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Research on the Impact of Management Shareholding Ratio on Corporate Innovation: Based on the Mediating Effect of Financial Deepening

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Abstract

The management shareholding ratio is an indicator to measure the degree of separation between ownership and management in a company. The lower the management shareholding ratio, the higher the degree of separation between ownership and management. Research and development innovation is the key to measuring the development of a company. The ratio of management shareholding ratio will affect the level of innovation in the company. Financial deepening refers to non-financial enterprises whose profits come more from investment activities. Therefore, this study used data from China from 2014 to 2018 to research the impact of management shareholding ratio on innovation R&D investment and output in non-financial enterprises through a fixed effects model. The degree of financial deepening is added as an intermediary variable to investigate the effect of management shareholding ratio on enterprise innovation under the influence of financial deepening. Ultimately, it was found that management shareholding ratio weakens the degree of financial deepening in enterprises, thereby promoting innovation R&D investment and output.

I. INTRODUCTION

Technological innovation is the key to the development of enterprises (Janjić & Rađenović, 2019; Zhang et al., 2021). Although technological innovation faces uncertainty and no immediate returns, it can create opportunities for future competitive advantages for enterprises. In the context of "mass entrepreneurship and innovation", examining the mechanisms by which enterprises promote technological innovation efficiency has positive practical significance for a deeper understanding of micro enterprise innovation practices and promotes industrial structure

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optimization and upgrading. With the separation of ownership and management rights in enterprises, agency problems have begun to emerge.

The management shareholding ratio is an indicator of the degree of separation between ownership and management in a company. The lower the management shareholding ratio, the higher the degree of separation between ownership and management in the company. The proportion of management shareholding affects the business decisions of enterprise managers and ultimately affects enterprise innovation. The concept of financial depth was initially proposed by American economists to reflect a country's level of commercial economy. Some foreign economists emphasize from the perspective of asset liability ratio that financial deepening is the process of transforming a company's operating assets into financial assets through relevant financial technologies. At the same time, some economists have defined financial deepening from the perspective of economic benefit accumulation, believing that financial deepening is the process by which enterprises earn benefits through various investments. At the same time, when enterprises obtain huge profits through financial deepening, they may also detach themselves from their main business. Therefore, this study has practical significance for the development of enterprises by studying the impact of managerial shareholding ratio and corporate financial deepening on corporate innovation.

Following the outlined research framework, this study developed a fixed effects model, designating the manager shareholding ratio as the independent variable, R&D investment and patent output related to enterprise innovation as the dependent variables, and financial deepening as the mediating variable. The aim was to analyze how the manager shareholding ratio influences enterprise innovation through the mediating role of financial deepening, offering practical insights for enterprise development.

II. LITERATURE REVIEW

This study examines how the managerial shareholding ratio affects corporate innovation, alongside the role of foreign and executive/institutional shareholding ratios in shaping corporate social responsibility. The results indicate that foreign and institutional shareholding ratios significantly enhance corporate social responsibility. In contrast, the executive shareholding ratio demonstrates a significant negative influence on corporate social responsibility (Haimei et al., 2014). For companies listed on the GEM board, there is a positive relationship between earnings volatility and R&D investment. Specifically, higher earnings volatility encourages companies to allocate more resources to R&D in order to strengthen their competitive edge in the market. Additionally, executive incentives play a role in amplifying this effect (Ling et al., 2019). In terms of executive shareholding ratio, government funding, and R&D investment in high-tech enterprises, government funding has a significant incentive effect on corporate R&D investment, when the proportion of executive shareholding ratio is moderate, government funding has a strong incentive effect on corporate R&D investment, when executive shareholding ratio is too high or too low, it can create a management defense effect, thereby suppressing the incentive effect of government funding on R&D investment in high-tech enterprises (Xiaofang et al., 2017). To examine the influence of management shareholding ratios on the technological innovation efficiency of Chinese listed companies, findings indicate that a higher proportion of management shareholding significantly enhances innovation efficiency. This positive relationship is particularly evident in companies with lower agency costs, where the effect is more pronounced (Xiding et al., 2018). This study examines the influence of executive incentives on innovation investment in asset-light companies. This study identifies a stronger positive association between

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executive compensation and R&D investment. Although the link between the executive shareholding ratio and R&D investment appears insignificant, there is a clear and significant relationship between executive equity incentives and R&D investment (Mu & Song, 2019).

In terms of the impact of management shareholding ratio on the deepening of corporate finance, the increase in management shareholding ratio significantly inhibits excessive financialization of enterprises (Safi et al., 2022). The financial background of a CEO significantly influences corporate financialization in a positive way, with non-bank financial backgrounds having an even greater effect. This conclusion remains consistent after addressing potential endogeneity issues. Additionally, an analysis of the underlying mechanisms reveals that a CEO's financial background primarily fosters corporate financialization by boosting their confidence and easing financing constraints (Yong et al., 2019).

The influence of financial deepening on enterprise innovation reveals that the financialization of commercial circulation enterprises exerts a crowding-out effect on their innovation efforts. In markets with advanced financial development, financialization significantly suppresses innovation within these enterprises. This inhibitory effect is even more pronounced in large-scale commercial circulation enterprises. While financialization may enhance the innovation performance of such enterprises in the short term, its long-term impact proves to be relatively insignificant (Lu, 2021). The financialization of enterprises plays a dual role, acting as a masking effect between digital inclusive finance and innovation investment while serving as a partial mediator between digital inclusive finance and innovation output. This mediating mechanism is primarily driven by short-term transactional financial assets. The impact of digital inclusive finance in enhancing innovation output by curbing corporate financialization is particularly pronounced in non-state-owned enterprises, firms without international audits, and those facing significant financing constraints (Jun et al., 2023). The suppressive impact of financialization on both the investment in and outcomes of low-carbon technology innovation is less significant in state-owned enterprises compared to non-state-owned enterprises. Similarly, this inhibitory effect is weaker in large-scale enterprises than in smaller ones. Furthermore, non-state-owned and small-scale enterprises exhibit more pronounced lagging and persistent effects of financialization in hindering low-carbon technology innovation (Nanbo et al., 2023). Corporate financialization exerts a notably adverse effect on the high-quality growth of enterprises, impacting both state-owned and non-state-owned firms. Technological innovation acts as a mediating variable in this relationship, demonstrating a significant partial mediating role. By diminishing innovation capabilities, corporate financialization obstructs the advancement of enterprises toward high-quality development (Zhiyong et al., 2023).

III. RESEARCH METHODS

Data sources and sample selection

This study focuses on Chinese A-share listed companies during the period from 2014 to 2018. To meet the research requirements, the samples were selected and filtered through the following steps:

1. excludes listed companies in the financial and insurance industries;
2. excludes companies that do not disclose their R&D investment and output at all during the research period;
3. excludes missing observations of other control variables. Finally, a balanced panel data of 24236 observations from 4253 listed companies is obtained. To address the impact of extreme values, the continuous variables are adjusted by trimming the top and bottom 1% quantiles.

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After a meticulous selection and exclusion process, the final dataset encompasses industries including agriculture, forestry, animal husbandry, fisheries, mining, energy production and supply, construction, wholesale and retail, transportation, warehousing, postal services, accommodation and catering, information transmission, software, IT services, real estate, leasing, business services, as well as scientific research and technology services.

This dataset comprehensively covers various sectors and scales within China's A-share market, excluding the finance and insurance industries.

The data utilized in this study, including the management shareholding ratio, R&D investment, and enterprise innovation output, were sourced entirely from the CSMAR database. This database, designed to meet academic research needs, is a domestic platform for economic and financial data. It was developed by integrating international database standards with China's specific national context. Access to the CSMAR database is available to individuals affiliated with Chinese universities who have the appropriate registration and purchase rights.

Regression model and variable definition

Referring to existing literature, this study adopts the following model to test the relationship between management shareholding ratio and enterprise innovation input and output:

$$R\&D_{it}=\alpha_0+\alpha_1 MoProp_{it}+\alpha_2 \text{Controls}_{it}+\varepsilon_{it} \quad (1)$$

Among them, $R\&D_{it}$ represents the innovation level of enterprises in the i-th region t period, $MoProp_{it}$ represents the shareholding ratio of enterprise management in the i-th region t period, Controls_{it} represents a series of control variables, and ε_{it} represents the error term of the model.

Explained variable

This study examines enterprise innovation metrics from two dimensions: innovation input and innovation output. Innovation input is measured by taking the natural logarithm of R&D expenditure, while innovation output is evaluated using the natural logarithm of the total number of patent applications submitted by year-end, incremented by 1.

Explained variable

Drawing from existing research, this study defines the management shareholding ratio (MoProp) as the proportion of total shares owned by the board of directors, supervisory board, and executives relative to the company's total shares. Additionally, for further analysis, the average annual management shareholding ratio across industries is utilized as an instrumental variable for testing.

Mediating variables

This study assesses the degree of corporate financialization (Fin) by analyzing the company's investments in financial assets. The assessment involves determining the ratio of monetary funds, trading financial assets, available-for-sale financial assets, investment properties, held-to-maturity investments, and receivable dividends to the company's total assets at the end of the reporting period.

Control variables

This study incorporates a range of factors that may impact corporate innovation to ensure a thorough analysis. These factors include company size (SIZE), company age (Age), cash flow (Cash), price-to-earnings ratio (PE), return on assets (ROA), the largest shareholder's ownership percentage (TOP1), and the total number of board members (BoardSize). Furthermore, the analysis controls for fixed effects associated with both the year and the industry. Table 1 offers detailed definitions and explanations of these variables.

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Table 1. Definition of Main Variables

Variable	Obs	Mean	Std.Dev.
Explained Variable	R&D Investment	lnRD	Natural logarithm of R&D investment amount
	Patent Output	Patent	The natural logarithm of the total number of patent applications plus 1
Explanatory Variable	Management Shareholding Ratio	MoProp	The ratio of the number of shares held by the management at the end of the year to the total number of shares held
Intermediary Variable	Degree of Financialization	Fin	The ratio of financial assets to total assets
	Enterprise Size	SIZE	Natural logarithm of total assets
	Enterprise Age	Age	The natural logarithm of the listing period
	Enterprise Cash Flow	Cash	The ratio of net cash flow generated from operations to total assets
	Enterprise P/E Ratio	PE	Market price per share of common stock ÷ Annual earnings per share of common stock
Control Variable	Return on Assets	ROA	Return on total assets=Net profit/Total assets x 100%
	Ownership Concentration	TOP1	Shareholding ratio of the largest shareholder
	Board Size	BoardSize	Number of directors in the board of directors
	Year	Year	
	Industry	Industry	

IV. RESEARCH RESULTS

Descriptive statistics

Table 2 displays the descriptive statistics for the key variables in this research. "InRD" and "Patent" represent the levels of innovation input and output within enterprises, respectively. The maximum value for innovation input is 21.738, while the minimum is 0, with an average of 16.034. For R&D output, the maximum value is 6.726, the minimum is 0, and the average is 2.726. These figures support the observation that certain companies place limited emphasis on innovation activities. Regarding the management shareholding ratio (MoProp), the highest ratio recorded is 68.4%, the lowest is 0, and the average is 14.8%. Notably, 80.32% of firms have a shareholding ratio above 0, while 35.13% exceed the average ratio. This suggests that most companies maintain a relatively balanced shareholding ratio, with only a small proportion having excessively high management shareholding ratios.

Table 2. Descriptive Statistics

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Variable	Obs	Mean	Std. Dev.	Min	Max
lnRD	24236	16.034	5.739	0	21.738
Patent	24236	2.726	1.712	0	6.726
MoProp	24236	.148	.199	0	.684
fin	24236	.045	.08	0	.441
SIZE	24236	22.248	1.289	20.012	26.186
Age	24236	2.041	.961	0	3.332
Cash	24236	.05	.066	-.143	.239
PE	24236	89.991	153.744	5.274	1078.074
ROA	24236	.055	.144	-.859	.311
TOP1	24236	33.933	14.668	8.538	74.018
BoardSize	24236	8.422	1.607	5	14

Regression results of management shareholding ratio and corporate innovation

This study investigates the influence of management's shareholding ratio on corporate innovation, with the findings summarized in Table 3. Columns (1) and (3) present results without accounting for additional influencing factors, while columns (2) and (4) include controls for certain other factors and industry-year fixed effects. Regardless of these controls, enterprise innovation, measured by R&D investment (InRD), and the management shareholding ratio (MoProp) exhibit a significant positive correlation at the 1% level. Similarly, the output of innovation, reflected in patent production (Patent), also shows a significant positive relationship with the management shareholding ratio (MoProp) at the 1% level, highlighting a strong connection between management shareholding and enterprise innovation (Xiding et al., 2018). Specifically, for every unit increase in management shareholding ratio, the proportion of innovation and research and development investment in enterprises increases by 2.546%, and the proportion of innovation output rises by 2.118%. This indicates that management shareholding ratio can promote enterprise innovation.

Table 3. Management Shareholding Ratio and Corporate Innovation

	(1) lnRD	(2) lnRD	(3) Patent	(4) Patent
MoProp	2.546***	2.118***	0.382***	0.437***
	(0.359)	(0.340)	(0.133)	(0.125)
SIZE		1.286***		0.494***
		(0.114)		(0.0298)
Age		-0.688***		-0.0200
		(0.113)		(0.0296)
Cash		0.555		-0.0285
		(0.450)		(0.123)
PE		0.0000779		0.0000956

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		(0.000209)		(0.0000582)
ROA		-0.265		0.0257
		(0.213)		(0.0534)
TOP1		0.00707		0.00273
		(0.00777)		(0.00192)
BoardSize		0.0357		0.0106
		(0.0341)		(0.0101)
Year				
Ind				
_cons	14.37***	-13.24***	2.087***	-8.937***
	(1.846)	(3.144)	(0.406)	(0.761)
N	24236	24236	24236	24236
R^2	0.119	0.142	0.156	0.188
adj. R^2	0.117	0.139	0.153	0.185

The impact mechanism of management shareholding ratio on corporate innovation

In the daily operation and decision-making management process of enterprises, if there is an excessive shift from real to virtual investment and capital operation through non production and operation businesses, it may have a negative impact on the relationship between management shareholding ratio and enterprise innovation. To foster a stronger positive relationship between the management shareholding ratio and enterprise technological innovation, it may be advantageous to minimize the degree of enterprise financialization. On the one hand, based on the resource-based theory, the boundaries of enterprise resources are clear, and there is a complementary, increasing, and decreasing relationship between financial resources and innovation resources. If an enterprise invests too much of its own funds in the operation of financial products, it will squeeze out innovation investment and ultimately lead to a decrease in innovation output (Lu, 2021). On the other hand, the principal-agent theory suggests that agents tend to choose financial products with high investment returns for the purpose of evaluating their own business performance and salary returns, in order to obtain profits. This also squeezes out innovation and research and development investment. This study suggests that the influence of the management shareholding ratio on corporate innovation may be mediated through the pathway of corporate financialization. However, the transition from real economic activities to virtual ones can either enhance or hinder the positive correlation between the management shareholding ratio and corporate innovation.

The previous section has examined the impact of management shareholding ratio on corporate innovation, but the transmission channels need further verification. There may be different motivations for companies to invest in financial assets, which led to different impacts of financial deepening on the input and output of enterprise innovation (Jun et al., 2023), therefore, the mechanism by which management shareholding ratio affects corporate innovation through financial investment may also differ. To examine how corporate financialization influences the relationship between the management shareholding ratio and corporate innovation, it is crucial to differentiate its effects by considering both innovation input and innovation output.

Using Sobel's test, Table 4 presents the findings regarding the mediating mechanism linking corporate financialization, management shareholding ratio, and investment in corporate technological innovation. The results show that after adding corporate financialization (Fin) as an intermediary variable, the management shareholding ratio (MoProp) is still significantly correlated with research and development investment (lnRD) and output (Patent) at the 1% level (Xiaofang et al., 2017; Xiding et al., 2018). At the same time, the management shareholding ratio (MoProp) is negatively correlated with the degree of corporate financialization (Fin) (Safi et al.,

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2022), while the degree of corporate financialization (Fin) is significantly correlated with research and development investment (lnRD) and output (Patent) at the 1% level (Lu, 2021; Nanbo et al., 2023), with correlation coefficients of -4.803 and -0.675, respectively, indicating that the degree of corporate financialization inhibit the positive relationship between management shareholding ratio and corporate innovation.

Table 4. Intermediary Mechanism of Corporate Financialization

	(1) lnRD	(2) Patent
Fin	-4.803***	-0.675***
	(0.330)	(0.103)
MoProp	1.141***	0.391***
	(0.158)	(0.0496)
SIZE	1.404***	0.663***
	(0.0264)	(0.00828)
Age	-0.590***	-0.0110
	(0.0356)	(0.0111)
PE	-0.000735***	-0.000280***
	(0.000179)	(0.0000561)
ROA	0.0552	0.304***
	(0.187)	(0.0586)
TOP1	-0.00380**	-0.000280
	(0.00188)	(0.000589)
BoardSize	0.0695***	0.0251***
	(0.0170)	(0.00532)
year	0.303**	0.0878**
	(0.118)	(0.0370)
Ind	-7.153***	-0.0916
	(1.017)	(0.319)
_cons	-14.71***	-13.33***
	(0.662)	(0.207)
N	24236	24236
R^2	0.537	0.489
adj. R^2	0.535	0.487

Further testing

To address the potential reverse causality between the management shareholding ratio (MoProp) and corporate innovation—measured through research and development investment (lnRD) and output (Patent)—it is important to consider that corporate innovation levels might also influence the management shareholding ratio. To mitigate this endogeneity issue, the industry average management shareholding ratio (AverMoProp) was employed as an instrumental variable for additional analysis. The first-stage regression results, presented in Table 5, show a significantly positive relationship between AverMoProp and MoProp at the 1% level. Furthermore, the F-value of 195.9 exceeds the critical threshold of 16.38 at the 10% significance level, thereby ruling out the possibility that the instrumental variable is weak.

Table 5. 2 SLS Instrumental Variables: First Stage Regression Results

MoProp	Coefficient	Std. err.	t	P>|t|	[95%conf.	interval]
AverMoProp	0.3341556	0.023875	14.00	0.0000	0.28736	0.380952
SIZE	-0.0015066	0.001359	-1.11	0.2680	-0.00417	0.001157
Age	-0.0467194	0.001693	-27.59	0.0000	-0.05004	-0.0434

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Cash	0.002981	0.008061	0.37	0.7120	-0.01282	0.01878
PE	-6.03E-06	3.54E-06	-1.70	0.0890	-1.3E-05	9.09E-07
ROA	0.0242881	0.00343	7.08	0.0000	0.017565	0.031012
TOP1	0.0017451	9.15E-05	19.08	0.0000	0.001566	0.001924
BoardSize	0.0023141	0.000553	4.18	0.0000	0.00123	0.003398
dyear						
dInd						

Table 6 presents the regression outcomes from the second stage, examining the relationship between the management shareholding ratio (MoProp) and R&D investment in corporate innovation (lnRD). After using the industry average management shareholding ratio (AverMoProp) to alleviate endogeneity issues, the regression coefficient of management shareholding ratio (MoProp) on R&D investment in corporate innovation remains significantly positive, consistent with the previous results.

Table 6. 2 SLS Instrumental Variables: Second Stage Regression Results (R&D Investment)

lnRD	Coefficient	Std. err.	z	P>|z|	[95%conf.	interval]
MoProp	13.2668	3.171195	4.18	0.0000	7.051374	19.48223
SIZE	1.303093	0.060505	21.54	0.0000	1.184505	1.421681
Age	-0.14951	0.17047	-0.88	0.3800	-0.48362	0.184606
Cash	0.533478	0.357806	1.49	0.1360	-0.16781	1.234765
PE	0.000144	0.000158	0.91	0.3610	-0.00017	0.000455
ROA	-0.55269	0.172825	-3.20	0.0010	-0.89142	-0.21396
TOP1	-0.01273	0.006942	-1.83	0.0670	-0.02633	0.000876
BoardSize	0.009422	0.025662	0.37	0.7130	-0.04087	0.059718
dyear						
dInd						

Table 7 reports the regression results of management shareholding ratio (MoProp) and enterprise innovation output (Patent) in the second stage. After using the industry average management shareholding ratio (AverMoProp) to alleviate endogeneity issues, the regression coefficient of management shareholding ratio (MoProp) on enterprise innovation output becomes negative. This may be due to the fact that the actual number of patents produced by enterprise innovation and R&D investment are directly affected by management shareholding ratio, and the output of patent quantity is influenced by more complex factors. Therefore, adding the industry average management shareholding ratio (AverMoProp) as an instrumental variable affects the results.

Table 7. 2 SLS Instrumental Variables: Second Stage Regression Results (Innovation Output)

Patent	Coefficient	Std. err.	z	P>|z|	[95%conf.	interval]
MoProp	-2.06438	0.981405	-2.10	0.0350	-3.98789	-0.14086
SIZE	0.489739	0.018725	26.15	0.0000	0.453039	0.526439
Age	-0.1408	0.052756	-2.67	0.0080	-0.2442	-0.0374
Cash	-0.02362	0.110732	-0.21	0.8310	-0.24065	0.193415
PE	8.06E-05	0.000049	1.65	0.1000	-1.5E-05	0.000177
ROA	0.090352	0.053485	1.69	0.0910	-0.01448	0.19518
TOP1	0.00717	0.002148	3.34	0.0010	0.00296	0.011381
BoardSize	0.01648	0.007942	2.08	0.0380	0.000915	0.032046

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V. CONCLUSION

This study uses a sample of 24236 A-share listed companies in China from 2014 to 2018 to explore the impact of management shareholding ratio on corporate innovation. Firstly, this study verified through a fixed effects model that the proportion of management shareholding affects the input and output of corporate innovation (Xiding et al., 2018). Secondly, after adding financial deepening as an intermediary variable, it was found that management shareholding ratio weakens the degree of financial deepening of the enterprise, and ultimately promotes the R&D input and output of the enterprise (Jun et al., 2023; Nanbo et al., 2023), which indicated that as the proportion of financial assets held by enterprises steadily decreases, they had more funds to invest in research and development, which to some extent promotes innovation and leads to more innovation output.

This study acknowledges several limitations in its research approach. Firstly, substituting R&D results for R&D output as the dependent variable in measuring enterprise innovation fails to resolve endogeneity issues effectively. This may be because instrumental variables are strongly linked to a company's R&D investment but lack a robust connection to its R&D output. Secondly, the findings suggest that the influence of managers' shareholding ratios on corporate innovation remains consistent across various types of enterprises, implying that the nature of the enterprise does not significantly affect the outcomes of this research. Lastly, while the industry average level was chosen as the instrumental variable, the ownership ratio of industry managers is inherently connected to that of individual enterprise managers, which does not adequately address the issue of omitted variables. Future research could explore more suitable instrumental variables to overcome these challenges.

Based on the research in this study, the following suggestions are proposed for the shareholding ratio of corporate managers on deepening of corporate finance, and corporate innovation. Firstly, increasing managerial shareholding ratio appropriately can encourage corporate management to pay attention to risk management and capital utilization; Secondly, the deepening of corporate finance has a restraining effect on R&D investment, and efforts should be made to reduce the degree of financial deepening from a perspective other than that of managers; The third is that there is a certain relationship between enterprise R&D investment and achievement transformation. Paying attention to enterprise R&D investment is conducive to enhancing the importance of innovation, and paying attention to enterprise achievement output is conducive to paying attention to the innovation efficiency of enterprises.

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