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Corporate Risk-Taking and Corporate Innovation

-- Empirical Research Based on the Data of Chinese Listed Companies

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Abstract

This paper takes R & D investment and patent output as the measurement indicators of enterprise innovation level, and empirically tests the impact of China's enterprise risk-taking on enterprise innovation. This article draws the following conclusions: First, the level of risk-taking of Chinese companies has a significant inhibitory effect on innovation, and the conclusion remains robust after considering endogenous issues. Second, larger enterprises can weaken the inhibitory effect of the level of risk-taking on innovation output to a certain extent. Third, the level of corporate risk-taking has inhibited the innovation of state-owned enterprises and private enterprises, but the inhibitory effect is not significant in the grouping of foreign-funded enterprises. Fourth, in the process of corporate risk-taking level affecting corporate innovation, the extent of corporate financing constraints plays an intermediary role. The conclusion of this article implies that the level of corporate risk-taking plays an important role in promoting the high-quality development of China's real economy, and expands the relevant literature in the fields of corporate innovation influencing factors and the economic consequences of risk-taking.

Keywords

Corporate risk-taking, corporate innovation, financing constraints.

1. INTRODUCTION

Innovation is an important driving force for a country's economic development. Since the mid-1980s, economists represented by Romer (1986) and Lucas (1988) have proposed new growth theories, emphasizing the important role of technological progress in promoting economic growth. Schumpeter (1912) first proposed the concept of "innovation" in "Economic Development Theory", defining it as "recombination of production factors", and revealed the important role of innovation activities in economic development. For enterprises, innovation is the main factor shaping their core competitiveness. The report of the Nineteenth National Congress of the Communist Party of China pointed out that "innovation is the first driving force for development and the strategic support for building a modern economic system." Enterprises are an important micro-subject of the national innovation and development strategy. Against the background of the rapid development of the market economy, the increasingly fierce competitive environment and the constantly changing customer needs, only through continuous innovation can the enterprises realize their own survival and development, and the country can achieve high Economic growth of quality.

Corporate risk-taking reflects the choice of risk taken by the enterprise in business decision-making. Moderate risk-taking can improve the company's own value and capital allocation efficiency (Yu Minggui et al., 2013), and promote the sustainable and healthy development of

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the company and the social economy. Since corporate risk-taking is often at the expense of the uncertainty of the revenue flow, corporate risk-taking is generally measured by the volatility of cash flow (John et al., 2008; Yu Minggui et al., 2013). Enterprise innovation is a long-term investment activity with high risks and lagging returns. On the one hand, it needs the support of external financing of the enterprise, on the other hand, it is also highly dependent on the internal cash flow situation. A company's stable cash flow situation can provide a good operating environment for its innovation activities, while the more volatile cash flow will inhibit the company's R & D investment. When the uncertainty faced by the enterprise is large, in order to avoid risks, decision makers tend to further increase the holding of cash flow, thereby indirectly squeezing out part of the investment in innovation and R & D, which will have a negative impact on the overall innovation level of the enterprise(Zhang Chuangqi et al., 2019). Since the financial crisis, corporate risk-taking has been a hot topic of research. The previous literature research mainly focused on the influencing factors of corporate risk-taking and the exploration of the role of corporate risk-taking on the development of enterprises. Few studies have involved research on the level of risk-taking and corporate innovation. This article believes that studying the relationship between the two will have important practical significance for the decision-making of enterprise managers and national innovation-driven development strategies.

This article uses the sample of A-share listed companies from 2007 to 2016 to discuss the relationship between risk-taking level and corporate innovation and the intermediary role of financing constraints. The research in this paper finds that the higher the level of corporate risk-taking, the lower the level of R & D investment and innovation output, that is, the level of risk-taking has a significant inhibitory effect on corporate innovation. In addition, in the process of corporate risk-taking level affecting corporate innovation, corporate financing constraints play an intermediary role. The article also found that for small-scale enterprises, their R & D investment and innovation output are inhibited by the level of corporate risk-taking, while for large-scale enterprises, although the level of enterprise risk-taking has a significant inhibitory effect on R & D input, the impact is not obvious. At the same time, the difference in the nature of equity will also cause heterogeneity in corporate risk suppression. The level of corporate risk-taking has suppressed the R & D input and innovation output of state-owned enterprises and private enterprises, but in the group of foreign-funded enterprises, the level of risk-taking The impact of these indicators is not significant.

The contribution of the research conclusions of this paper is as follows: First, this paper uses the micro data of listed companies to prove the significant inhibitory effect of corporate risk-taking on corporate innovation, and expands the relevant literature on the impact of corporate risk-taking on corporate innovation. Second, this article confirms the intermediary role played by financing constraints and identifies the heterogeneous impact of corporate size and property rights on the role of corporate risk-taking in corporate innovation. The research results of this article can help decision makers to conduct corporate governance and provide clues for decision makers to adjust their growth plans to promote R & D and innovation of enterprises.

The follow-up arrangements of this paper are as follows: the second part is literature review and theoretical hypothesis, the third part is data, variable description and empirical models, the fourth part is empirical results, and the fifth part is research conclusions.

2. LITERATURE REVIEW AND THEORETICAL ASSUMPTIONS

The current research on the influencing factors of the innovation level of enterprises mainly focuses on the macro level (government policy (Lin Zhouyu et al., 2013), investor protection mechanism (Brown et al., 2013), intellectual property protection (Spulber, 2013), credit scale (Ma Guangrong et al., 2014) and government support (Xiao Wen and Lin Gaobang, 2014), etc.

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and the micro level (property nature (Zhang et al., 2003), enterprise size (Booyens, 2011), and managerial characteristics (Hirshleifer et al., 2012)etc). Based on the micro perspective of corporate risk-taking, this paper studies its impact on the level of corporate innovation and its mechanism to make up for the deficiencies of existing literature.

Corporate risk taking usually means the uncertainty of future cash income flow (Yu Minggui et al., 2013). The uncertainty of cash income flow on the one hand shows the stability and predictability of corporate cash flow, on the other hand it also means that the company opportunities and possibilities for the company's future growth and development. Hall (1992) used American manufacturing companies as samples, and the research confirmed that corporate R & D investment is highly dependent on internal cash flow. Uncertainty in cash flow caused by changes in the environment will lead to increased pressure on corporate financing, which in turn will inhibit corporate investment activities (Liu Kangbing, Shen Pu 2011). Zhang Chuanqi et al. (2019) found that the uncertainty of cash flow has a significant inhibitory effect on the innovation level of enterprises, among which non-state-owned enterprises have a stronger inhibitory effect than state-owned enterprises. In addition to changes in the external macro environment, the unique risks of the enterprise have a greater impact on the enterprise. The greater the risk of the enterprise itself, the lower its investment efficiency. The resulting uncertainty of cash flow will further inhibit the investment activities of the enterprise (Gong Guangming et al., 2013). As an investment activity with huge investment, long investment period and lagging earnings, R & D and innovation activities have a stronger dependence on the stability of cash flow. Li Chunxia et al. (2014) found that in financing-constrained companies, the uncertainty of cash flow increases the incentives for companies to hold cash, which results in companies being too conservative in their investment activities, and finally exerts a restraining effect on corporate innovation. Based on the above theoretical analysis, this paper proposes the following research hypotheses:

Hypothesis 1: The higher the level of corporate risk-taking, the lower the level of innovation.

Too many risks usually cause the increased financing pressure faced by an enterprise (Liu Kangbing, Shen Pu, 2011), that is, increased financing constraints faced by companies. Liu Kangbing et al. (2011) found that the higher the degree of uncertainty faced by enterprises, the more severe their investment expenditures are subject to financing constraints. As a high-risk project that requires continuous investment, R & D activities are funded by basic elements that support its operation. Excessive financing constraints will further increase the possibility of companies falling into liquidity dilemmas. At this time, companies will allocate more funds to short-term productive investments, which will make enterprises invest in R & D activities insufficiently, leading to a reduction in innovation levels (Aghion et al. , 2012). Many domestic and foreign literatures have confirmed the inhibitory effect of financing constraints on corporate innovation based on different national backgrounds (Hall, 1992; Bloch, 2005; Lu Xin et al., 2013). Therefore, this article proposes the following hypothesis:

Hypothesis 2: In the process of corporate risk-taking level affecting corporate innovation, part of it works through intermediary channels constrained by corporate financing.

The size of the enterprise may have different effects on the role of risk-taking on the innovation level of the enterprise. The theory of the impact of enterprise size on innovation can be traced back to the "Xiong Peter hypothesis". Xiong Peter believes that the larger the enterprise size, the richer the innovation resources it has, the more likely it is to conduct R & D and innovation, compared with large-scale enterprises, SMEs lack economies of scale and resource advantages. With the increase of the same enterprise risk-taking level, the innovation output of SMEs may decline even more. In terms of financing, due to the large amount of investment, long cycle and high risk of innovative investment activities, it is difficult for companies to guarantee stable returns to investors, so it is relatively difficult to rely on external

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financing to obtain funds, while internal financing can be as a remedy for the inadequacy of the capital market, the larger the scale of the enterprise, the higher the concentration of internal funds, and the more beneficial it is to large-scale innovative R & D activities. In addition, large-scale enterprises have stronger intellectual property protection capabilities, so they have a certain incentive effect on innovation R & D investment (Chi Renyong, 2001), so the risk-taking effect of large enterprises on innovation output may be weak. Based on the above analysis, this article proposes the following hypothesis:

Hypothesis 3: Large-scale enterprises can weaken the degree of risk-taking inhibition of innovation output to a certain extent.

The nature of property rights is also an important factor that affects the corporate risk-taking effect. Because state-owned enterprises are more seriously affected by government intervention, their business objectives are more distorted, and they lack management incentive and restraint mechanisms, the operating efficiency of state-owned enterprises is worse than that of non-state-owned enterprises. State-owned enterprises are inherently "paradoxical" because they are always faced with the trade-off between "corporate profitability" and "national publicity" (Zhou Yaodong and Yuhui, 2012). Investment behavior is more stable. In addition, the government may directly intervene in the investment decisions of state-owned enterprises (Li Wengui and Yu Minggui, 2012). To ensure the stable operation of state-owned enterprises, the government may prevent state-owned enterprises from making high-risk investment decisions. If the risk-taking level of the state-owned enterprise itself is high, then in the trade-off between government intervention and the enterprise itself, innovative R & D as a type of high-risk investment activity has a higher probability of being abandoned. Therefore, based on the above analysis, this article proposes the following hypothesis:

Hypothesis 4: The risk-taking effect of state-owned enterprises on R & D investment will be significant.

3. DATA AND VARIABLE DESCRIPTIONS AND EMPIRICAL MODELS

3.1. Sample Selection

This article mainly uses the amount of R & D investment and the number of patent applications (and finally obtained authorization) to measure the innovation level of the enterprise. Since the R & D investment data of listed companies has been disclosed since 2007, this article selects Chinese A-share listed companies from 2007 to 2016 as a sample, and screens according to the following criteria: (1) exclude listed companies in the financial industry; (2) exclude ST companies (3) Eliminate sample companies with missing data; (4) In order to reduce extreme values, all continuous variables are subjected to a 1% up and down tailing (Winsorize). All financial data, nature of equity, number of patents, and R & D investment data in this article are from the CSMAR database. Through sample screening, a total of 9810 "annual-enterprise" observations were obtained.

3.2. Model Design and Variable Definition

Drawing on existing literature, this article establishes the following model to examine the impact of risk-taking on corporate innovation:

$$Inno_{it} = \beta_0 + \beta_1 RiskT_{it} + \beta_i CV_{it} + \varepsilon_{it} \tag{1}$$

$Inno_{it}$ measures the innovation level of an enterprise, in which i represents the enterprise and t represents the year. The innovation level includes the natural log $R\&D$ of R & D investment plus one and the natural log $Ptotal$ of total number of patents plus one .$RiskT_{it}$

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represents the level of risk-taking of enterprises. Enterprises with higher levels of risk-taking usually face a greater degree of uncertainty in future cash inflows. Therefore, this paper draws on existing literature (John et al., 2011; Yu Minggui et al., 2013) and adopts the annual interest, tax, depreciation and amortization profit (EBITDA) and the volatility of total assets ratio (standard deviation) to measure the level of corporate risk-taking.E_i is obtained by dividing the company's annual interest, tax, depreciation and amortization profit (EBITDA) in year i by the corresponding year-end total assets (ASSETS). The industry average is used to adjust$E_i$to remove the measurement noise caused by industry heterogeneity, and then it calculates its five-year rolling Standard deviation. which is:

$$RiskT_i = \sqrt{\frac{1}{N-1}\sum_{n=1}^{N}(E_{in} - \frac{1}{N}\sum_{n=1}^{N}E_{in})^2} \,|N = 5$$, Among them:

$$E_{in} = \frac{EBITDA_{in}}{ASSETS_{in}} - \frac{1}{X}\sum_{k=1}^{X}\frac{EBITDA_{kn}}{ASSETS_{kn}}$$

(i represents the enterprise, and n represents the year in the observation period, with a value of 1-5. X represents the number of companies in the industry, and k represents the k-th company in the industry).

In model (1),CV represents multiple control variables. This article refers to Li Wengui and Yu Minggui (2015), He Ying, etc. (2019) to control the following variables: (1) Return on assets (ROA), defined as profit divided by total assets. (2) Cash holding level ($Cash$, defined as the cash holding level divided by the total assets. (3) Fixed asset ratio (PPE),defined as the fixed assets in the total assets of the enterprise at the end of the year. (4) Enterprise growth ($Growth$), defined as the annual growth rate of the company's net profit. (5) Asset-liability ratio (Lev), defined as the ratio of total corporate liabilities to total assets. (6) Government subsidy ($Subsidy$) ,defined as the natural logarithm of the government subsidy of each year obtained by the enterprise plus 1. This article applies Winsorize to all continuous variables at 1% level. At the same time, in order to avoid the influence of random autocorrelation factors in the sample, the standard errors of all regression results in this paper are clustered to the enterprise level.

3.3. Descriptive Statistics

Table 1 is the descriptive statistics of variables, in which R & D and patent data are the values after adding one and taking the logarithm. The average value of R & D investment $R\&D$ before taking the logarithm is 119.4 million, the minimum and maximum values are 0 and 104.1193 billion, the average value of the number of R & D personnel before taking the logarithm is 678, and the minimum and maximum values are 4 and 42334,which shows that various enterprises are affected by many factors, and the R & D investment is quite different. The average number of total patents, invention patents, utility model patents and design patent applications (and finally authorized) before taking the logarithms are 53, 15, 31 and 7, respectively, and the maximum and minimum values are significantly different.The average and median of the core explanatory variables $RiskT$ are 0.0569 and 0.0451, respectively, and the average and median risk-taking of Chinese companies from 1998 to 2011 are 0.0611 and 0.0335 (Li Wengui, Yu Minggui, 2012),indicating that the level of risk-taking of listed enterprises has decreased overall, but the level of risk-taking of most enterprises has increased.

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Table 1. Descriptive statistics

Variable	Number of samples	Mean value	Standard deviation	Median	Min	Max
R&D	9,810	11.83	8.469	16.906	0	21.27
RDperson	9,810	1.262	2.427	0	0	7.769
Ptotal	9,810	2.793	1.327	2.708	0.693	6.615
Pinvent	9,810	1.443	1.238	1.386	0	5.268
Putility	9,810	2.133	1.484	2.079	0	6.068
Pdesign	9,810	0.811	1.207	0	0	4.820
ROA	9,810	0.0484	0.0631	0.042	-1.341	1.757
Cash	9,810	0.171	0.129	0.134	0.013	0.631
PPE	9,810	0.233	0.151	0.203	0.008	0.676
Growth	9,810	-0.196	3.752	0.096	-24.29	12.90
Lev	9,810	0.442	0.201	0.444	0.050	0.871
RiskT	9,810	0.0569	0.0477	0.0451	0.008	0.355
Subsidy	9,810	16.98	1.711	17.002	11.29	21.19

4. EMPIRICAL RESULTS

Table 2. The impact of corporate risk-taking on innovation

	(1) R&D	(2) R&D	(3) R&D	(4) Ptotal	(5) Ptotal	(6) Ptotal
RiskT	-14.186***	-12.368***	-8.855***	-1.091***	-0.631**	-0.729***
	(-7.49)	(-6.70)	(-5.33)	(-3.59)	(-2.32)	(-3.74)
ROA		-11.334***	-14.158***		0.760*	-0.416*
		(-4.70)	(-3.80)		(1.92)	(-1.91)
Growth		-0.065**	-0.086***		-0.004	-0.001
		(-2.43)	(-2.60)		(-0.95)	(-0.25)
Lev		-13.817***	-7.111***		0.294**	-0.086
		(-19.54)	(-5.41)		(2.27)	(-0.69)
Subsidy		1.262***	2.087***		0.291***	0.135***
		(17.33)	(23.19)		(17.90)	(12.39)
Cash		-5.133***	-10.751***		-0.143	-0.604***
		(-5.02)	(-9.68)		(-0.75)	(-4.97)
PPE		-7.241***	-10.087***		-1.067***	-0.451***
		(-7.98)	(-6.54)		(-5.73)	(-2.86)
Constant	12.643***	0.332	-15.056***	2.853***	-2.019***	0.801***
	(74.68)	(0.25)	(-8.65)	(80.75)	(-7.03)	(4.04)
Observations	9,810	9,810	9,810	9,810	9,810	9,810
R2	0.006	0.130	0.142	0.002	0.160	0.052
Firm FE	NO	NO	YES	NO	NO	YES

Note: ***, **, and * are significant at the levels of 1%, 5%, and 10%, respectively. The t-values in parentheses are the results of company-level cluster adjustment.

4.1. Basic Analysis

Three basic models can be used for the static panel: mixed model, fixed effect model and random effect model. After F test and Hausman test, the fixed effect model is superior to the mixed model and random effect model. Therefore, this article uses a fixed effect model. Table 3

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reports the regression results of the model (1). This paper tests by gradually adding control variables and fixed effects. The first three columns use R & D input as the explained variable, and the last three columns use the total patent output as the explained variable. Columns (1) and (4) are the univariate regression results, (2) and (5) are the multiple regression results; columns (3) and (6) are the multiple regression results after controlling the fixed effects.

4.2. Heterogeneity Analysis

(1) Distinguish enterprise size

Considering that the different scales of enterprises may cause their innovations to be affected by different levels of risk-taking, this paper measures the scale of enterprises by the natural logarithm of total assets, and uses the median of scale to return all listed companies to groups. As the regression results in Table 4 shown : due to space reasons, the control variables are omitted. For R & D investment, the coefficients of risk-taking levels of small and large enterprises are -5.711 and -7.662, respectively, both of which are significant at the level of 1%. R & D investment decreased by 5.711% and 7.662% respectively. For innovation output, the coefficient of small enterprises is -0.935, which means that for every 1% increase in the enterprise's risk-taking level, the innovation output of small-scale enterprises will decrease by 0.935%, while the coefficient of large enterprises is not statistically significant. It shows that risk-taking has a significant inhibitory effect on the innovation output of small enterprises, while large enterprises can weaken the inhibitory effect of the level of risk-taking on innovation output to a certain extent. Based on the above analysis, Hypothesis 3 holds.

Table 3. Heterogeneity test 1: Regression results grouped by enterprise size

	Small company		Large company	
	(1)	(2)	(3)	(4)
	R&D	Ptotal	R&D	Ptotal
RiskT	-5.711***	-0.935***	-7.662***	-0.413
	(-3.00)	(-3.98)	(-2.80)	(-1.57)
CV	YES	YES	YES	YES
Constant	-3.891**	1.401***	-20.670***	0.783***
	(-2.28)	(6.64)	(-8.49)	(3.35)
Observations	4,948	4,948	4,862	4,862
R2	0.107	0.031	0.157	0.057
Firm FE	YES	YES	YES	YES

Note: ***, **, and * are significant at the levels of 1%, 5%, and 10%, respectively. The t-values in parentheses are the results of company-level cluster adjustment.

(2) Distinguish the nature of equity

Existing research shows that enterprises with different ownership types have different levels of innovation (Wu Yanbing, 2012). This paper believes that different ownership types of enterprises also lead to different impacts of risk-taking on R & D investment and innovation output of enterprises. Therefore, this article divides China's A-share listed companies into state-owned, private and foreign-funded enterprises, and group-regresses companies with different nature of equity. The results are shown in Table 5.

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For the R & D investment of state-owned enterprises and private enterprises, the coefficients of *RiskT* are -10.420 and -5.940, respectively, and both are significant at the level of 1%, indicating that for every 1% increase in the level of enterprise risk exposure, the R & D investment of state-owned enterprises and private enterprises will be reduced by 10.42% and 5.94% respectively. Therefore, Hypothesis 4 holds. For the innovation output of state-owned enterprises and private enterprises, the coefficients of *RiskT* are -0.701 and -0.934, respectively, and both are significant at the level of 1%, indicating that every 1% increase in the level of corporate risk-taking will reduce the innovation output of state-owned enterprises and private enterprises by 0.701% and 0.934%, respectively.

For foreign-funded enterprises, although the coefficient of risk-taking level is negative, it is not statistically significant. This article believes that, among all equity-owned enterprises, foreign-funded enterprises have the highest R & D efficiency and R & D intensity (Zhang et al., 2003; Jefferson et al., 2006), no matter what level of risk-taking foreign-funded enterprises are in, they will invest more capital to carry out R & D and innovation activities, so the risk-taking effect on R & D innovation is not significant.

Table 4. Heterogeneity test 2: Regression results grouped by the nature of equity

	State-owned enterprises		Private enterprises		Foreign-funded enterprises	
	(1) R&D	(2) Ptotal	(3) R&D	(4) Ptotal	(5) R&D	(6) Ptotal
RiskT	-10.420***	-0.701***	-5.940***	-0.934***	-10.712	-0.365
	(-4.12)	(-2.92)	(-2.85)	(-3.62)	(-1.14)	(-0.29)
CV	YES	YES	YES	YES	YES	YES
Constant	-19.305***	0.410*	-8.573***	1.077***	-0.951	0.754
	(-8.64)	(1.93)	(-4.87)	(4.95)	(-0.12)	(0.68)
Observations	4,649	4,649	4,879	4,879	282	282
R2	0.158	0.072	0.116	0.043	0.176	0.054
Firm FE	YES	YES	YES	YES	YES	YES

Note: ***, **, and * are significant at the levels of 1%, 5%, and 10%, respectively. The t-values in parentheses are the results of company-level cluster adjustment.

4.3. Inspection of Action Mechanism

As can be seen from the foregoing, the level of corporate risk-taking will have a significant negative impact on corporate innovation. However,how does an enterprise's risk-taking level affect its innovation level? In this part, this paper will use corporate financing constraints as an intermediary variable, and use the intermediary effect model to conduct an empirical analysis of the mechanism of corporate risk-taking level. Regarding the measurement of financing constraints, Lamont et al. (2001) used the methods of Kaplan and Zingales (1997) to measure the financing constraints of different companies and constructed the KZ index. Whited and Wu (2006) constructed the WW index using the same idea.However, both the KZ index and the WW index contain many endogenous financial variables, and the financing constraints may be mutually determined. In order to avoid endogenous interference, this article refers to the

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methods of Liu Liya (2015) and Sun Xuejiao (2019), and the SA index constructed by Hadlock and Pierce (2010) is used as an indicator to measure the degree of corporate financing constraints.

$$SA = -0.737 * Assets + 0.043 * Assets^2 - 0.04 * Age \tag{2}$$

(In the calculation of the SA index here, the data of the company 's total assets at the end of the year is first processed as data in millions of yuan, then Assets = Ln (total assets at the end of the year (unit: yuan) / 1 million) . Hadlock and Pierce (2010) truncated the total assets of the company and the company's listing life above the 95% quantile when calculating the SA index. This article refers to Liu Liya (2015) and first uses the original Assets and Age to calculate the original SA index. Then the 99% quantile of the index is truncated.)

Among them, $Assets$ is the total assets of the enterprise and Age is the listing period of the enterprise. According to the construction of the index, the larger the value of the index, the higher the degree of financing constraints faced by the enterprise. The construction of the intermediary effect model is as follows:

$$Inno_{it} = \beta_0 + \beta_1 RiskT_{it} + \beta_i CV_{it} + \varepsilon_{it} \tag{2}$$

$$SA_{it} = \alpha_0 + \alpha_1 RiskT_{it} + \alpha_i CV_{it} + \varepsilon_{it} \tag{3}$$

$$Inno_{it} = \gamma_0 + \gamma_1 RiskT_{it} + \gamma_2 SA_{it} + \gamma_i CV_{it} + \varepsilon_{it} \tag{4}$$

After excluding part of the missing value of the SA, 9783 annual-enterprise samples were obtained. Table 6 presents the test results of the risk-taking mechanism of the enterprise. The estimated coefficients of $RiskT$ shown in columns (1) and (2) are significantly negative. Column (3) takes the corporate financing constraint index SA as the dependent variable, and the estimated coefficient of $RiskT$ is significantly positive at the level of 1%, indicating that the increase in the level of corporate risk-taking will make the company subject to stronger financing constraints. Columns (4) and (5) report the regression results of dependent variable R & D input, innovation output and core explanatory variables $RiskT$ and intermediary variables SA. For R & D investment, the coefficient of $RiskT$ is negative but no longer significant, while the coefficient of financing constraints SA is significantly negative. For innovation output, the coefficient of $RiskT$ and SA are significantly negative. In addition, compared with columns (1) and (2), the estimated coefficients of $RiskT$ in columns (4) and (5) both decreased significantly. This shows that financing constraints are an important mechanism by which corporate risk-taking levels affect corporate innovation. Among them, financing constraints play a full intermediary role in the relationship between corporate risk-taking levels and corporate R & D investment, while financing constraints and enterprise innovation play a part of intermediary role in the relationship. The reasonable explanation is that when the enterprise assumes a greater risk, it will face greater financing difficulties. Excessive financing constraints will cause the enterprise to allocate more funds to short-term productive investment, which will make the company ’s R & D investment insufficient. Hypothesis 2 holds.

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Table 5. Examination of the mechanism of action

	(1) R&D	(2) Ptotal	(3) SA	(4) R&D	(5) Ptotal
RiskT	-8.797***	-0.719***	0.228***	-1.692	-0.364**
	(-5.44)	(-4.16)	(9.35)	(-1.18)	(-2.15)
SA				-31.180***	-1.558***
				(-48.17)	(-20.36)
CV	YES	YES	YES	YES	YES
Constant	-15.056***	0.801***	-2.926***	-106.290***	-3.757***
	(-11.03)	(5.49)	(-142.20)	(-47.35)	(-14.16)
Observations	9,783	9,783	9,783	9,783	9,783
R2	0.143	0.053	0.301	0.332	0.098
Firm FE	YES	YES	YES	YES	YES

4.4. Robustness Test

(1) Handling of endogenous problems

From the above test, we can see that the level of risk-taking has a significant impact on corporate innovation, and corporate innovation as a high-risk investment activity will also affect the level of corporate risk-taking, so there are endogenous problems between the two. In order to solve the endogenous problem, this paper uses the instrumental variable method to introduce the average value AvgRiskT of risk-taking in the same registration location, the same year and the same industry as the instrumental variable. Regression analysis uses two-stage least squares 2SLS and generalized moment estimation method GMM for estimation. The detailed results are shown in Table 7. Due to space limitations, the control variables are omitted. The coefficients of RiskT are all significantly less than 0, which is basically consistent with the results obtained above, proving that the conclusions of this paper are not affected by endogenous problems caused by mutual causation.

Table 6. Based on instrument variable method to deal with endogenous problems

	First stage	Second stage			
		2SLS		GMM	
	(1) RiskT	(3) R&D	(2) Ptotal	(5) R&D	(4) Ptotal
RiskT		-31.834***	-2.003***	-36.810***	-1.012**
		(-7.64)	(-5.01)	(-12.03)	(-2.17)
AvgRiskT	0.999***				
	(41.65)				
CV	YES	YES	YES	YES	YES
Constant	0.003	-12.927***	0.919***	1.955**	-1.993***
	(0.39)	(-7.47)	(4.56)	(2.23)	(-14.94)
Observations	9,783	9,783	9,783	9,783	9,783
R2	0.296	0.128	0.074	0.111	0.160
Firm FE	YES	YES	YES	YES	YES

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Note: ***, **, and * are significant at the levels of 1%, 5%, and 10%, respectively. The t-values in parentheses are the results of company-level cluster adjustment.

(2) Replacement of enterprise innovation variables

China's "Patent Law" divides enterprise patents into three categories: invention patents, utility model patents and design patents. Among them, invention patents are improvements to products and methods or new proposals; utility model patents are new technical solutions suitable for the shape and structure of the product; design patents are new designs that are aesthetically pleasing and suitable for industrial applications by the combination of product shapes, patterns, and colors. Compared with invention patents, utility model patents and design patents reflect a lower capacity for independent innovation, so the complexity of applying for authorization is lower and the approval time is shorter.

In order to test the robustness of the results, this paper has tested different types of patents, and the results are shown in Table 8. Corporate risk-taking is negatively correlated with three different types of patent output. Among them, the inhibitory effect on utility model patents is the strongest and most significant, while the inhibitory effect on design patents is not statistically significant.

In addition, considering that the R & D investment of an enterprise includes not only capital investment, but also investment of R & D personnel. This paper selects the number of R & D personnel in the enterprise to further test the robustness of the results. RDperson is the natural logarithm of the number of R & D personnel plus 1 . The results show that the coefficient of RiskT of corporate risk-taking level is -1.071, and it is significant at the level of 5%, that is, corporate risk-taking has a significant inhibitory effect on R & D investment.

Table 7. Inspection of patent classification and number of R & D personnel

	(1) Pinvent	(2) Putility	(3) Pdesign	(4) RDperson
RiskT	-0.317*	-0.747***	-0.188	-1.071**
	(-1.73)	(-3.55)	(-1.23)	(-2.26)
CV	YES	YES	YES	YES
Constant	0.463**	-0.438*	0.286*	-5.856***
	(2.42)	(-1.94)	(1.77)	(-11.18)
Observations	9,810	9,810	9,810	9810
R2	0.008	0.077	0.007	0.119
Firm FE	YES	YES	YES	YES

Note: ***, **, and * are significant at the levels of 1%, 5%, and 10%, respectively, and the t value in parentheses is the result of cluster adjustment after company.

5. RESEARCH CONCLUSION

This article uses the data of Chinese non-financial listed companies from 2007 to 2016 as a sample, and uses R & D input and patent output as the measurement standards of enterprise innovation level, and makes a theoretical explanation and empirical analysis on how enterprise risk-taking affects enterprise innovation level. The results of the study show that the higher the level of corporate risk-taking, the lower the level of innovation, that is, risk-taking has a significant inhibitory effect on the level of innovation. In addition, in the process of corporate

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risk-taking level affecting corporate innovation, corporate financing constraints play an intermediary role. The results of the sub-sample test show that risk-taking has a significant inhibitory effect on the innovation output of small enterprises, while large enterprises can weaken the inhibitory effect of risk-taking levels on innovation output to a certain extent. Further examination found that the difference in the nature of equity also leads to heterogeneity in corporate risk suppression. Corporate risk-taking levels inhibit the innovation of state-owned and private companies, but the suppression is not significant in the grouping of foreign-funded companies. The conclusion of this article implies that the level of corporate risk-taking plays an important role in promoting the high-quality development of China's real economy, and expands the relevant literature in the fields of corporate innovation influencing factors and the economic consequences of risk-taking.

The research conclusion of this paper has the following enlightenment: First, the level of corporate risk-taking has a significant inhibitory effect on corporate innovation. If companies want to maintain or improve their own level of innovation, they can start with their own risk management and control to maintain a reasonable and stable cash flow volatility. Second, enterprises can expand the scale of enterprises through mergers, acquisitions, brand extensions, and further financing. With the expansion of scale, they can grasp richer resources, increase the concentration of internal funds, and enhance the ability to protect intellectual property rights, thereby alleviating the risk-taking effect of corporate risk-taking on innovation output. Third, the government should increase subsidies for innovative activities with long investment cycles, large amounts, and high risks to help enterprises maintain or improve their existing innovation levels.

REFERENCES

[1] Aghion P., Askenazy P., Berman N., Cette G., Eymard L., Credit Constraints and the Cyclicality of R&D Investment: Evidence from France, Journal of the European Economic Association, 2012, 10 (5): 1001-1024

[2] Bloch, C.2005.R&D Investment and Internal Finance: The Cash Flow Effect. Economics of Innovation and New Technology, 14 (3) :213-223

[3] Brown, J. R., Martinsson, G., Petersen, B C. Law, Stock Markets, and Innovation [J]. The Journal of Finance, 2013, 68 (4).

[4] Booyens, I. Are small, medium-and micro-sized enterprises engines of innovation? The reality in South Africa [J]. Science&Public Policy, 2011, 38 (1): 67-78.

[5] Hadlock, J., Pierce, J., New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index, Review of Financial Studies, 2020, 23(5), 1909-1940

[6] Hall, B.H., Investment and research and development at the firm level:Does the source of financing matter?.NBER Working Paper, No.4096, 1992.

[7] Hirshleifer D., Low A., Teoh S. H., Are Overconfident CEOs Better Innovators? [J]. The Journal of Finance, 2012, 67 (4).

[8] Jefferson, G. H., Huamao, B., Xiaojing, G., & Xiaoyun, Y. R&D Performance in Chinese industry. Economics of Innovation and New Technology, 2006, 15(4-5), 345–366.

[9] John, K., Litov, L., & Yeung, B., Corporate Governance and Risk-Taking. The Journal of Finance, 2008, 63(4), 1679-1728.

[10] Kaplan S., Zingales I., Do Financial Constraints Explain Why Investment Is Correlated with Cash Flow, Quarterly Journal of Economies,1997,112,169-216

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202007_6(7).0017

[11] Lamont, O., C., Polk, and J., Sa's-Requejo, Financial Constraints and Stock Returns, Review of Financial Studies,2001,14,529-554

[12] Shiu, E., & Walker, D. New product market visioning in small enterprises. Journal of Small Business and Enterprise Development, 2007 14(1), 81–92.

[13] Whited, T. M., Wu. G., Financial Constraints Risk, Review of Financial Studies,2006,19,531-559

[14] Zhang, A., Zhang, Y., & Zhao, R. A study of the R&D efficiency and productivity of Chinese firms. Journal of Comparative Economics, 2003,31(3), 444–464.

[15] Chi Renyong, Wu Tianzu, Ouyang Zhongjian. The effect of enterprise scale on technological innovation and the choice of technological innovation system [J]. Science and Technology Progress and Countermeasures, 2001 (06): 67-69.

[16] Gong Guangming, Zeng Zhaocun. Company-specific risks, managerial risk characteristics and enterprise investment efficiency: empirical data from Chinese listed companies [J]. Economics and Management Research, 2013 (11): 67-75.

[17] Li Wengui, Yu Minggui. Ownership nature, marketization process and enterprise risk-taking [J]. China Industrial Economy, 2012 (12): 115-127.

[18] Li Chunxia, Tian Lihui, Zhang Wei. Cash-Cash Flow Sensitivity: Financing Constraints or Uncertain Income? [J]. Economic Review, 2014 (02): 115-126.

[19] Lin Zhouyu, Lin Hanchuan, Deng Xinghua. Income tax reform and technological innovation of Chinese enterprises [J]. China Industrial Economy, 2013 (03): 111-123.

[20] Liu Liya, He Yanlin, Wang Zhaofei, Cheng Tianxiao. Will financing constraints affect Chinese companies 'foreign direct investment? —— Theoretical and empirical analysis based on a micro perspective [J]. Financial Research, 2015 (08): 124-140.

[21] Liu Kangbing, Shen Pu, Sterken E. Financing Constraints, Uncertainty and Corporate Investment: Evidence Based on Panel Data of Listed Manufacturing Companies [J]. Nankai Economic Research, 2011 (04): 86-97.

[22] Lu Xin, Zheng Yangfei, Li Jianming. Research on the Impact of Financing Constraints on Enterprise R & D Investment——Empirical Evidence from Chinese High-tech Listed Companies [J]. Accounting Research, 2013 (05): 51-58 + 96

[23] Ma Guangrong, Liu Ming, Yang Enyan. Bank credit, credit crunch and enterprise research and development [J]. Financial Research, 2014 (07): 76-93.

[24] Sun Xuejiao, Zhai Shuping, Yu Su. Can flexible tax collection and management ease corporate financing constraints—evidence from the natural experiment of tax credit rating disclosure [J]. China Industrial Economy, 2019 (03): 81-99.

[25] Xiao Wen, Lin Gaobang. Government Support, R & D Management and Technology Innovation Efficiency——Based on the Empirical Analysis of China 's Industrial Industry [J]. Management World, 2014 (04): 71-80.

[26] Yao Yang, Zhang Qi. Analysis of technical efficiency of Chinese industrial enterprises [J]. Economic Research, 2001 (10): 13-19 + 28-95.

[27] Zhang Chuanqi, Sun Yi, Lu Xueyao. Cash flow uncertainty, managerial risk appetite and corporate innovation [J]. Journal of Zhongnan University of Economics and Law, 2019 (06): 71-81.

[28] Zhou Yaodong, Yu Hui. Research on the relationship between state-owned monopoly boundary, control power and performance [J]. China Industrial Economy, 2012 (06): 31-43.