



The impact of capital operation strategy and financing constraints on firm innovation

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Abstract

This study investigates the effects of capital operation strategy on firm innovation and the processes by which these effects are influenced, using Chinese listed companies as an example from 2007 to 2021. This article specifically examines the effects of the period expense ratio, free cash flow level, accounts receivable turnover rate, and firm innovation. It also examines the channel through which capital operation strategy influences firm innovation. The main indicators of capital operation strategy in this paper include period expense ratio, free cash flow level, and turnover rate of accounts receivable. R&D costs serve as a gauge of firm innovation. Panel data, the panel fixed effect model, and the mediating effect model are used for empirical research. The results of panel fixed regressions show that period expense ratio and free cash flow level significantly positively affect firm innovation below the 5% significance level. However, the turnover rate of accounts receivable doesn't significantly affect firm innovation. Further research on mediating effect regression shows that financing constraints are one of the important influencing mechanisms, playing a partial mediating role. The results demonstrate that firms can boost their investment in innovation by lowering their free cash flow and period expense ratio. By imposing financial restrictions, they can also raise the amount of money invested in innovation.

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1. Introduction

The capital operation strategy generally includes the period expense ratio, free cash flow ratio, accounts receivable turnover rate, inventory turnover rate, and so on. The quality of the capital operation strategy not only affects the company's cash flow but also affects the company's financing and investment decisions, and then affects the company's operating performance. A scientific and reasonable capital operation strategy is an important way to improve the company's performance. In recent years, due to the impact of COVID-19, many companies had cash flow problems, and corporate bonds could not be repaid when they were due, which hindered the firm's investment in long-term projects.

Firm innovation belongs to long-term investment, which requires enough funds to carry out innovation. The project recovery cycle is long, and the risk is high (Shen, Fu, Pan, Yu, & Chen, 2020; Shen et al., 2021). If

the innovation project is finally successful, the company can also obtain a higher income. Scholars have found that innovation can enhance a firm's core competitiveness and is the foundation for sustainable and high-quality development of the company (Chemmanur, Kong, Krishnan, & Yu, 2019; Ting, Wang, Yang, & Tuan, 2021). Over the previous five years, the Chinese government has released a number of programmes to promote and assist scientific and technical innovation. The government, the media, and academics are now all are very interested in the concept of innovation.

To sum up, how the company's capital operation strategy affects innovation is important and necessary. This study examines the impact and outcomes of capital operation strategy on innovative company investment by using a panel fixed effect model and a mediating effect model, with Chinese listed companies from 2007 to 2021 serving as the sample. Panel fixed effect model reduces covariance between variables, mitigates endogeneity problems, and eliminates the effect of individual characteristics.

Theoretical significance: The impact mechanism and outcomes of different capital operation strategies on a company's innovation investment are first examined in this paper, which also deepens and broadens the relevant research on the economic effects of the capital operation strategy and the factors that influence a firm's innovation investment. Secondly, this paper further discusses the influencing mechanism of financing constraints as capital operation strategies affecting the firm's innovation investment, which provides a new idea for future research.

Practical value: First, according to the empirical research results, it can provide a scientific basis for listed companies to optimize their capital operation strategy and avoid the risk of the company's capital chain fracture. Secondly, according to the empirical research results of the influencing mechanism, it is beneficial for listed companies to formulate scientific and reasonable systems and strategies to improve the level of firm innovation.

Figure 1 shows the conceptual and theoretical framework.

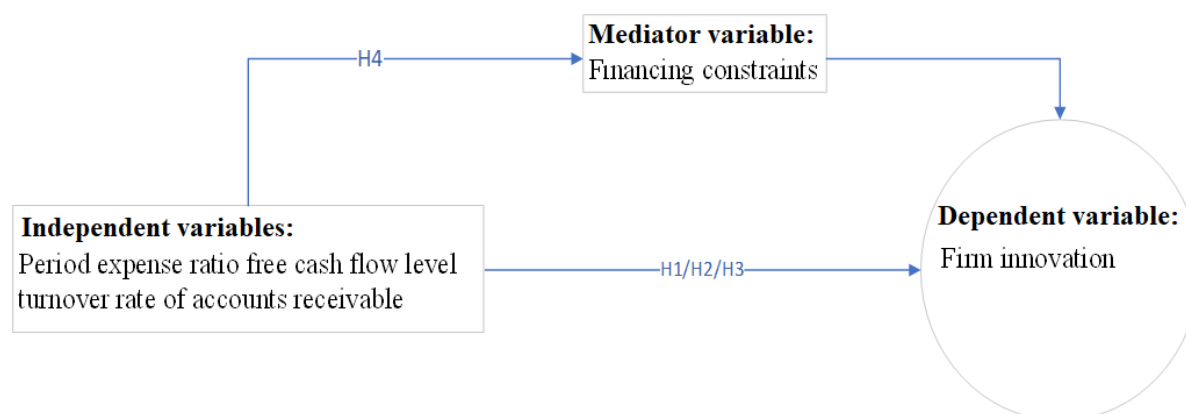


Figure 1. Conceptual and theoretical framework.

2. Literatures Review and Hypotheses

2.1. Literatures Review

The research on the company's capital operation strategies mainly focuses on the period expense ratio, free cash flow, turnover rate of accounts receivable, and other aspects, and the research conclusions of different scholars are not entirely consistent. Some scholars show that working capital has a negative effect on firm investment and performance (Afza & Nazir, 2007; Fazzari & Petersen, 1993; Lai, Lou, Zhang, & Fan, 2021).

Other scholars argue that working capital has a positive effect on firm investment and performance (Boisjoly, Conine Jr, & McDonald IV, 2020; Ding, Guariglia, & Knight, 2013; Kieschnick, Laplante, & Moussawi, 2013; Orichom & Omeke, 2021).

Also, some scholars find that working capital has a non-monotonic linear effect on firm investment and performance (Aktas, Croci, & Petmezas, 2015; Baños-Caballero, García-Teruel, & Martínez-Solano, 2012, 2014).

To sum up, scholars have reached inconsistent conclusions about how working capital affects firm investment and performance. There are few scholars who have studied how the capital operation strategy affects the company's innovation investment. This paper empirically investigates the impact of capital operation strategies on firms' investment in innovation.

2.2. Hypotheses

According to the previous research, this paper intends to measure the capital operation strategy by using the period expense ratio, free cash flow, and turnover rate of accounts receivable.

So, how does the period expense ratio affect a firm's innovation investment? Generally speaking, the higher the ratio of period expenses, the higher the company's management expenses, sales expenses, and

financial expenses in the current period, and the higher the R&D^① expenses used for the current period may be (Akbar, Jiang, & Akbar, 2022; Dai, Zhang, & Luo, 2022), thereby increasing the company's investment in innovation. To sum up, this paper proposes hypothesis 1.

H₁: The period expense ratio significantly positively influences the firm's innovation investment.

When a company's free cash flow level is higher, more sufficient funds can be used for investment, thus improving the firm's innovation investment (Lefebvre, 2022; Ting et al., 2021). Similarly, the higher the level of free cash flow of the company, the lower the level of financing constraints, the stronger the ability of external financing and the more funds that can be provided for the company's innovation investment. To sum up, this paper proposes hypothesis 2.

H₂: The level of free cash flow significantly positively influences the firm's innovation investment.

The accounts receivable turnover ratio reflects the efficiency of an enterprise's accounts receivable turnover. In general, the higher the accounts receivable turnover ratio, the more efficient the enterprise's accounts receivable turnover is and the more sufficient funds are available for the company's investment (Boisjoly et al., 2020). Similarly, the turnover rate of accounts receivable also reflects the operating efficiency of the company's total assets (Shen, Lan, Xiong, Lv, & Jian, 2020). The higher the accounts receivable turnover, the more efficiently the asset is being operated, the higher the operating income and profit from the same asset are likely to be, and the more funds will be available for the company's investments. To sum up, this paper proposes hypothesis 3.

H₃: The accounts receivable turnover rate has a significant positive influence on the company's innovation investment.

According to the previous analysis, financing constraints may be one of the important impact mechanisms of the capital operation strategy on a firm's innovation investment (Syafrizal & Ilham, 2023). Generally speaking, when the capital operation strategy improves the financing constraint level of the company, the less funds the company can use for innovation investment, reducing the level of innovation investment of the company (Wang, Shen, Tang, Wu, & Ma, 2021). On the contrary, when the capital operation strategy reduces the level of the company's financing constraints, the more abundant the company's funds are, the more funds can be used for the company's innovation investment. In sum, this paper proposes hypothesis 4.

H₄: The capital operation strategy affects the company's innovation investment through financing constraints.

3. Research Model and Variable Definition

3.1. Data Source and Research Model

The sample of this paper includes listed companies in China from 2007 to 2021. First of all, excluding the financial listed companies, the listed companies that were ST * ST that year. Additionally, it is important to remove organisations that underwent an initial public offering (IPO) within the specified year. Finally, after removing the samples with missing variable values, 4334 companies were listed, obtaining a total of 33,362 company-year sample observations.

The CSMAR and WIND databases, which primarily collect annual reports from Chinese listed companies, are the primary sources of all the data. In order to eliminate the effect of extreme values on the continuous variables, the tails of the continuous variables were reduced by 1 percent and 99 percent, respectively.

This paper will use model (1) for panel regression to test H₁, H₂, and H₃, which are about how the company's capital operation strategy affects innovation investment. The main parts of the research results are the coefficient and significance of each independent variable.

$$rdp_{i,t} = \alpha_0 + \alpha_{11} * pcost_{i,t} + \alpha_{12} * fcash_{i,t} + \alpha_{13} * rturn_{i,t} + \alpha_2 * size_{i,t} + \alpha_3 * mb_{i,t} + \alpha_4 * shr cr1_{i,t} + \alpha_5 * analysis_{i,t} + \alpha_6 * djgnum_{i,t} + \alpha_7 * ip_{i,t} + \alpha_8 * big4_{i,t} + \alpha_8 * dual_{i,t} + \alpha_9 * attend_{i,t} + \alpha_{10} * dagree_{i,t} + \alpha_{11} * state_{i,t} + \alpha_{12} * year_{i,t} + \alpha_{13} * ind_{i,t} + \mu \quad (1)$$

Equation 1 presents the effect of period expense ratio, free cash flow level, and turnover rate of accounts receivable on firm innovation. R&D expenses divided by total assets yield *rdp*, the dependent variable in model (1), which represents the company's innovation investment. The independent variable is the company's capital operation strategy, mainly including the period expense ratio (*pcost*), free cash flow level (*fcash*), accounts receivable turnover rate (*rturn*), etc.

In order to empirically test hypothesis 4, in this paper, models (2) and (3) are proposed to be used and tested in combination with model (1):

$$fc_{i,t} = \alpha_0 + \alpha_{11} * pcost_{i,t} + \alpha_{12} * fcash_{i,t} + \alpha_{13} * rturn_{i,t} + \alpha_2 * size_{i,t} + \alpha_3 * mb_{i,t} + \alpha_4 * shr cr1_{i,t} + \alpha_5 * analysis_{i,t} + \alpha_6 * djgnum_{i,t} + \alpha_7 * ip_{i,t} + \alpha_8 * big4_{i,t} + \alpha_8 * dual_{i,t} + \alpha_9 * attend_{i,t} + \alpha_{10} * dagree_{i,t} + \alpha_{11} * state_{i,t} + \alpha_{12} * year_{i,t} + \alpha_{13} * ind_{i,t} + \mu \quad (2)$$

$$rdp_{i,t} = \alpha_0 + \alpha_{11} * pcost_{i,t} + \alpha_{12} * fcash_{i,t} + \alpha_{13} * rturn_{i,t} + \alpha_2 * fc_{i,t} + \alpha_3 * size_{i,t} + \alpha_4 * mb_{i,t} + \alpha_{54} * shr cr1_{i,t} + \alpha_6 * analysis_{i,t} + \alpha_7 * djgnum_{i,t} + \alpha_8 * ip_{i,t} + \alpha_9 * big4_{i,t} + \alpha_{10} * dual_{i,t} + \alpha_{11} * attend_{i,t} + \alpha_{12} * dagree_{i,t} + \alpha_{13} * state_{i,t} + \alpha_{14} * year_{i,t} + \alpha_{15} * ind_{i,t} + \mu \quad (3)$$

^① R&D is the abbreviation of research and development.

Equation 2 presents the effect of period expense ratio, free cash flow level, and turnover rate of accounts receivable on financing constraints. Equation 3 presents the effect of period expense ratio, free cash flow level, turnover rate of accounts receivable, and financing constraints on financing constraints.

In models (2) and (3), FC represents financing constraints. According to the calculation method of FC financing constraints by Billett and Mauer (2003), the following steps are taken to calculate: First, firm size, age, and cash dividend payment rate are standardized by year, and the value of the dummy variable of financing constraints is calculated based on the mean value of the standardized variable; see models (4) and (5). The financing constraint level of companies with an average value higher than 1/3 quantiles is low, and the QFC value is 0, otherwise, the value is 1. Second, a Logit model is used to regress the firm's annual probability of financing constraints, i.e., the financing constraints index fc , which ranges from 0-1. Generally speaking, the higher the value of fc , the higher the level of the firm's financing constraints and the more serious the problem.

$$P(QFC = 1|z_{i,t}) = e^{z_{i,t}} / (1 + e^{z_{i,t}}) \quad (4)$$

$$z_{i,t} = \alpha_0 + \alpha_1 * size_{i,t} + \alpha_2 * debt_{i,t} + \alpha_3 * (div/tasset)_{i,t} + \alpha_4 * mb_{i,t} + \alpha_5 * (nwc/tasset)_{i,t} + \alpha_6 * (ebit/tasset)_{i,t} \quad (5)$$

In models (4) and (5), QFC is the quantile level of financing constraints, size is the company size, debt is the asset-liability ratio, div is the company's cash dividend, tasset is the company's total assets, mb is the market value book ratio, nwc is the company's net working capital, and ebit is the company's profit before interest and tax.

3.2. Variable Definition and Calculation

3.2.1. Innovation Investment (Dependent Variable)

According to the research from Shen and Hou (2021), this paper intends to measure a firm's investment in innovation using the ratio of R&D expenses to total assets.

3.2.2. Capital Operation Strategy (Independent Variable)

The independent variable of this paper is capital operation strategy, which mainly includes the period cost ratio (pcost), free cash flow level (fcash), and accounts receivable turnover rate (rturn). The period expense ratio is calculated by dividing the total management expenses and sales expenses incurred during the current year by the operating income. Free cash flow level is measured by dividing cash and cash equivalents at the end of the year by total assets (cash and cash equivalents). The accounts receivable turnover rate indicates the tightness level of the company's credit policy, which is measured by dividing the operating revenue by [(total assets at the beginning of the period + total assets at the end of the period)]/2.

3.2.3. Financing Constraints (Intermediary Variable)

The intermediary variable is financing constraints (fc); see models (4) and (5) for the calculation process.

Control variables mainly include company size, market value book ratio, shareholding of the largest shareholder, number of analysts tracking, sum of the number of meetings of the Board of Directors, the Supervisory Board, and the General Meeting of Shareholders, and shareholding ratio of institutional investors. Whether it is the four major audit institutions, whether the chairman and general manager are the same person, whether the independent directors are absent from the meeting, whether the independent directors express objections, whether it is state-owned or non-state-owned, dummy variables of year and industry. See Appendix Table 1 for a calculation description of all variables.

4. Empirical Results

4.1. Descriptive Statistics

The descriptive statistical analysis results of all variables in this paper are listed in Appendix Table 2. The mean value of rdp is 0.0340, which means the average value of the R&D expense ratio is low. The standard deviation of period expense ratio ($pcost$) is 0.119, indicating that the difference in $pcost$ between samples is large, and some companies have higher period expense ratios. The minimum and maximum values of free cash flow level (fcash) are 0.0120 and 2.180, respectively, indicating that the difference in $fcash$ between samples is large. The minimum and maximum values in the turnover rate of accounts receivable ($rturn$) are 0.775 and 1409, respectively, which indicates that the turnover rate of accounts receivable varies greatly among companies. The mean value, maximum, and minimum decimals of the above variables are basically consistent with the actual value.

4.2. Panel Fixed Effect Regression Results of Capital Operation Strategy and Firm Innovation Investment

Table 1 shows the results of the panel fixed effect regression analysis of the capital operation strategy on the firm's innovation investment. Column (1) shows the regression results of the period expense ratio ($pcost$) affecting the firm's innovation investment. The period expense ratio significantly positively affects a firm's innovation investment at the level of 1%. More importantly, the regression coefficient has significant economic implications. For each unit standard deviation increase in the period expense ratio, the company's innovation investment increases by 7.9% on average, this is about 35.6% of the average rdp . Column (2) shows the

regression result between the free cash flow level and the firm's innovation investment. The free cash flow level significantly positively affects a firm's innovation investment at the level of 5%. More importantly, the regression coefficient has significant economic implications. For each unit standard deviation of the free cash flow level, the company's innovation investment increases by 0.1% on average; this is about 0.78% of the average rdp. Column (3) shows the regression result between the turnover rate of accounts receivable and the company's innovation investment. The turnover rate of accounts receivable doesn't significantly affect a firm's innovation investment. The above findings support H1 and H2, but H3 is not supported.

Among all control variables, the market value to book ratio and the shareholding ratio of the largest shareholder significantly negatively affect the firm's innovation investment (rdp) at the level of 1%, while the number of analysts tracking and whether the independent directors have objections significantly positively affect the firm's innovation investment (rdp) at the level of 1%. The influence of other control variables on R&D productivity (RDP) is found to be statistically insignificant, aligning with the findings reported in the current literature on factors impacting a company's investment in innovation.

Table 1. Regression results of panel fixed effect between capital operation strategy and firm innovation investment.

Variables	(1) rdp	(2) rdp	(3) rdp
Pcost	0.079*** (41.255)	-	-
Fcash	-	0.001** (2.305)	-
Rturn	-	-	-0.000 (-1.450)
Size	0.002*** (7.147)	0.000 (0.919)	0.000 (0.513)
Mb	-0.005*** (-5.721)	-0.005*** (-5.454)	-0.004*** (-5.180)
Shrcr1	-0.009*** (-5.465)	-0.010*** (-5.967)	-0.010*** (-5.871)
Analysis	0.001*** (2.705)	0.001** (2.493)	0.002*** (2.784)
Report	-0.000 (-0.889)	-0.001 (-1.394)	-0.001 (-1.575)
Djgnum	-0.001* (-1.722)	-0.000 (-0.946)	-0.000 (-1.001)
Ip	-0.002* (-1.757)	-0.000 (-0.172)	-0.000 (-0.134)
Big4	-0.001 (-1.534)	0.000 (0.037)	0.000 (0.069)
Dual	-0.000 (-1.010)	-0.000 (-0.278)	-0.000 (-0.208)
Attend	-0.001 (-1.041)	-0.000 (-0.553)	-0.000 (-0.567)
Degree	0.001** (2.287)	0.001** (2.456)	0.001** (2.322)
State	0.001* (1.833)	0.001 (0.865)	0.001 (0.836)
Constant	-0.029*** (-5.115)	0.018*** (3.065)	0.021*** (3.592)
Firm and year	Controlled	Controlled	Controlled
Observations	33362	33362	33362
Overall_R2	0.177	0.129	0.129
F-value	230.643	158.542	158.406

Note: *, ** and *** in the table indicate correlation at 10%, 5% and 1% significance levels respectively. The value of t statistic variable is in parentheses.

4.3. Impact Mechanism of Capital Operation Strategy on Firm Innovation Investment

This paper discusses the impact mechanism of capital operation strategy on firm innovation investment; financing constraints may be one of the mechanisms. Table 2 shows the results of the impact mechanism of financing constraints when the period expense ratio and free cash flow level are independent variables. Columns (1) to (3) are the results of the period expense ratio (pcost) as an independent variable. Column (1) shows that the period expense ratio significantly positively affects a firm's financing constraints below the level of 1%, which means that the higher the period expense ratio is, the higher the firm's financing constraint level is. The results in column (2) show that the period expense ratio significantly positively affects a company's innovation investment below the 1% level. Column (3) is the result when the period expense ratio and financing constraint are included in the model at the same time. It shows that the period expense ratio is

significantly positively correlated with the company's innovation investment below the level of 1%, and the financing constraint level is significantly negatively correlated with the company's innovation investment at the level of 1%. Combining the results in columns (1), (2), and (3), it is shown that financing constraint is one of the mechanisms by which the expense ratio of the period affects the company's innovation investment, and financing constraint plays a part in the intermediary role. The Z values of the Sobel, Goodman-1, and Goodman-2 tests are $Z = 12.66$, $Z = 12.65$ and $Z = 12.67$, respectively, indicating the partial intermediary effect of financing constraints. The ratio of financing constraints to total effect is 0.02695613, and the proportion of indirect effect to direct effect is 0.02770289. Finally, the Bootstrap cycle 1000 times method is used to retest the intermediary effect, avoiding the positive distribution hypothesis of Sobel test. The Z value of indirect effect $r(\text{ind_eff})$ is 16.31, and the Z value of direct effect $r(\text{dir_eff})$ is 33.5, which shows that the financing constraint plays a part of the intermediary role in the influence of the period expense ratio on the company's innovation investment and supports H4.

Columns (4) to (6) are the test results of the free cash flow level as an independent variable. The results in column (4) show that the free cash flow level significantly positively affects the company's financing constraints below the level of 1%, which means that the free cash flow level increases the firm's financing constraints. The results in column (5) show that the level of free cash flow significantly positively influences the level of corporate innovation investment below the 1% level, which is consistent with the results of Table 1. Column (6) is the result when the level of free cash flow and financing constraints are included in the model at the same time. It shows that the level of free cash flow significantly positively affects a company's innovation investment below the level of 1%, while the level of financing constraints is significantly negatively correlated with the company's innovation investment at the level of 1%. Combined with the results in columns (4), (5), and (6), it is shown that financing constraints are one of the mechanisms by which the free cash flow affects the company's innovation investment, and financing constraints play a partial intermediary role. The Z values of the Sobel, Goodman-1, and Goodman-2 tests are $Z = 10.57$, $Z = 10.57$ and $Z = 10.57$, respectively, indicating that the partial intermediary effect of financing constraints is significant below the level of 1%. The ratio of financing constraints to total effect is 0.2638606, and the proportion of indirect effect to direct effect is 0.35843837. Finally, the Bootstrap cycle 1000 times method is used to retest the intermediary effect, avoiding the positive distribution hypothesis of Sobel test. The Z value of indirect effect $r(\text{ind_eff})$ is 19.9, and the Z value of direct effect $r(\text{dir_eff})$ is 9.56, indicating that the financing constraint plays a part of the intermediary role in the impact of free cash flow on the company's innovation, which supports H4.

Table 2. Results of financing constraint impact mechanism.

Variables	(1) fc	(2) rdp	(3) rdp	(4) fc	(5) rdp	(6) rdp
Pcost	0.683*** (4.177)	0.079*** (41.255)	0.101*** (63.077)	-	-	-
Fcash	-	-	-	-3.255*** (-104.660)	0.001** (2.305)	0.011*** (16.068)
Fc	-	-	-0.002*** (-18.031)			-0.001*** (-10.614)
Control variables	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
N	33,362	33,362	33,362	33,362	33,362	33,362
Adj-R2	0.202	0.177	0.487	0.421	0.129	0.430
F value	272.607	230.643	659.400	780.144	158.542	524.373
Sobel test	Z=12.66, ***			Z=10.57, ***		
Goodman-1 (Aroian) test	Z=12.65, ***			Z=10.57, ***		
Goodman-2 test	Z=12.67, ***			Z=10.57, ***		
Proportion of total effect that is mediated	0.02695613			0.2638606		
Ratio of indirect to direct effect	0.02770289			0.35843837		
Bootstrap 1000 times	r(_bs_1), Z=16.31,*** r(_bs_2), Z=33.5,***			r(bs_1), Z=19.90,*** r(bs_2), Z=9.56,***		

Note: ** and *** in the table indicate correlation at 10% and 5% significance levels respectively. The value of t statistic variable is in parentheses.

4.4. Conclusions

This research employs a panel fixed effect model to examine the impact and mechanism of capital operation strategy on corporate innovation investment, using Chinese listed companies from 2007 to 2021 as case studies. The findings demonstrate that, at least at the 10% threshold, the period expense ratio and free cash flow level have a substantial positive impact on innovation investment. Nevertheless, business innovation investment is not greatly impacted by the accounts receivable turnover rate. Additional investigation reveals that one of the most significant influencing factors is financial limitations.

5. Implications and Limitations

Based on the empirical findings presented in this study, we propose recommendations and insights primarily focused on the following areas: The innovation investment is notably influenced in a positive manner by both the period expense ratio and the degree of free cash flow. To enhance the company's investment in innovation, it is possible to decrease the expenditure ratio and free cash flow. Hence, it is imperative for the listed companies to carefully consider the benefits and drawbacks associated with these two forms of financing. It is also essential to discuss the disadvantages of different forms of funding, with the objective of keeping the negative effects of funding from outweighing the positive ones and harming the interests of the company as a whole. In the light of the above factors, if the advantages outweigh the drawbacks, it may be considered reasonable to increase the corresponding allocation of funds. Furthermore, the financial limitations act as a mediator. We can increase the company's innovation by relaxing the financial restrictions.

Limitations of this paper: the present research solely investigates the influence of capital operation strategy on a company's innovation investment, neglecting other potential factors. Future studies should consider examining the impact of innovation investment from various perspectives, such as, investment strategy, financing strategy, and other relevant dimensions.

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Appendix Table 1. Variable definition.

Variables	Calculation description
Rdp	The company's innovation investment is the company's R&D expenses divided by total assets.
Pcost	Period expense ratio. It is measured by dividing the sum of management expenses and sales expenses of the current year by operating income.
Fcash	Free cash flow level. It is measured by dividing cash and cash equivalents at the end of the year by (total assets - cash and cash equivalents).
Rturn	Accounts receivable turnover rate. Indicates the tightness level of the company's credit policy, which is measured by dividing the operating revenue by $[(total\ assets\ at\ the\ beginning\ of\ the\ period + total\ assets\ at\ the\ end\ of\ the\ period)] / 2$.
Fc	Financing constraints are to be measured by FC method.
Size	The company size is calculated by taking logarithms of total assets.
Mb	Market to book ratio: the market value of the stock divided by the owner's equity.
Shrcr1	The shareholding ratio of the largest shareholder, the proportion of the number of shares held by the largest shareholder in the number of circulating shares.
Analysis	The number of analysts who have tracked and analyzed the company.
Djgnum	The total number of meetings of the board of directors, board of supervisors, and shareholders.
Ip	The shareholding ratio of institutional investors is the number of shares held by institutional investors divided by the total number of outstanding shares.
Big4	Whether there are four major audit institutions. If it is one of the four major audit institutions, the value is 1; if it is not, the value is 0.
Dual	Two functions are integrated into one. The chairman and general manager are integrated, and the value is 1; otherwise, the value is 0.
Attend	Whether the independent director is absent from the board meeting, if not, the value is 1; if there is, the value is 0.
Dagree	Whether the independent directors have objections. The value of no objection is 1, and the value of objection is 0.
State	If it is a state-owned enterprise, the value is 1 if it is a state-owned enterprise; otherwise, the value is 0.
Ind	Industry dummy variable.
Year	Year dummy variable.

Appendix Table 2. Descriptive statistical analysis results.

Variables	Observations	Mean	S.D.	Mix.	25%	Median	75%	Max.
rdp	33362	0.0340	0.0420	0	0	0.0280	0.0470	0.229
pcost	33362	0.153	0.119	0.0140	0.0730	0.121	0.193	0.632
fcash	33362	0.267	0.336	0.0120	0.0850	0.156	0.301	2.108
Rturn	33362	43.95	171.9	0.775	3.159	5.825	14.66	1409
Size	33362	22.11	1.303	19.74	21.16	21.92	22.85	26.16
mb	33362	0.617	0.243	0.116	0.433	0.617	0.799	1.156
shrcr1	33362	0.354	0.150	0.0880	0.235	0.334	0.456	0.750
Analysis	33362	1.482	1.181	0	0	1.386	2.485	3.784
djgnum	33362	2.709	0.370	1.792	2.485	2.708	2.944	3.584
ip	33362	0.0380	0.135	0	0	0	0	0.714
Big4	33362	0.0620	0.241	0	0	0	0	1
dual	33362	0.278	0.448	0	0	0	1	1
Attend	33362	0.0310	0.173	0	0	0	0	1
Dagree	33362	0.947	0.224	0	1	1	1	1
State	33362	0.331	0.470	0	0	0	1	1