

Influence of Financing Constraints on Corporate Innovation Investment

Binhan Li

Yunnan University, Kunming, Yunnan, 650091, China

Abstract

Based on the data of Shanghai and Shenzhen A-share listed companies from 2016 to 2020, this paper empirically examines the relationship between financing constraints and corporate innovation investment, as well as the impact of the heterogeneity of enterprise size and organizational form on the relationship between the two. The research results show that there is a significant "inverted U-shaped" relationship between financing constraints and corporate innovation investment. The micro-enterprises studied in terms of enterprise scale, as well as the Sino-foreign joint ventures and collective enterprises studied in terms of organizational form, their innovation investment is more significantly affected by financing constraints. In view of this, when facing financing constraints beyond the scope of control, enterprises themselves should also actively broaden financing channels and improve their own risk-bearing capabilities.

Keywords

Financing Constraints; Corporate Innovation Investment; Inverted U-shaped Relationship; Enterprise Scale; Organizational Form.

1. Introduction

With the structural slowdown of the economy, the marginal utility of traditional demand management policies diminishes, and the input of production factors can no longer support rapid economic growth. With the new round of technological revolution sweeping the world, the knowledge economy explodes in the era of digital economy, and information is highly transparent, making innovation one of the capabilities that companies have to have to deal with rapidly changing markets. The Fifth Plenary Session of the Nineteenth Central Committee of the Communist Party of China clearly stated that "insist on the core position of innovation in the overall situation of my country's modernization drive" and "to enhance the technological innovation capabilities of enterprises". At the same time, in order to cope with the impact of the new crown pneumonia epidemic and the negative impact of the trade war, and to achieve economic and social development goals and tasks, my country urgently needs to accelerate the implementation of an innovation-driven development strategy to achieve sustainable economic growth led by high-quality innovation.

Under the background of economic globalization, the only way for enterprises to maintain long-term advantages in the fierce market competition is to continuously innovate. Therefore, studying corporate innovation and related issues has important practical significance and social value. Combining existing research, the factors affecting corporate innovation can be divided into internal and external factors. The internal factors mainly include, leverage ratio [1], manager cognition [2], internal enterprise Control [3], etc., external factors mainly include macro-industrial policies [4], media pressure [5] government subsidies [6], etc. Because technological innovation requires the support of a large and stable cash flow, and may face the risk that R&D results cannot be implemented or commercialized in the short term, when

companies face strong financing constraints, they tend to reduce high-risk, high-cost innovation expenditures. Instead of investing funds in "short, flat and fast" projects, the R&D incentives of enterprises are suppressed, resulting in a low level of R&D investment.

It is generally believed that financing constraints have two influences on corporate innovation: promotion and suppression. Some studies believe that: First, due to lack of funds, companies subject to financing constraints will invest R&D funds in projects with the highest return on income, reducing inefficient innovation activities, thereby improving the innovation efficiency of enterprises. Second, when facing financing constraints, companies will optimize investment strategies and reduce long-term R&D investment, and prefer to invest in short-term R&D projects to avoid the impact of the macroeconomic environment on innovation returns, thereby bringing higher innovation output [7]. But more studies believe that: First, companies with more financial resources will carry out more innovative activities. Second, due to the high risk of innovation activities, the uncertainty of output results, positive externalities and confidentiality, the degree of information asymmetry has deepened [8]. Enterprises cannot clearly identify the financing constraints they are facing, which leads to financing constraints hindering the innovation input and output of enterprises.

In view of this, this article takes the Shanghai and Shenzhen A-share listed companies from 2016 to 2020 as the research object to examine the impact of financing constraints on corporate innovation. The study found that: financing constraints and the innovation investment of enterprises present an inverted U-shaped relationship, which is a trend that promotes first and then inhibits; at the same time, this paper conducts a grouping test according to the organizational form and company size, and the results show that the impact of financing constraints on corporate innovation is in Sino-foreign joint ventures. It is more significant in enterprises and collective enterprises, and compared with large companies, micro-enterprises are more significantly affected.

The marginal contribution of this article is mainly reflected in two points. First, unlike most scholars who believe that financing constraints have an inhibitory effect on corporate innovation investment, this article finds that there is not a linear relationship between financing constraints and the innovation investment of enterprises. Second, on the basis of the existing literature, this article further expands the research framework of the interaction between financing constraints and micro-firm behaviors. Starting from the company's scale and organizational form, this article deeply explores the mechanism of financing constraints on corporate innovation investment.

2. Research Design

2.1. Data Source

This paper takes Shanghai and Shenzhen A-share listed companies as the research object and constructs a panel data set for 2016-2020. The relevant company data comes from the Choice database. In order to improve the quality of the sample, this article processed the initial data as follows: (1) Excluding the samples of ST and PT enterprises; (2) Excluding the samples of enterprises with serious missing data on important variables. In addition, in order to reduce the influence of outliers on the empirical results, a 1% double-tailing treatment (Winsorize) was performed on all continuous variables. In the end, 18750 observations were obtained.

2.2. Variable Selection

2.2.1. Explained Variable-corporate Innovation

Corporate innovation is based on the development trend of market demand, making full use of and constantly optimizing its own resources, creating from all levels of the enterprise, including institutional innovation, technological innovation and management innovation. The existing

literature mainly measures corporate innovation from two dimensions: innovation input and innovation output. There are two ways to measure innovation input: (1) Absolute investment. That is, the total amount of R&D investment of the corporate. Due to the differences in profitability and scale of enterprises, using absolute investment will lead to bias, and it is unscientific to use it for comparison between enterprises. (2) Relative investment. That is, the ratio of R&D investment to operating income, and the ratio of R&D investment to total assets. There are also two ways to measure innovation output: (1) The number of patent applications or patents granted by enterprises or the number of citations. (2) The number of new products that the company has improved or developed. Considering the accuracy of current data acquisition and the maturity of measurement methods, this paper selects the ratio of R&D investment to operating income in the relative investment of innovation to measure corporate innovation.

2.2.2. Financing Constraints

Kaplan and Zingales (1997) summarized the definition of financing constraints commonly used in the literature: market incompleteness (asymmetric information, agency costs, etc.) leads to the difference between internal financing costs and external financing costs. There are three common methods for calculating financing constraints: (1) KZ index. Drawing lessons from Kaplan and Zingales (1997), the KZ index is constructed with Chinese listed companies as a sample. The larger the KZ index, the higher the degree of financing constraints faced by listed companies. (2) WW index. The Tobin q value in the KZ index, which represents a company's investment opportunities, usually has a very large measurement error, while the WW index excludes Tobin's q Value to improve accuracy. The larger the WW index, the higher the degree of enterprise financing constraints. (3) SA index. The KZ index and WW index contain many endogenous financial variables, such as cash flow and leverage. In order to avoid endogenous interference, Hadlock and Pierce (2010) used the KZ method to classify the types of enterprise financing constraints based on enterprise financial reports, and then only used two variables that did not change much with the event and had a strong exogenous nature to construct SA index. The SA index is negative, and the greater the absolute value, the higher the degree of enterprise financing constraints[9]. This article refers to the research of Zhang Xuan et al. (2017)[10] to select SA indicators. The calculation method is as the formula:

$$SA = -0.73 * Size + 0.04 * Size^2 - 0.04 * Age.$$

2.2.3. Control Variables

Table 1. Variable Description

Variable category	Variable name	Symbol	Definition
Explained variable	Corporate innovation investment	Inno	R&D investment/operating income
Core explanatory variables	Financing constraints	SA index	SA index, calculated by formula
Control variable	Company's establishment age	Age	2021- year established +1, take the natural logarithm
	Company size	Size	Natural logarithm of total assets at the end of the period
	Growth	Growth	Operating income growth rate
	Asset-liability ratio	Lev	Total liabilities/total assets at the end of the period
	Proportion of fixed assets	Fixratio	Net fixed assets/total assets
	Return on assets	ROA	Net profit/total assets at the end of the period

With reference to the research of Feng Nanping (2021) [11], this paper selects the company's establishment age, company size, growth, asset-liability ratio, fixed asset ratio, and return on assets as control variables.

2.3. Model Construction

This paper examines the nonlinear relationship between financing constraints and corporate innovation input, and builds the model as follows:

$$\text{Inno} = \alpha_0 + \alpha_1 \text{SA} + \alpha_2 \text{SA}^2 + \sum \alpha_i \text{Controls} + \varepsilon \quad (1)$$

In the formula, Inno represents the company's investment in innovation, that is, the proportion of R&D investment in operating income. SA is a corporate financing constraint variable; ε is a random interference term; Controls represents other control variables that affect corporate R&D investment, including company size (Size), asset-liability ratio (Lev), return on assets (ROA), and company's establishment year (Age), proportion of fixed assets (Fixratio), etc.

3. Empirical Results and Analysis

3.1. Descriptive Statistics and Analysis

The average value of corporate innovation investment is 0.06, the standard deviation is 0.18, the minimum value is 0, and the maximum value is 9.73, indicating that there are large differences in innovation input among enterprises. The mean and standard deviation of financing constraints are -3.96 and 0.30, respectively, indicating that the sample companies generally face financing constraints. Overall, the sample has a good degree of discrimination.

Table 2. Variable Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	Observations
Inno	0.06	0.18	0	9.73	N = 18826
SA	-3.96	0.30	-5.83	-2.68	N = 22056
SA ²	15.73	2.36	7.18	34.01	N = 22056
Age	22.64	6.18	6	67	N = 22220
Size	8.19	1.55	5.24	13.23	N = 22056
Lev	42.55	20.91	6.24	94.16	N = 22056
Fixratio	0.19	0.16	0	2.96	N = 22054
ROA	9.39	7.85	0.40	43.99	N = 21574

3.2. The Impact of Financing Constraints on Corporate Innovation Investment

Table 3 conducts an empirical test on the relationship between financing constraints and corporate innovation investment. The results show that the coefficients before the first and second terms of SA are significantly negative, and the "inverted U-shaped" relationship is established, indicating that the impact of financing constraints on the innovation investment of enterprises is first positive and then negative. The reason may be: the influence of financing constraints on the innovation investment of enterprises is an aggregate effect [12]. When the positive effect of financing constraints is greater than the negative effect it brings, the aggregate effect is positive, and vice versa. When facing moderate financing constraints, companies often optimize investment strategies and reduce long-term R&D investment, thereby promoting short-term innovation investment. At this time, because the role of negative factors is not

obvious enough, it will show a certain positive effect. With the increase in the degree of financing constraints, when the level of financing constraints has exceeded the company's control, because the level of risk-taking is greatly reduced, companies often choose to significantly reduce R&D investment, and the negative effect will offset the positive. The total effect shows a negative trend.

Table 3. Regression Results of Financing Constraints on Corporate Innovation Investment

Variable	Inno
SA	-0.5352**(0.2312)
SA ²	-0.6302**(0.0309)
Size	-0.0076*** (0.0030)
Lev	-0.00002(0.0001)
Fixratio	0.0082(0.0157)
Roa	0.0006*** (0.0002)
Cons	-1.1357*** (0.4284)
N	18750
Year FE	Yes
Ind FE	Yes

3.3. Analysis of Heterogeneity

There has been “scale discrimination” in resource allocation for a long time, which is manifested as: large-scale enterprises have larger assets, more assets that can be used for mortgage guarantee, stronger solvency, and ability to obtain external financing at a lower cost; Micro-enterprises have smaller assets, higher risk of default, and are more likely to face the dilemma of financing constraints. Table 4 reports the regression results of enterprises of different sizes. Among the four sizes of large, medium, small and micro enterprises, only micro-enterprises have significant financing constraints at the 1% statistical level. The possible explanation is that the larger the scale of the enterprise, the more the management level of the enterprise will increase, and the time for problem handling and feedback will be longer. However, the speed of product technology change is fast, so enterprises have a lag effect in the decision-making and implementation of innovation activities. Therefore, financing constraints have a more significant effect on the innovation investment of micro-enterprises.

Table 4. Analysis of Heterogeneity Based on Enterprise Scale

Variable	microenterprise	small enterprise	medium-sized enterprise	large enterprise
SA	27.7126*** (5.0423)	0.0936(0.2459)	-0.0842(0.3576)	-0.1438(0.2445)
SA ²	3.4220*** (0.6191)	0.0301(0.0355)	-0.0238(0.0498)	-0.0166(0.0321)
Size	-0.0654** (0.0207)	-0.0259** (0.0113)	0.0314*** (0.0089)	0.0011(0.0023)
lev	0.0019** (0.0007)	-0.0001(0.0001)	-0.00008(0.0002)	-0.00003(0.0001)
lev	-0.0130(0.0226)	0.0523** (0.0204)	0.0760*** (0.0232)	0.0058(0.0160)
Roa	-0.0011(0.0008)	0.0005*** (0.0002)	0.0005** (0.0002)	-0.0003* (0.0002)
Cons	56.3621*** (10.2829)	0.1572(0.4394)	-0.1386(0.6526)	-0.2686(0.4618)
N	14	651	7139	10726
Year FE	Yes	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes	Yes

State-owned enterprises have natural financing advantages due to political connections and other reasons, are easier to obtain more adequate credit resources, have lower financing

constraints, and will have more stable investment in innovation. Therefore, in order to study whether there are differences in the impact of financing constraints on the innovation investment of different organizational forms of enterprises, this article divides the organizational forms of enterprises into Sino-foreign joint ventures, state-owned enterprises, foreign-funded enterprises, private enterprises and collective enterprises. Table 5 reports the regression results of companies with different organizational forms. Among them, the financing constraints of Sino-foreign joint ventures are significant at the 1% statistical level. The financing constraints of collective enterprises are significant at the 5% statistical level. The results show that financing constraints have a more significant effect on the innovation investment of non-state-owned enterprises, especially Sino-foreign joint ventures and collective enterprises. The possible reason is that compared with state-owned enterprise, the degree of information asymmetry between non-state-owned enterprises and the financial market is higher, and the financial risks associated with enterprises are also higher, so they suffer more severe credit discrimination. Therefore, financing constraints have a more significant impact on the innovation investment of non-state-owned enterprises.

Table 5. Analysis of Heterogeneity Based on Enterprise Organizational Form

Variable	sino-foreign joint venture	state-owned enterprise	foreign-funded enterprise	private enterprise	collective enterprise
SA	-2.5065*** (0.8365)	0.0572 (0.1022)	1.4788* (0.8741)	-0.3799 (0.3086)	-5.6559** (2.0761)
SA^2	-0.3149*** (0.1161)	0.0083 (0.0132)	0.1907 (0.1210)	-0.0456 (0.0416)	-0.6956** (0.2643)
Size	0.0123 (0.0124)	-0.0014 (0.0011)	0.0027 (0.0193)	0.0103** (0.0044)	-0.0231** (0.0095)
Lev	0.0004 (0.0004)	-0.0001*** (0.00004)	-0.0003 (0.0004)	-0.00003 (0.0001)	0.0002 (0.0002)
Fixratio	0.0800 (0.0554)	0.0105* (0.0059)	-0.0806 (0.0588)	-0.0004 (0.0213)	-0.0700 (0.0475)
Roa	-0.0010* (0.0005)	-0.0001 (0.00008)	-0.0010 (0.0006)	0.0009*** (0.0002)	-0.0008 (0.0005)
Cons	-5.0045*** (1.4927)	0.1454 (0.1987)	2.9755* (1.5810)	-0.8082 (0.5701)	-11.2239*** (4.0131)
N	1225	4373	54	13055	43
Year FE	Yes	Yes	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes	Yes	Yes

4. Conclusions and Recommendations

Based on the data of my country's Shenzhen and Shanghai A-share listed companies from 2016 to 2020, this article empirically analyzes the inverted U-curve relationship between financing constraints and corporate innovation investment, and whether there is a difference in this relationship among companies of different sizes and organizational forms. The main conclusions of the research are as follows: (1) The relationship between financing constraints and corporate innovation investment is in an inverted U-shaped curve. (2) Compared with large, medium and small enterprises, the inverted U-shaped relationship between financing constraints and innovation investment in micro enterprises is more significant. (3) Compared with state-owned enterprises, the inverted U-shaped relationship between financing constraints and innovation investment in non-state-owned enterprises is more significant, especially in Sino-foreign joint ventures and collective enterprises.

This article puts forward 3 suggestions as follows:

- (1) The government can try to support and guide the development of informal finance based on new technologies with a more inclusive attitude, so as to make up for the lack of functions and efficiency losses of the formal financial system.
- (2) In the face of inherent "scale discrimination", the government can ease this problem by relaxing loan restrictions, easing financing conditions, and broadening financing channels. Enterprises themselves should also make full use of innovative resources, value and actively promote R&D innovation. At the same time, improving their own risk-bearing capacity, making decisive decisions when facing high-risk, high-yield project decisions.
- (3) The government should pay more attention to non-state-owned enterprises, use digital technology to effectively solve the problem of information asymmetry, and reduce financing transaction costs. Enterprises themselves should also identify innovative projects based on their own development strategies, strengthen the innovation financing information disclosure mechanism and the establishment of corporate credit rating systems, and reduce the information asymmetry between enterprises and external investors.

References

- [1] Wang Yuze, Luo Nengsheng, Liu Wenbin. What kind of leverage ratio is conducive to corporate innovation[J]. China Industrial Economy, 2019(03): 138-155.
- [2] Yu Hao, Shen Ying. Research on the relationship between manager's cognition and corporate performance--based on the mediating role of dual innovation[J/OL]. Science and Technology and Economy, 2021(04):76-80[2021-08- 28].<https://doi.org/10.14059/j.cnki.cn32-1276n>. 2021. 04. 014.
- [3] Peng Xiaoxue. Research on Corporate Social Responsibility, Internal Control and Innovation Performance [J]. Hebei Enterprise, 2021(08): 41-43.
- [4] Li Wenjing, Zheng Manni. Substantial innovation or strategic innovation?-The impact of macro-industrial policies on micro-enterprise innovation[J]. Economic Research, 2016, 51(04): 60-73.
- [5] Yang Daoguang, Chen Hanwen, Liu Qiliang. Media pressure and corporate innovation [J]. Economic Research, 2017, 52(08): 125-139.
- [6] Wang Tong. Government subsidies, equity pledge and enterprise innovation investment[J]. Accounting Study, 2021(23): 159-161.
- [7] Financing Constraints and Corporate Investment[J]. Brookings Papers on Economic Activity, 1988, 1988 (1).
- [8] Georgios Efthymoulou, Priit Vahter. Financial Constraints, Innovation Performance and Sectoral Disaggregation*[J]. The Manchester School, 2016, 84(2).
- [9] Charles J. Hadlock, Joshua R. Pierce. New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index[J]. The Review of Financial Studies, 2010, 23(5).
- [10] Zhang Xuan, Liu Beibei, Wang Ting, Li Chuntao. Credit rent-seeking, financing constraints and enterprise innovation [J]. Economic Research, 2017, 52(05): 161-174.
- [11] Feng Nanping, Wang Zhiying, Wei Fenfen. Research on the Relationship between Enterprise Technology Innovation, Management Innovation and Financing Mode: Evidence from Chinese Manufacturing Enterprises [J]. East China Economic Management, 2021, 35(09):1-10.
- [12] Zhang Haili. Financing constraints, executive financial linkages and high-tech enterprise innovation performance [D]. Wuhan University of Technology, 2020.