

The Inhibitory Mechanism of Financial Investment on Technological Innovation and the Moderating Effect of Managerial Behavior

Zihui Bao

School of Economics and Management, Nanjing University of Science and Technology, Nanjing, China

3346791459@qq.com

Abstract. Innovation is the primary factor driving enterprise development. Based on Chinese A-share non-financial listed companies from 2009 to 2022, this paper employs fixed-effect regression models and heterogeneity tests to empirically examine the impact of corporate financialization on technological innovation. We further introduce managerial overconfidence as a moderating variable to analyze its effect on the relationship between innovation input and output. The results show that corporate financial asset investment significantly inhibits technological innovation, as reflected by simultaneous declines in R&D input and innovation output. Managerial overconfidence mitigates the negative impact of financialization on innovation output to a certain extent, and this effect is particularly pronounced in high-tech industries and non-state-owned enterprises, indicating the moderating roles of ownership and industry attributes. These findings enrich the theoretical research at the intersection of behavioral finance and innovation economics, and provide practical implications for policymakers. We emphasize that optimizing resource allocation, improving corporate governance, and strengthening differentiated support can guide enterprises to control financialization risks while achieving high-quality innovative development.

Keywords: Financial investment, Corporate innovation, Corporate financialization, Overconfidence, Managerial behavior.

1. Introduction

1.1. Research Background and Significance

1.1.1. Research Background

At the critical stage of China's economic transition from high-speed growth to high-quality development, technological innovation has been clearly positioned as the core driver of development. Since the 19th National Congress of the Communist Party of China, the state has successively issued a series of policy documents, including the Outline of the National Innovation-Driven Development Strategy and the 14th Five-Year Plan for National Scientific and Technological Innovation, to continuously strengthen policy support and institutional guarantee for enterprises' innovation capabilities. Meanwhile, with the continuous improvement of the capital market and the enrichment of financial instruments, an increasing number of enterprises have tilted capital allocation toward financial assets. The trend of enterprises "shifting from real to virtual" has aroused widespread concern in academia and policy circles. Against this macro background, clarifying whether corporate financialization exerts a crowding-out effect on technological innovation and exploring the underlying impact mechanism are of great practical significance for understanding the tension between capital allocation efficiency and the innovation-driven strategy.

Existing research presents two opposing views on the relationship between financial investment and corporate technological innovation. On the one hand, some studies argue that excessive capital allocation by non-financial enterprises to finance, real estate and other fields squeezes resources for technological R&D and equipment renewal, ultimately inhibiting technological progress. However, the relationship is not necessarily a simple crowding-out process in every context; Kliman and Williams [1] argue that financialization has not necessarily depressed productive investment in the

United States. This debate highlights the need to examine the relationship between financial investment and technological innovation empirically.

On the other hand, some scholars hold the opposite opinion. They believe that corporate financialization may be conducive to innovation input to a certain extent. For example, Bonfiglioli[2] points out that moderate financial investment can bring additional returns to enterprises, effectively alleviating financing constraints and enabling enterprises to accumulate more disposable internal funds to support R&D activities. Yang Songling et al. [3] also note that short-term financial operations using idle funds help improve asset liquidity, maintain and increase capital value, and enhance enterprises' ability to cope with future capital risks, thereby creating a more favorable financial environment for technological innovation. In addition, positive returns from financial investment may indirectly promote the sustainable development of innovation activities by improving corporate operating performance.

Research on the impact of managerial confidence on corporate behavior has also gradually expanded. The academic community mainly focuses on the mechanism of managerial confidence in corporate innovation activities and investment decisions. Existing foreign literature generally suggests that executive overconfidence may help improve corporate innovation capabilities. Galasso and Simcoe [4] examine the relationship between CEO overconfidence and innovation, while Hirshleifer et al. [5] discuss whether overconfident CEOs are better innovators. Relevant domestic empirical studies also support this view. Wang Shanhui et al. [6] find a significant positive relationship between managerial overconfidence and corporate R&D input. Zhang Xiuping and Wang Huacheng [7] reach related conclusions, further suggesting that managerial behavioral characteristics may play a role in corporate innovation.

On the other hand, some studies examine managerial overconfidence from the perspective of investment decision-making efficiency. Malmendier and Tate [8] find that overconfident managers rely more on internal cash flow for investment, indicating that their decisions are more driven by subjective judgment and may increase the risk of irrational investment. Jiang Fuxiu et al. [9] also point out that managerial overconfidence significantly increases the overall investment level and internal expansion speed of enterprises. However, from another perspective, Liu Yanxia and Qi Huaijin [10] propose that compared with overconfident managers, executives with low confidence may avoid over-investment or under-investment more effectively due to their cautious attitude, thus improving investment efficiency to a certain extent. These findings indicate a complex and subtle balance between managerial confidence and investment efficiency, which deserves further exploration of its deep impact on the implementation of the innovation-driven strategy.

1.1.2. Research Significance

This study makes the following innovative contributions:

First, from the perspective of behavioral finance, we introduce the variable of managerial overconfidence to reveal its moderating role between financialization and innovation, enriching the theoretical analysis of the impact path of corporate financial behavior on innovation. Second, we adopt multi-dimensional innovation indicators to measure innovation input and output separately, enhancing the rigor and explanatory power of the research. Third, we further explore the heterogeneous effects of enterprise ownership and industry characteristics, providing more detailed hierarchical suggestions for policy-making.

1.2. Research Content

The rest of this paper is structured as follows:

Section 2 is theoretical analysis and research hypotheses, sorting out existing research and constructing a theoretical framework to propose hypotheses.

Section 3 introduces data sources, variable definitions and model construction.

Section 4 presents empirical results, including main effect tests, moderating effect analysis and heterogeneity tests.

Section 5 draws research conclusions and puts forward policy recommendations.

Through the above arrangement, this paper strives to provide more in-depth and comprehensive empirical evidence and policy implications for understanding the interaction between corporate financialization and technological innovation.

2. Theoretical Analysis and Research Hypotheses

2.1. The Impact of Financial Investment Behavior on Technological Innovation

As the core driving force for high-quality economic development, innovation has received increasing attention from national strategies and enterprise development. Nevertheless, with the rapid development of financial markets and the continuous rise in returns on financial assets, a growing number of non-financial enterprises tend to allocate resources to financial asset investment, making corporate financialization increasingly prominent. Against this background, the impact of financial investment on technological innovation presents a complex dual effect, which mainly depends on the original intention and motivation of enterprises to allocate financial assets.

From a positive perspective, if enterprises conduct financial investment out of a precautionary saving motive—that is, to enhance financial stability through the liquidity and high profitability of financial assets—such behavior may exert a “reservoir effect” and indirectly support technological innovation activities. On the one hand, the easy convertibility of financial assets helps enterprises flexibly deploy funds amid long R&D cycles and volatile capital demands, preventing liquidity risks from interrupting innovation input, as discussed by Ju et al. [11]. On the other hand, value-added income from financial investment may help ease external financing constraints, increase internal cash flow, and provide capital for sustained technological R&D activities. Hu et al. [12] discuss the motives behind financial asset allocation, while Wang Hongjian et al. [13] examine whether financialization promotes or inhibits corporate innovation.

However, if enterprises engage in financial investment mainly for speculative arbitrage, financialization may instead produce a “crowding-out effect” on technological innovation. First, due to the scarcity of resources, excessive financialization may directly crowd out funds and managerial attention originally used for innovation, weakening enterprises’ sustained support for equipment renewal and R&D projects; Wang Hongjian et al. [13] examine this potential inhibitory relationship. Second, the principal-agent problem may exacerbate this negative effect. When management is under short-term performance pressure, it may choose high-return but opaque-risk financial investments to pursue quick profits while ignoring long-term strategic goals and R&D resource allocation. Duan Junshan and Zhuang Xudong [14] investigate financial investment behavior and corporate technological innovation from the perspective of motivation and empirical evidence.

In summary, the impact of corporate financialization on technological innovation is not unidirectional, but depends on the motivation and financial strategies of enterprises’ financial asset investment. However, combined with the prominent trend of “shifting from real to virtual” in China and the economic environment where financial returns far exceed those of physical investment, corporate financial investment is more manifested as short-term arbitrage behavior, and its inhibitory effect on technological innovation has become increasingly prominent. Therefore, this paper proposes the following research hypotheses:

H1a: Financial investment behavior negatively affects technological innovation input.

H1b: Financial investment behavior negatively affects technological innovation output.

2.2. The Moderating Mechanism of Managerial Overconfidence

On the basis of examining the “crowding-out effect” of financial investment on technological innovation output, this paper further introduces the factor of “overconfidence” in managerial behavioral characteristics to analyze its potential moderating effect on corporate resource allocation decisions from the perspective of behavioral finance. Overconfident managers tend to overestimate the accuracy of their own judgment and the enterprise’s future development potential, and

underestimate the uncertainty and risks in the external environment. Such psychological characteristics may exert an important impact on corporate innovation strategies.

On the one hand, overconfident managers usually exhibit strong risk preference and control desire. When faced with the temptation of short-term returns from financialization, they are more likely to adhere to their long-term strategic vision and not easily cut innovation input due to short-term market fluctuations. Under their leadership, enterprises may maintain financial asset allocation while still retaining a high willingness to invest in technological innovation, thereby weakening the inhibitory effect of financial investment on innovation output. In addition, overconfident managers prefer to support innovation projects through internal financing to demonstrate their decision-making ability and strategic foresight, so they are more willing to convert income from financial investment into innovation input.

On the other hand, some studies also show that overconfident managers, holding optimistic expectations about corporate innovation prospects, are more likely to promote high-risk and high-return technological R&D projects, thus enhancing corporate innovation output performance. In high-tech industries or environments with intense competitive pressure, such behavioral bias may instead become a driving force for enterprises to achieve breakthrough innovation. Therefore, based on the above theoretical reasoning, this paper puts forward the second research hypothesis:

H2: Managerial overconfidence positively moderates the inhibitory effect of financial investment on technological innovation output.

In other words, in enterprises with a higher level of executive overconfidence, the negative impact of financial investment on innovation output will be weakened. Managers alleviate the “crowding-out effect” through strategic persistence and resource restructuring, and to a certain extent realize the coordinated development of financial capital and technological innovation.

2.3. The Strengthening Effect of Behavioral Bias in High-Tech Enterprises

When exploring the moderating mechanism of managerial overconfidence in the relationship between financial investment and innovation, the heterogeneity of industry backgrounds cannot be ignored. Particularly for high-tech enterprises, their operational characteristics, innovation models, and external environments differ significantly from those of traditional industries. Thus, the impact of managerial behavior on strategic implementation may be more pronounced.

High-tech enterprises are typically featured by technology intensity, large R&D investment, long innovation cycles, and high market uncertainty. As a result, they rely more heavily on managers’ judgment and risk attitudes in resource allocation and strategic decision-making. In this context, managerial behavioral bias is more likely to be amplified in actual operation. In particular, when facing the temptation of high returns from financial assets, overconfident managers who maintain strong expectations for the enterprise’s technological development tend to sustain or increase innovation input, thus resisting the “crowding-out effect” caused by financialization. In contrast, non-high-tech enterprises are less dependent on innovation with slower technological upgrading, and their sensitivity to managerial behavioral characteristics is weaker. Therefore, the moderating role of managerial confidence may be insignificant in such enterprises.

In addition, high-tech enterprises are usually driven by both policy support and market competition. Managers face greater pressure to promote technological progress and maintain core competitiveness, and are more willing to achieve differentiated competition by increasing R&D investment. Driven by such pressure, managerial confidence is closely related to their attitude toward resource allocation—especially the trade-off between financial investment and technological innovation. Overconfident managers are more likely to adhere to an innovation-oriented strategy, thus forming a stronger hedge against the inhibitory effect of financial investment on innovation. Accordingly, this paper proposes the third hypothesis:

H3: Compared with non-high-tech industries, the moderating effect of managerial overconfidence on the inhibition of innovation input by financial investment is more significant in high-tech enterprises.

2.4. Differential Moderation of Managerial Confidence under Ownership Background

The nature of enterprise ownership largely affects the actual effect of managerial behavior on resource allocation. State-owned enterprises (SOEs) are subject to strict regulatory systems and policy orientations. Their investment decisions are more easily influenced by government will, audit supervision, and performance evaluation mechanisms, which to some extent restrict the direct impact of individual managerial traits on decision-making. Even if managers are highly overconfident, their behaviors are constrained by institutional restrictions and collective decision-making mechanisms, resulting in an insignificant inhibitory effect of financial investment on innovation input.

In contrast, non-state-owned enterprises (non-SOEs) usually enjoy higher operational autonomy and more flexible management mechanisms. Decision-making power is often more concentrated in individual managers, so the influence of managerial confidence is more prominent. Overconfident managers tend to overestimate their ability to judge the market and prefer financial asset allocation with clear short-term returns, thereby reducing long-term capital input required for technological innovation. Therefore, the moderating effect of managerial confidence on the inhibition of innovation input by financial investment is more evident in non-SOEs. Based on the above analysis, the following hypothesis is proposed:

H4: Compared with state-owned enterprises, the moderating effect of managerial confidence on the inhibition of innovation input by financial investment is more significant in non-state-owned enterprises.

3. Data Sources and Model Design

3.1. Data Sources

This paper takes China's A-share listed companies from 2009 to 2022 as the research sample. To ensure data accuracy, we exclude special industries including finance, insurance, electricity, and real estate, as well as special treatment (ST) enterprises and industries with few observations in some years. The following data processing procedures are adopted: first, samples with missing financial data are eliminated; second, continuous variables are winsorized at the 1st and 99th percentiles. Finally, a total of 20,400 firm-year observations are obtained.

Among them, data on executive overconfidence, financial indicators, and financial investment are sourced from the China Stock Market & Accounting Research (CSMAR) Database. The dependent variables, including technological innovation input, innovation output, and patent counts, are collected from the China Research Data Service Platform (CNRDS). Descriptive statistics are presented in Table 1.

Table 1. Descriptive Statistics

Variable	N	Mean	SD	Min	p50	Max
rd	20200	17.85	1.367	7.720	17.84	24.08
rda	20200	0.0259	0.0241	0	0.0213	1.455
Overcon	20400	0.583	0.493	0	1	1
inv	18200	1.457	1.509	0	1.099	8.515
pat	18200	2.495	1.994	0	2.639	9.584
fin	20400	0.233	0.148	0.000700	0.199	0.930
size	20400	21.91	1.097	16.41	21.80	28.64
lev	20400	0.746	3.649	-175.9	0.500	275.3
grow	20400	0.0951	1.686	-0.985	0.00200	168.5
share	20400	0.320	0.141	0.0184	0.299	0.877
board	20400	0.381	0.0651	0.188	0.364	0.733
ip	20200	0.0281	0.0458	0	0.0168	3.447

3.2. Variable Definitions

(1) Dependent Variables: This paper takes technological innovation input and output as proxy variables for corporate innovation. Innovation input is measured by the natural logarithm of R&D

expenditure, and innovation output is measured by the natural logarithm of the number of valid patents.

(2) Independent Variable: Corporate financial investment is measured by the ratio of financial assets to total assets held by the enterprise in the current year.

(3) Moderating Variable: Following Jiang et al. (2009), this paper measures managerial overconfidence using the executive relative compensation method. Specifically, we first calculate the ratio of the total compensation of the top three highest-paid executives to the total executive compensation. This ratio is then compared with the median value of the same ratio across all sample firms. If the ratio is higher than the median, managers are defined as overconfident and assigned a value of 1; otherwise, 0.

(4) Control Variables: To control for other firm-level factors that may affect corporate innovation, this paper selects the following control variables: firm size (size), firm growth (grow), financial leverage (lev), ownership concentration (share), board structure (board), and compensation incentive (ip). Detailed definitions and measurement methods of the variables are presented in Table 2.

Table 2. Variable Definitions

Variable Category	Variable Name	Symbol	Definition
Dependent Variables	Technological Innovation Input	rd rda	Measured by the natural logarithm of R&D expenditure R&D expenditure / Total assets
	Technological Innovation Output	inv pat	Measured by the natural logarithm of the number of valid invention patents Measured by the natural logarithm of the total number of valid patents
	Managerial Overconfidence	Overcon	1 = overconfident, 0 = otherwise
Independent Variables	Financial Investment	fin	(Cash + Trading financial assets + Available-for-sale financial assets + Investment property + Held-to-maturity investments + Dividend receivable + Interest receivable) / Total assets
		Sfin	Ratio of cash and trading financial assets to total assets (current period)
		psfin	Ratio of cash and trading financial assets to total assets (previous period)
Control Variables	Firm Size	pfin size	Ratio of financial investment to total assets (previous period) Measured by the natural logarithm of total assets
	Financial Leverage	lev	Total liabilities / Total assets
	Firm Growth	grow	Measured by operating revenue growth rate
	Ownership Concentration	share	Measured by the shareholding ratio of the largest shareholder
	Board Structure	board	Measured by the ratio of independent directors to total directors
	Compensation Incentive	IP	Measured by total annual salary of directors, supervisors and executives

3.3. Model Specification

3.3.1. Baseline Main Effect Model

To verify the relationship between corporate financial investment and technological innovation input and output, combined with the variable definitions above, this paper constructs the following baseline regression models:

$$inv_{it} = \beta_0 + \beta_1 fin_{it} + \gamma Control_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

$$rd_{it} = \beta_0 + \beta_1 fin_{it} + \gamma Control_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

3.3.2. Moderation Model

To verify the moderating effect of managerial confidence in the relationship between financial investment and technological innovation, this paper constructs the following models:

$$inv_{it} = \beta_0 + \beta_1 fin_{it} + \beta_2 Overcon_{it} + \beta_3 (fin_{it} \times Overcon_{it}) + \gamma Control_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

$$rd_{it} = \beta_0 + \beta_1 fin_{it} + \beta_2 Overcon_{it} + \beta_3 (fin_{it} \times Overcon_{it}) + \gamma Control_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

Where i denotes the firm, t denotes the year, β_0 denotes the intercept term, and ε_{it} is the random disturbance term.

4. Empirical Analysis

4.1. Correlation Analysis

This paper conducts correlation tests on all firm data and obtains the correlation coefficients among variables. The results are shown in Table 3.

Table 3. Correlation Analysis

	rd	rda	inv	pat	fin	pfin	sfin	Overcon
rd	1.0000							
rda	0.4740***	1.0000						
inv	0.1621***	0.1175***	1.0000					
pat	0.0837***	0.0623***	0.8366***	1.0000				
fin	-0.0504***	0.1251***	-0.0200***	-0.0180***	1.0000			
pfin	-0.0476***	0.1382***	0.0248***	0.0240***	0.7918***	1.0000		
sfin	-0.0239***	0.1448***	-0.0400***	-0.0354***	0.9463***	0.7494***	1.0000	
Overcon	-0.0861***	-0.0225***	-0.0765***	-0.0689***	0.0092	0.0075	-0.0040	1.0000

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

The correlation analysis indicates that financial investment exerts a systematic inhibitory effect on technological innovation. Financial investment is significantly negatively correlated with innovation input (rd) at -0.0504 and negatively correlated with innovation output (inv) at -0.0200 , supporting the crowding-out hypothesis of financial asset allocation on real innovation. Managerial overconfidence shows paradoxical correlations: it is significantly negatively correlated with innovation input (rd) at -0.0861 and negatively correlated with innovation output (inv) at -0.0765 , implying that overconfident managers may underestimate innovation risks. However, this variable is not significantly correlated with financial investment (fin), suggesting a potential non-linear interaction, which provides an empirical basis for the subsequent moderation effect tests.

4.2. Baseline Regression

Table 4. Benchmark Regression Analysis

	(1) m1 inv	(2) m2 rd	(3) m3 inv	(4) m4 rd
fin	-0.8492*** (-12.3885)	-0.2507*** (-7.0829)		
pfin			-0.5662*** (-7.8174)	-0.0881** (-2.4394)
size	0.2840*** (19.4584)	0.8662*** (113.5150)	0.2905*** (16.7631)	0.8517*** (98.9302)
lev	-0.0036* (-1.9275)	-0.0040*** (-3.4870)	-0.0028 (-1.4644)	-0.0033*** (-2.9537)
grow	-0.0082** (-2.0766)	-0.0161*** (-6.9496)	-0.0056 (-1.4105)	-0.0137*** (-6.2812)
share	-0.3548*** (-3.0338)	-0.5134*** (-8.2116)	-0.0348 (-0.2625)	-0.5387*** (-7.9601)
board	0.2289* (1.6706)	-0.0420 (-0.5672)	0.1373 (0.9643)	-0.0353 (-0.4778)
ip	0.0002*** (107.4612)	-0.0000*** (-21.1101)	0.0002*** (100.7123)	-0.0000*** (-19.2944)
Constant	-6.1162*** (-17.9058)	-0.7285*** (-4.0710)	-6.4184*** (-15.9505)	-0.4159** (-2.0773)
Observations	18,159	20,202	15,235	16,724
R-squared	0.4684	0.5627	0.4892	0.5437
Number of stkcd_num	2,488	2,488	2,481	2,465

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

The baseline regression results clearly reveal the systematic inhibitory effect of financial asset investment on corporate technological innovation. In terms of innovation output, each 1% increase in the current ratio of financial asset investment leads to a significant decrease of 0.8492 units in innovation. This inhibitory effect remains robust after considering the lagged impact of financial investment, indicating that the crowding-out effect of financialization on technological innovation has persistent inertia. The baseline regression results are reported in Table 4.

Regarding innovation input, each unit increase in current financial investment significantly reduces R&D input by 0.2507, and the inhibitory intensity of lagged financial investment is -0.0881. This confirms that allocating financial assets not only directly cuts R&D budgets but also forms path dependence to compress long-term innovation investment.

In terms of control variables, firm size significantly promotes innovation, highlighting the fundamental supporting role of economies of scale for technological innovation. In the innovation input model, R&D input decreases significantly as the shareholding ratio of the largest shareholder (share) rises by 1 percentage point, reflecting that large shareholders tend to adopt conservative financial strategies. However, this effect is insignificant in the innovation output model, implying a complex transmission mechanism of controlling shareholders' influence on innovation efficiency.

Overall, the regression results show that financial investment significantly inhibits corporate innovation input and output. The results of control variables are generally consistent with expectations, and Hypothesis H1 is verified.

4.3. Moderating Effect

The moderating effect test reveals that managerial overconfidence acts as a key buffer in the relationship between financial investment and technological innovation. In terms of innovation output, the coefficient of the interaction term between current financial investment and managerial confidence is 0.3210, indicating that overconfident managers can weaken the inhibitory effect of financial investment on invention patents. This buffering effect is even stronger in the lagged model. The regression results for the moderating effects are presented in Table 5.

Table 5. Moderating Effect Analysis

VARIABLES	(1) inv	(2) rd	(3) inv	(4) rd
fin	-0.8032*** (-7.2717)	-0.1799*** (-3.0820)		
Overcon	-0.0741** (-2.1299)	-0.0103 (-0.5591)	-0.0933*** (-2.7308)	0.0003 (0.0160)
fin_over	0.3210** (2.5729)	-0.0221 (-0.3345)		
pfin			-0.7940*** (-7.7770)	-0.0352 (-0.6520)
pfin_over			0.3949*** (3.3342)	-0.0652 (-1.0407)
size	0.3043*** (17.5297)	0.8377*** (89.5603)	0.2967*** (17.0089)	0.8389*** (89.1345)
lev	-0.0029 (-1.5093)	-0.0030*** (-2.7172)	-0.0028 (-1.4610)	-0.0029*** (-2.5880)
grow	-0.0047 (-1.1564)	-0.0138*** (-6.2798)	-0.0045 (-1.1107)	-0.0139*** (-6.3338)
share	-0.0921 (-0.6973)	-0.5155*** (-7.3265)	-0.0329 (-0.2478)	-0.5227*** (-7.3810)
board	0.1890 (1.3161)	-0.0551 (-0.7246)	0.1789 (1.2458)	-0.0565 (-0.7416)
ip	0.0002*** (97.8957)	-0.0000*** (-20.4019)	0.0002*** (98.5001)	-0.0000*** (-20.1390)

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

Notably, managerial confidence exhibits a “double-edged sword” property: it significantly reduces innovation output when acting independently, but generates a net positive moderation by weakening financial inhibition, confirming the theoretical hypothesis that “confident managers are better at financial resource allocation”.

In the dimension of innovation input, the interaction terms of both current and lagged periods are insignificant, suggesting that managerial confidence fails to alleviate the crowding-out effect of financial investment on R&D funds. This asymmetry implies a behavioral boundary in the moderating mechanism of confident managers—they can protect innovation output through informal channels, but cannot break through the rigid compression of R&D input under formal budget constraints.

The main effect of financial investment remains strongly negative in the innovation output equation, but the inhibitory intensity decreases by 5.4% compared with the baseline model, further confirming the existence of the moderating mechanism. Overall, the regression results show that managerial overconfidence can alleviate the negative impact of financial investment on technological innovation output, and Hypothesis H2 is verified.

4.4. Robustness Checks

Previous studies have conducted detailed robustness tests on the baseline regression; therefore, this paper mainly focuses on testing the moderating effect.

To verify the reliability and robustness of the baseline results, this paper carries out robustness tests from multiple dimensions, including replacing explanatory and dependent variables, to exclude interference from model specification or sample selection bias. The results are shown in the following tables.

(1) Replacing the Explanatory Variable

Following Duan Junshan and Zhuang Xudong [14], this paper replaces the explanatory variable with the ratio of cash and trading financial assets to total assets in the current period (*sfin*). As shown in Table 6, the regression results further verify the reliability of the core conclusions.

Table 6. Robustness Check 1

	(1) ml_sfin	(2) m2_psfin
sfin	-0.9670*** (-8.7259)	
Overcon	-0.0735** (-2.2098)	-0.0928*** (-2.8420)
sfin_over	0.3349*** (2.6439)	
size	0.2980*** (17.1498)	0.2914*** (16.6898)
lev	-0.0031 (-1.6028)	-0.0030 (-1.5259)
grow	-0.0045 (-1.1134)	-0.0044 (-1.0936)
share	-0.0455 (-0.3443)	0.0021 (0.0161)
board	0.1862 (1.2980)	0.1787 (1.2460)
ip	0.0002*** (96.5247)	0.0002*** (98.2073)
psfin		-0.8980*** (-8.8554)
psfin_over		0.4157*** (3.4810)
Constant	-6.5112*** (-16.0985)	-6.4035*** (-15.7605)

When the narrow-sense financial asset investment ratio is used to replace the original broad-sense indicator, its inhibitory effect on innovation output becomes stronger: each unit increase in the narrow-sense financial investment ratio (*sfin*) leads to a significant decrease of 0.9670 units in the number of valid invention patents, and the inhibitory intensity increases by 20.4% compared with the broad-sense indicator.

The key moderating effect remains robust. The coefficient of the interaction term between narrow-sense financial investment and managerial confidence (*sfin_over*) is 0.3349, slightly higher than 0.3210 in the original model, indicating that overconfident managers can weaken the inhibition of liquid financial assets on innovation by 33.5%. In the lagged model, it is confirmed that the moderating effect continues to strengthen over time. The independent negative effect of managerial confidence is also highly consistent with that in the main model.

(2) Replacing the Dependent Variable

Following Kong Dongmin et al. [15], this paper adopts the total number of valid patents of listed companies, including invention patents, utility model patents and design patents, and replaces the dependent variable with the natural logarithm of the total number of valid patents (*Pat*) for regression. The corresponding robustness test results are presented in Table 7.

When the logarithm of total patents (*pat*) is used to replace the number of invention patents (*inv*) as the proxy variable for innovation output, the core conclusions remain highly robust. The inhibitory effect of financial asset investment is still significant: each unit increase in the current financial investment ratio (*fin*) significantly reduces the total number of patents by 0.8637 units, and the inhibitory intensity is comparable to that in the invention patent model. The negative effect of lagged financial investment (*pfin*) also confirms the persistence of financialization damage.

The moderating effect of managerial confidence shows time-lag differentiation: the coefficient of the interaction term (*fin_over*) in the current model is 0.1926 and insignificant, while the coefficient of the interaction term between lagged financial investment and confidence (*pfin_over*) in the lagged model is 0.2818 and marginally significant at the 10% level, implying that the moderating effect of confident managers on patent output takes longer to appear.

Table 7. Robustness Check 2

	(1) ml_pat	(2) m2_pat
fin	-0.8637*** (-6.4120)	
Overcon	-0.0674 (-1.5888)	-0.0891** (-2.1356)
fin_over	0.1926 (1.2660)	
size	0.2529*** (11.9460)	0.2470*** (11.6025)
lev	-0.0105*** (-4.4322)	-0.0103*** (-4.3366)
grow	-0.0029 (-0.5968)	-0.0028 (-0.5775)
share	0.9147*** (5.6781)	0.9592*** (5.9142)
board	0.2461 (1.4054)	0.2377 (1.3563)
ip	0.0002*** (104.5388)	0.0002*** (105.0981)
pfin		-0.7406*** (-5.9433)
pfin_over		0.2818* (1.9492)
Constant	-5.3234*** (-10.8045)	-5.2369*** (-10.5672)

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

4.5. Heterogeneity Analysis

4.5.1. High-Tech vs. Non-High-Tech Enterprises

The heterogeneity test reveals significant differences in the inhibitory effect of financial investment and the moderating role of managers across industry technological attributes. In the high-tech enterprise group, the inhibitory intensity of financial investment on innovation is 54.5% higher than that in non-high-tech enterprises. The results of the high-tech and non-high-tech enterprise subsample regressions are reported in Table 8.

The moderating effect of managerial confidence shows a “dual enhancement” characteristic in high-tech enterprises: its independent negative effect on innovation output is -0.1450 , and the buffering intensity generated through the interaction term (fin_over) reaches 0.4608 , meaning that overconfident managers can weaken financial inhibition by 46.1%. In contrast, the moderating effect is greatly weakened in the non-high-tech enterprise group, with the interaction term coefficient being insignificant.

In summary, the buffering effect of managerial confidence is stronger in high-tech enterprises than in non-high-tech industries, and Hypothesis H3 is verified.

Table 8. Heterogeneity Test (Enterprise Type)

	(1) m1_ind1	(2) m2_ind1	(3) m1_ind0	(4) m2_ind0
fin	-0.9986*** (-5.4072)		-0.6466*** (-4.8496)	
Overcon	-0.1151* (-1.9416)	-0.1450** (-2.5174)	-0.0526 (-1.2690)	-0.0702* (-1.7155)
fin_over	0.4608** (2.1910)		0.2413 (1.6081)	
size	0.6214*** (19.6646)	0.6130*** (19.2946)	0.2426*** (10.9552)	0.2348*** (10.5454)
lev	-0.0081 (-1.5193)	-0.0075 (-1.4188)	-0.0014 (-0.7150)	-0.0014 (-0.7080)
grow	-0.0018 (-0.3638)	-0.0019 (-0.3877)	-0.0088 (-1.2082)	-0.0081 (-1.1084)
share	0.6305*** (2.8074)	0.7033*** (3.1163)	-0.4418*** (-2.6862)	-0.3906** (-2.3630)
board	0.3547 (1.4675)	0.3366 (1.3930)	0.1486 (0.8597)	0.1417 (0.8194)
ip_num	0.0002*** (69.9661)	0.0002*** (70.5688)	0.0002*** (73.3214)	0.0002*** (73.6951)
pfin		-0.9916*** (-5.8498)		-0.6674*** (-5.3867)
pfin_over		0.5715*** (2.9166)		0.3112** (2.1612)
Constant	-13.9713*** (-18.8924)	-13.8094*** (-18.5868)	-5.2254*** (-10.1756)	-5.0627*** (-9.7985)

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

4.5.2. State-Owned vs. Non-State-Owned Enterprises

The grouping test by ownership nature fully verifies the expectation of Hypothesis H4: the moderating effect of managerial overconfidence on the inhibition of innovation by financial investment is systematically strengthened in non-state-owned enterprises, but completely ineffective in state-owned enterprises. The regression results for state-owned and non-state-owned enterprises are reported in Table 9.

In the non-SOE group, the inhibitory intensity of current financial investment (fin) on innovation output is as high as -1.0241 , and the interaction term of managerial confidence (fin_over) produces a significant buffering effect of 0.4403 , equivalent to a 43.0% weakening of financial inhibition. For

lagged financial investment (pfin) in non-SOEs, the inhibition coefficient is -0.8600 , and its interaction term with confidence (pfin_over) delivers a buffering intensity of 0.5325 .

In the SOE group, the lagged interaction term is insignificant, showing a rupture of the moderating effect caused by the ownership system.

Table 9. Heterogeneity Test (Ownership Nature)

	(1) m1_gq1	(2) m2_gq1	(3) m1_gq0	(4) m2_gq0
fin	0.1993 (0.7156)		-1.0241*** (-8.6390)	
Overcon	0.1028 (1.1494)	0.1649* (1.8657)	-0.1280*** (-3.4444)	-0.1536*** (-4.2024)
fin_over	-0.1000 (-0.3039)		0.4403*** (3.3219)	
pfin		-0.3544 (-1.2669)		-0.8600*** (-7.9751)
pfin_over		-0.3929 (-1.2080)		0.5325*** (4.2709)
size	0.0499 (1.0749)	0.0478 (1.0308)	0.3543*** (19.1815)	0.3491*** (18.7697)
lev	0.0032 (0.1996)	0.0015 (0.0980)	-0.0033* (-1.7291)	-0.0030 (-1.6081)
grow	0.0004 (0.0176)	0.0002 (0.0107)	-0.0046 (-1.1800)	-0.0046 (-1.1680)
share	-0.0749 (-0.2060)	-0.0929 (-0.2560)	0.1390 (0.9840)	0.1742 (1.2218)
board	0.2322 (0.6451)	0.2359 (0.6564)	0.1350 (0.8756)	0.1202 (0.7783)
ip	0.0002*** (45.7877)	0.0002*** (45.8962)	0.0002*** (82.9867)	0.0002*** (83.6206)

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

5. Conclusions and Implications

5.1. Research Conclusions

Using data of Chinese A-share non-financial listed firms from 2009 to 2022, this study systematically verifies the inhibitory effect of financial investment on technological innovation and the moderating mechanism of managerial overconfidence, and reveals the key heterogeneous impacts of ownership and industry attributes. The core conclusions are as follows:

First, corporate financial asset investment has a significant crowding-out effect on technological innovation. A one-unit increase in the current financial investment ratio significantly reduces corporate R&D input (rd) and innovation output (inv). This negative effect remains robust after accounting for the lagged effect of financial investment, indicating that financialization not only squeezes current innovation budgets but also forms path dependence in subsequent years, continuously suppressing innovation input and output.

Second, managerial overconfidence plays a “buffering role” in the dimension of innovation output. Overconfident managers may partially offset the inhibitory effect of financialization on invention patent counts through informal channels or risk preference adjustment. However, this moderation only appears in innovation output and has no significant impact on R&D input under strict budget constraints.

Finally, this moderating effect is most prominent in high-tech enterprises and non-state-owned enterprises. In high-tech industries, overconfident managers weaken the negative effect of financial investment by nearly 50%, while the effect is almost ineffective in state-owned enterprises. This

shows that ownership and industry attributes jointly shape the interaction mechanism between behavioral finance and innovation.

5.2. Policy Recommendations

Based on the above conclusions, this paper puts forward the following suggestions:

Joint efforts should be made at both macro and micro levels. On the one hand, incentive tools such as tax preferences and subsidies should be used to guide listed companies to reduce excessive financialization and optimize the allocation between financial assets and real investment. On the other hand, corporate governance should be improved to strengthen the supervision of the board of directors and supervisory board over major investment decisions, so as to avoid biases in R&D input caused by overconfidence of individual managers.

In addition, for high-tech enterprises, fiscal support and credit preference for R&D expenditure should be further increased to encourage them to rationally use financial tools while consolidating core technologies. For state-owned enterprises, ownership structure reform should be carried out to grant management more innovation autonomy, and an incentive and restraint mechanism linked to R&D performance should be established to break the constraints of institutional rigidity on innovation activities.

Through such comprehensive policy design, it is possible to curb the crowding-out effect of financialization on innovation while fully stimulating managers' initiative and innovation vitality, so as to promote enterprises to achieve high-quality technological progress and sustainable development.

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