	1

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