

Shareholding Ratio of Institutional Investors, Stability of Senior Management Team and Dual Innovation of Enterprises - The Moderating Role of Digital Transformation

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Abstract. There is still A lack of explanation on the influence mechanism of the existing theories of institutional investors on the dual innovation perspective. Based on the resource-based view, this project takes 3093 A-share listed companies from 2015 to 2019 as samples and uses OLS regression analysis to explore the relationship between the shareholding ratio of institutional investors and enterprise exploratory innovation, exploitative innovation and dual innovation. On this basis, the mediating role of TMT stability and the moderating role of digital transformation are analyzed. It is found that the shareholding ratio of institutional investors inhibits firms' exploratory innovation, development innovation and dual innovation. The stability of SENIOR management team plays a partial mediating role in the influence of shareholding ratio of institutional investors on exploratory innovation, developmental innovation and dual innovation. Digital transformation inhibits the influence of shareholding ratio of institutional investors on exploratory innovation, development innovation and dual innovation. This study expands the existing theory of dual innovation and provides experience for enterprise innovation management.

Keywords: Shareholding by institutional investors; Dual innovation; Stability of senior management team; Digital transformation.

1. Introduction

In the current environment of fierce market competition, technological innovation has become an effective way for enterprises to enhance their competitiveness. Despite a series of innovation policy in China, and promote the innovation process, but most of the enterprise innovation still faces technological innovation effect is not obvious, [58,1], the innovation on such problems as unclear, lack of upgrading existing technology, business model and the ability to develop new technologies, new products, to ensure that the enterprise development of short-term and long-term lead [64]. Therefore, how to balance the focus of enterprise innovation and promote enterprise innovation has become a highly concerned issue in academic and practical circles. According to the dual innovation theory, the innovation activities of enterprises can be divided into exploratory innovation and exploitative innovation. Exploratory innovation has a long cycle and a large demand for resources. It takes acquisition and creation as the main goals and focuses on developing new products to enter new markets, so as to achieve long-term growth of enterprises [37]. Development innovation has a short cycle and less demand for resources, and its risk is lower than exploratory innovation. It takes the mining and processing of existing knowledge as the main goal and upgrades existing products, so as to improve short-term performance of enterprises [41]. Combination and balance the exploratory innovation and open innovation model for dual nature, refers to the enterprise by the resources, capabilities, and environmental factors, under the function of using the decision-making method of entrepreneurship, innovation and open innovation form organizational flexibility and the resources endowment, can at the same time guarantee the enterprise both short-term and long-term development, achieve sustainable competitive advantage.

In recent years, China has gradually improved the institutions and mechanisms conducive to institutional investors' participation in the capital market, providing strong support for high-quality economic development. Institutional investors have certain advantages in terms of professional knowledge, information acquisition and total amount of capital, and their investment decisions are

often more reasonable. Therefore, encouraging and advocating investment by institutional investors is of positive significance for efficient economic development [39]. Institutional investors control enterprises by holding their stocks and influence their decision-making process of innovation strategy to ensure the stable development of enterprises. However, previous studies have found that institutional investors are short-sighted and tend to avoid risks to avoid threats to their career [38].

In addition, when ownership and control are separated, the senior management team plays an important role in the implementation of corporate strategy and management of innovation activities, and its stability is undoubtedly a key factor affecting corporate innovation [52]. At the same time, China vigorously promotes enterprises to implement digital transformation. The rapid development of digital information, big data and other technologies strengthen the internal and external cooperation of enterprises, reduce the innovation cost of enterprises and improve the innovation efficiency [42], which has an increasingly prominent impact on enterprises' innovation activities.

Combining the above analysis, this paper, by constructing the OLS regression model to explore the institutional investors holding exploratory innovation, open innovation of enterprise and the dual innovation affect respectively, and to further explore the executive team stability in the relationship between the existence of a mediating role, and digital transformation of the situational factors that affect the incentive if there is a regulation, This paper studies the effect of institutional investors' shareholding on China's macroeconomic growth from a micro perspective, and provides a novel research perspective for the influencing factors of enterprises' dual innovation.

2. Literature Review

Dual innovation includes exploratory innovation with a high degree of innovation and exploitative innovation with a low degree of innovation [3]. Exploratory innovation is beneficial to enterprises to enhance long-term competitive advantages, but it needs a large amount of capital investment. Development innovation focuses on short-term development and performance improvement. There is a certain competition for resources between the two. Paying too much attention to exploratory innovation while ignoring development innovation will lead to loss of economic income and negative impact on short-term performance of enterprises. Excessive attention to development innovation while ignoring exploration innovation will result in weak market adaptability of enterprise products and lack of follow-up motivation [63]. Therefore, the balance and matching of two kinds of innovation activities have a direct impact on enterprise development and performance level.

Existing theories of ambidextrous innovation mainly focus on concept definition [6], antecedent traceability [56], path construction [66], balance model [25] and evolutionary process [24]. Among them, the research on anova mainly discusses CEO and TMT [9], organizational static characteristics [26,50], organizational dynamic characteristics [13,22], etc., but less attention is paid to institutional investors and binary innovation.

As the dominant force in the current capital market, institutional investors usually participate in corporate governance by holding the stocks of listed companies, and have a certain influence on the value of the company. With the continuous improvement of policies related to institutional investors, the academic circle has also conducted multi-dimensional discussions on the governance effectiveness of institutional investors: the governance level of institutional investors [36], the investment and financing efficiency of institutional investors and enterprises [47], and the information quality of institutional investors and financial reports [46,60]. However, when scholars focus on the role of institutional investors in improving enterprises' innovation ability, most of them are limited to the heterogeneity of institutional investors [15,27], institutional investor research, shareholding stability of institutional investors, etc., while the research on shareholding ratio of institutional investors is still incomplete.

In addition, as an important human capital of an enterprise, the turnover of senior executives will inevitably lead to the fluctuation of team stability. Previous studies mainly focused on the influencing

factors of TMT stability [23] and the relationship between TMT stability and corporate performance [35,51]. However, few articles discuss the relationship between the stability of senior management team and the shareholding ratio of institutional investors and the ambidextrous innovation by taking the stability of senior management team as a mediator variable.

Digital transformation is the innovation symbol of an enterprise moving from an industrial system to a digital system [59]. In the era of rapid development of big data, cloud computing and other emerging technologies, enterprises cannot rely on the previous model for development. Therefore, enterprises need to keep up with the innovation pace of The Times, complete the digital transformation of enterprises, and make full use of the knowledge reorganization and transfer capabilities brought by digital transformation to promote enterprises to achieve more effective innovation. Thus help enterprises to achieve beyond their own advantages in all aspects of improvement.

3. Theoretical foundation and research hypothesis

3.1 Shareholding ratio of institutional investors and enterprise exploratory, exploitative and dual innovation

Based on the short-sighted theory of institutional investors, there is information asymmetry between institutional investors and their management. Institutional investors do not understand the internal situation of enterprises and will not make high-risk investment behaviors for high returns. Therefore, institutional investors will block both the exploratory innovation with large investment and long investment time and the development innovation with small investment and short development time, so as to ensure their stable cash flow income.

From the perspective of performance appraisal, institutional investors, such as fund managers, tend to invest in enterprises with relatively stable development and no major innovation in order to maintain their stable earnings due to short performance appraisal cycle in fund companies. Companies on the rise, which require a lot of research and development, are more likely to be removed from fund managers' portfolios. Based on this, both exploratory innovation that requires a large amount of resources and focuses on the research and development of new products and development innovation that uses small-scale resources and focuses on the reconstruction of existing products will have a certain weakening effect when the shareholding ratio of institutional investors is too high. The increase in the shareholding ratio of institutional investors will bring higher performance requirements and pressure to enterprise management, and in order to meet the needs of institutional investors, the management will try to reduce enterprise innovation activities, profit manipulation [5], and reduce the capital input of enterprise innovation. In addition, the performance of institutional investors will affect their ranking and reputation, so institutional investors tend to avoid high-risk investments [43].

In order to improve dual-innovation, enterprises must realize the balanced development of enterprise development innovation and exploration innovation [68]. Dual innovation is a collaborative process of exploratory and developmental innovation, which requires organizations to effectively coordinate multidimensional objectives and interest conflicts. Institutional investors will pay more attention to stable operation of enterprises and reduce their investment in exploratory and developmental innovation, resulting in the failure of both types of innovation activities [68].

Based on the above analysis, the following hypotheses are proposed:

- H1a: The shareholding ratio of institutional investors inhibits exploratory innovation;
- H1b: The shareholding ratio of institutional investors inhibits development innovation;
- H1c: The shareholding ratio of institutional investors inhibits binary innovation.

3.2 The mediating role of senior management team stability

Stability of senior management team refers to the ability of team members and size to remain unchanged in a certain period [2,61], indicating that the team has high cohesion, trust each other and

can make consistent decisions. In order to reduce principal-agent costs and implement more direct control over senior executives, institutional investors set stricter company rules and regulations to limit the turnover of senior executives, so as to strengthen the stability of senior management team. In addition, institutional investors, focusing on the current corporate performance, will inevitably exert performance pressure on the corporate management and require the senior management team to give positive feedback on the enterprise operation activities in the short term, so as to achieve reasonable and effective supervision of the corporate management. This supervision helps to improve the individual competence of senior management team members and further strengthen the stability of senior management team. Therefore, under the active management of institutional investors, the stability of senior management team has been positively strengthened.

The stable senior management team will cater to the will of institutional investors, reduce the R&D investment and innovation behavior of enterprises, and maintain the status quo of stable operation of enterprises. Meanwhile, in order to gain high remuneration and reputation [52], the senior management team will be less enthusiastic about carrying out major innovative activities [14] and more inclined to stable enterprise operation so as to obtain immediate benefits. Therefore, the stability of the senior management team is a strong guarantee for institutional investors to maintain their stable returns [16]. Institutional investors hope that enterprises can reduce risks, and their behaviors and activities will strengthen the short-sighted behaviors of management [44], encourage management to carry out stability construction, and make it easier for senior executives to reach a consensus in the decision-making of enterprises, take positive and consistent actions, and reduce capital investment, thus forming a negative feedback cycle for innovation activities. Based on the stability of the senior management team in the influence of institutional investors play a role, enterprises need to make a trade-off between innovation and steady development [29], and there is a conflict of interest, cannot achieve [40] at the same time, led to the decrease of the enterprise innovation level, exploratory and open innovation in development, more conducive to the formation of the dual sexual innovation model.

Based on the above analysis, the following hypotheses are proposed:

H2a: Senior management team stability plays a mediating role in the shareholding ratio of institutional investors and exploratory innovation;

H2b: The stability of senior management team plays a mediating role in the shareholding ratio of institutional investors and developmental innovation;

H2c: The stability of senior management team plays a mediating role in the shareholding ratio of institutional investors and binary innovation.

3.3 The moderating effect of digital transformation

Based on the "resource view" of the enterprise, the digitized transformation need to invest a lot of manpower and material resources [30], there is high risk, and the enterprises and institutional investors to reduce the risk and to maintain the position of business running smoothly, thus injecting resources in the enterprise for digital transformation of enterprises, enterprise innovation activities will be further reduced. Institutional investors aim to achieve stable performance, participate in corporate governance, and reduce operational risks [31]. Digital transformation requires enterprises to have the ability to penetrate the entire business chain through technology, which leads to increased risks faced by institutional investors. Therefore, institutional investors will actively influence the resource allocation of enterprises, greatly reduce the investment in exploratory innovation activities with high risk level, and even may reduce the investment in development innovation activities with low risk level, thus inhibiting the development of dual-innovation of enterprises.

On the contrary, for enterprises with small shareholding ratio of institutional investors, it is difficult for them to participate in the sustainable development of enterprises, and they will not supervise and manage management behaviors. Therefore, based on the long-term development goals, enterprises with small shareholding ratio of institutional investors will still strengthen the development of exploratory innovation and exploitative innovation, strive to increase market share

and maintain the lasting vitality of enterprise development under the moderating effect of digital transformation. Therefore, digital transformation will further regulate the reduction of innovation investment of enterprises with high shareholding ratio of institutional investors, and strengthen the restraining effect of shareholding ratio of institutional investors on enterprises' exploratory innovation and exploitative innovation behavior. According to the dual innovation theory, investing a large amount of resources to improve existing technologies and try new options is the key for enterprises to carry out innovation activities [55], while digital transformation promotes enterprises to digitally transform existing businesses with digital technologies, occupying r&d investment [20]. Due to the short-sighted attitude of institutional investors towards the investment of enterprises, they mainly focus on the stable interests of enterprises, forcing the management to focus on profit operation activities [15], breaking the balanced development of binary innovation.

Based on the above analysis, the following hypotheses are proposed:

H3a: Digital transformation positively moderates the inhibiting effect of shareholding ratio of institutional investors on exploratory innovation;

H3b: Digital transformation positively moderates the restraining effect of shareholding ratio of institutional investors on development innovation;

H3c: Digital transformation positively moderates the restraining effect of shareholding ratio of institutional investors on binary innovation.

3.4 The following concept model is constructed according to the above hypothesis

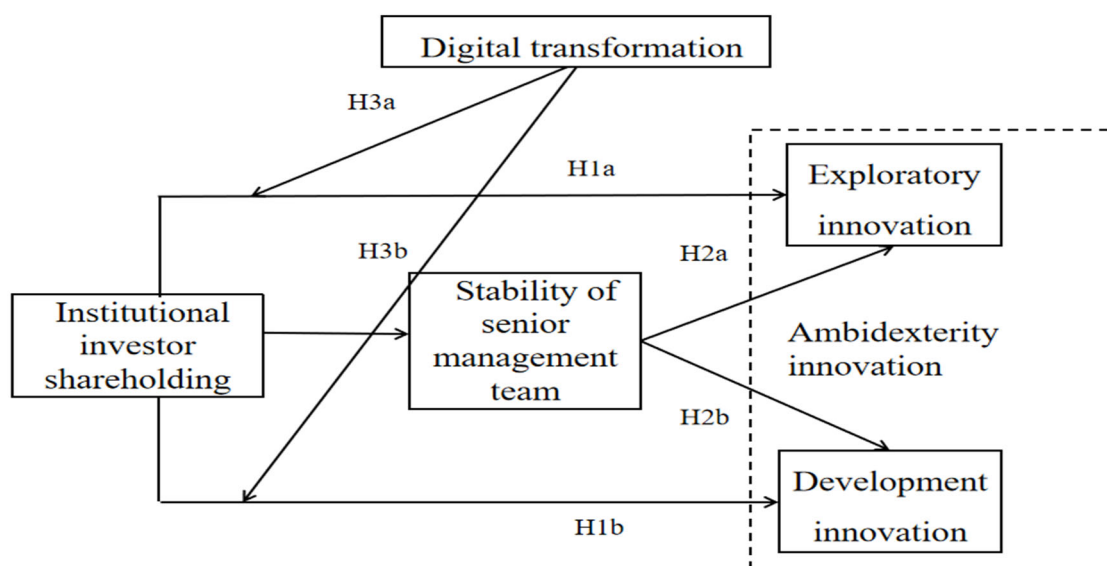


Fig.1 Concept model

4. Research design

4.1 Sample selection and data sources

In this study, Chinese A-share listed companies from 2015 to 2019 were selected as the initial sample, and the initial sample was screened in the following order: (1) The listed companies treated by ST and ST* during the sample selection period were excluded; (2) Excluding the sample of listed companies in the financial industry; (3) Excluding companies that do not disclose r&d expenditures and those that do not disclose r&d expenditures in detail; (4) The research data were mainly obtained from CSMAR and WIND database, and some missing data were obtained from semi-annual reports and annual reports of sample companies. (5) Python software was used to crawl the phrases related

to digital transformation in the websites of listed companies and make statistics on their word frequency. (6) All variables were indented to exclude variables less than 1% and greater than 99%, and a total of 12,398 observations from 3093 companies were obtained. Stata was used to analyze the research data.

4.2 Variable design and measurement

4.2.1 Explained variables:

exploratory innovation, exploitative innovation and dual innovation. At present, there are many quantitative methods for exploratory innovation and exploitative innovation, for example, the number of patent applications of different types is measured [17], or the number of invention patents is used to measure exploratory innovation, while the number of utility model and appearance patents is used to measure exploitative innovation. In addition, Gima, Jansen, Kollmann and other scholars designed a variety of scales of exploration ability and development ability in their own studies, but using scales to measure is easy to generate potential subjective and endogenous problems. According to the accounting standards for enterprises no. 4 - intangible assets ", our country enterprise internal r&d project investment zone is divided into research phase investment and development stage, the stage investment is more risk and uncertainty as a result, more and exploratory innovation connotation of the construct, characteristics and development stages of the investment and use of same sex innovation [3], This project draws lessons from bi Xiaofang et al. [3] and divides R&D investment into exploratory innovation ($R > 0, D > 0$; $R > 0, D = 0$) and development innovation ($R = 0, D > 0$). Therefore, this study measures exploratory innovation investment (R) by expensed expenditure of r&d activities, and developmental innovation investment (D) by capitalized expenditure, and divides the two by total assets of the company to avoid the interference of firm size effect. Existing literature uses the summation, product and absolute difference of exploitative innovation and exploratory innovation to measure binary innovation. March et al. [40] believe that it is very important for the survival of enterprises to maintain the balance between exploratory innovation and exploitative innovation, and binary innovation can take the optimal value or intermediate value in a continuum. Exploratory innovation and exploitative innovation occupy the two ends of the continuum respectively. Therefore, referring to the research of He & Wong[21] and Cao et al. [10], the absolute value of the difference between exploratory and exploitative innovation is used to represent the balanced ambidexterity and to measure the ambidexterity innovation.

4.2.2 Explanatory variable: shareholding ratio of institutional investors.

At present, there are mature and abundant quantitative methods for the shareholding ratio of institutional investors. For example, the shareholding ratio of institutional investors at the end of the third quarter is equal to the proportion of the shareholding ratio of institutional investors at the end of the third quarter to the total shareholding ratio at the end of the third quarter, and some studies also define it as the proportion of the shareholding ratio of institutional investors at the end of the year to the total shareholding ratio [7]. However, studies have shown that regression of the ratio of the number of shares held by institutional investors to the total number of shares at the end of the year calculated by year-end data is prone to endogenous problems [5], so the first quantitative method is adopted in this paper.

4.2.3 Mediating variable: stability of senior management team.

The stability of the senior management team includes the change of members and the change of the number, which refers to the number of board members except the independent directors. For the measurement of the stability of the senior management team, the research of Crutchley et al., Yu Dongzhi and Chi Guohua [61] is used to measure the stability of the senior management team by the number of executives who remain in the current period. The calculation formula is as follows:

$$STMT_{t,t+1} = [M_t - \#(S_t/S_{t+1})]/M_t \times M_{t+1}/(M_t + M_{t+1}) + [M_{t+1} - \#(S_{t+1}/S_t)] M_{t+1} \times M_t/(M_t + M_{t+1})$$

STMT is the stability of the senior management team, and the value is [0,1]. The closer it is to 1, the stronger the stability of the senior management team is. M_t is the total number of senior executives in year T ; $\#(St/St+1)$ is the number of executives who were on the job in T years but left $t+1$; M_{t+1} is the total number of senior executives in $t+1$ year; $\#(St+1/St)$ represents the number of new executives who are not on the job in t year but added in $T+1$ year.

4.2.4 Moderating variable: digital transformation.

Learn from the practice of [57], such as the Wu Fei some keywords related to digital transformation, such as the "Internet" "big data" "artificial intelligence", "cloud computing", "digital", "block chain" and so on, after using the Python reptiles crawl the annual reports of listed companies in relevant keywords, and calculate the total word frequency, set up the index system of digital transformation. At the same time, the total word frequency is logarithmic processing, data "right bias" problem.

4.2.5 Control variables

According to the existing literature, the shareholding ratio of institutional investors and r&d investment of enterprises are regulated by enterprise size, profitability and other factors. According to domestic and foreign literature, property rights, enterprise size, asset-liability ratio, cash flow, Tobin's Q value, return on total assets, ownership concentration and revenue growth rate are selected as control variables.

Table 1 Variable definition table

Nature	Name	Symbol	Explanation
Interpreted variables	Exploratory innovation	<i>R</i>	Cost expenditure of R&D activities / company total assets
	Exploitative innovation	<i>D</i>	Capital expenditure of R&D activities / company total assets
	Ambidextrous innovation	<i>RD</i>	Absolute value of exploratory innovation minus exploitative innovation
Explanatory variable	Shareholding ratio of institutional investors	<i>Ins</i>	Shares held by institutional investors at the end of Q3 / Total shares at the end of Q3
Intermediary variables	Stability of senior management team	<i>Stmt</i>	Refer to the above formula
Adjusting variables	digital transformation	<i>H</i>	The natural logarithm of the total frequency of related words
Control variables	Corporate scale	<i>Size</i>	Natural logarithm of total assets
	Assets and liabilities ratio	<i>Lev</i>	Total liabilities/total assets
	Cash flow	<i>Cf</i>	Net cash flow from operating activities
	Tobin Q value	Tobinq	Company's market value/replacement cost of assets
	return on total assets	<i>Roa</i>	Net profit/total assets
	ownership concentration	<i>Shr1</i>	share proportion of the largest shareholder
	revenue growth rate Year	<i>Gro Year</i>	Current year's revenue growth/last year's total revenue Annual virtual variable

4.3 Research model establishment

4.3.1 Institutional investor shareholding and enterprise exploration, development and dual innovation

$$R = \alpha_0 + \beta_0 \times INS + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (1)$$

$$D = \alpha_0 + \beta_0 \times INS + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (2)$$

$$RD = \alpha_0 + \beta_0 \times INS + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (3)$$

4.3.2 Mediating effect of senior management team stability

$$STMT = \alpha_0 + \beta_0 \times INS + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (4)$$

$$R = \alpha_0 + \beta_0 \times INS + \beta_1 \times STMT + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (5)$$

$$D = \alpha_0 + \beta_0 \times INS + \beta_1 \times STMT + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (6)$$

$$RD = \alpha_0 + \beta_0 \times INS + \beta_1 \times STMT + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (7)$$

4.3.3 Moderating effect of digital transformation

$$R = \alpha_0 + \beta_0 \times INS + \beta_2 \times H \times INS + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (8)$$

$$D = \alpha_0 + \beta_0 \times INS + \beta_2 \times H \times INS + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (9)$$

$$RD = \alpha_0 + \beta_0 \times INS + \beta_2 \times H \times INS + \sum_j C_{j,i,t} + \xi_{i,t} \dots\dots\dots (10)$$

The formula, i and t represent the company and year respectively; j represent the number of control variables; α_0 represent a constant term; β_0 represent the coefficient of board diversity; β_1 represent the coefficient of resource redundancy; β_2 represent the coefficient of resource flexibility; β_3 represent the interaction between network centrality and board diversity Term coefficient; β_j represents the coefficient of the control variable; C_j represents all the control variables; ξ represents the random disturbance term, and controls the dummy variable for the year in the regression.

5. Empirical test and results analysis

5.1 Descriptive Statistics

Table 2 is the descriptive statistical results. It can be seen that the standard deviation of expensed expenditure of A-share listed companies in the sample is 0.004, the minimum value is 0, and the maximum value is 2.60%, indicating that there are significant differences in expensed expenditure of R&D activities of listed companies. Capitalized expenditure in the enterprise standard deviation is 0.012, the minimum value is 0, the maximum of 6.40%, shows that the difference of open innovation is greater than exploratory innovation, difference between individual impact on open innovation investment of listed companies is larger, this conclusion is consistent with the existing literature, exploratory innovation and utilization index selection and a reasonable measure. The statistical values of control variables are basically consistent with existing studies and will not be repeated.

Table 2 Descriptive statistics

Variable	N	Mean	Sd	Min	Max
<i>R</i>	12398	0.002	0.004	0.000	0.026
<i>D</i>	12398	0.006	0.012	0.000	0.064
<i>RD</i>	12398	0.007	0.012	0.000	0.062
<i>Ins</i>	12398	0.358	0.242	0.000	0.877
<i>Stmt</i>	12398	0.955	0.056	0.712	1.000
<i>H</i>	12398	3.618	1.298	0.000	7.502
<i>Size</i>	12398	22.189	1.274	20.067	26.212
<i>Lev</i>	12398	0.394	0.191	0.059	0.857
<i>Cf</i>	12398	3.078	2.243	-15.712	6.897
<i>Tobinq</i>	12398	2.093	1.253	0.871	7.997
<i>Roa</i>	12398	0.043	0.059	-0.245	0.193
<i>Shrl</i>	12398	33.859	14.316	8.448	72.840
<i>Gro</i>	12398	0.171	0.360	-0.441	2.199

5.2 Correlation Analysis

Table 3 shows the correlation analysis among the main variables. From the correlation coefficient, the shareholding ratio of institutional investors is negatively correlated with exploratory innovation and dual innovation, which is consistent with hypothesis 1 and 3. However, it is positively correlated with development innovation, which is inconsistent with hypothesis 2, but the specific correlation needs to be verified by regression analysis. Noticed between independent variables and control variables are significant correlation, illustrate the potential multicollinearity problems existing in the model, but the correlation coefficient of absolute value of each variable was less than 0.5 and the model of the test of variance coefficient of expansion between the mean 2 VIF is based in 1 ~ 2, far lower than the critical value of 10, rule out the possibility of the existence of multicollinearity.

Table 3 Pearson correlation analysis

variable	<i>R</i>	<i>D</i>	<i>RD</i>	<i>Ins</i>	<i>Stmt</i>	<i>H</i>	<i>Size</i>
<i>R</i>	1						
<i>D</i>	-0.010	1					
<i>RD</i>	0.263***	0.909***	1				
<i>Ins</i>	-0.003	0.002	-0.017*	1			
<i>Stmt</i>	0.002	0.007	0.004	0.039***	1		
<i>H</i>	0.203***	0.025***	0.083***	-0.077***	0.032***	1	
<i>Size</i>	0.036***	0.00400	-0.015*	0.507***	0.014	-0.030***	1
<i>Lev</i>	-0.019**	-0.025***	-0.058***	0.262***	0.003	-0.072***	0.564***
<i>Cf</i>	-0.019**	0.008	-0.009	0.315***	-0.013	-0.044***	0.576***
<i>Tobinq</i>	0.114***	-0.028***	0.025***	0.049***	-0.113***	0.049***	-0.402***
<i>Roa</i>	-0.038***	0.122***	0.111***	0.0110	0.019**	0.0110	-0.059***
<i>Shrl</i>	-0.124***	0.087***	0.041***	0.329***	-0.021**	-0.132***	0.167***
<i>Gro</i>	0.020**	-0.046***	-0.039***	0.0110	0.046***	0.079***	0.058***
	<i>Lev</i>	<i>Cf</i>	<i>Tobinq</i>	<i>Roa</i>	<i>Shrl</i>	<i>Gro</i>	
<i>Lev</i>	1						
<i>Cf</i>	0.222***	1					
<i>Tobinq</i>	-0.317***	-0.132***	1				
<i>Roa</i>	-0.351***	0.074***	0.161***	1			
<i>Shrl</i>	0.060***	0.180***	-0.070***	0.129***	1		
<i>Gro</i>	0.055***	0.00400	0.019**	0.186***	-0.028***	1	

Note: *** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$ (The remaining form is identical)

5.3 Regression analysis and hypothesis testing

5.3.1 Shareholding ratio of institutional investors and enterprise exploration, development and dual innovation

Models 1, 2, and 3 are regression models of the influence of shareholding ratio of institutional investors on exploratory innovation, developmental innovation, and binary innovation, and the regression results are all significant. The regression results of Model 1 show that the shareholding ratio of institutional investors is significantly negatively correlated with exploratory innovation ($P < 0.05$, regression coefficient -0.138), supporting H1a, that is, the shareholding ratio of institutional investors inhibits exploratory innovation of enterprises. The regression results of Model 2 show that the shareholding ratio of institutional investors is significantly negatively correlated with the development innovation ($P < 0.01$, regression coefficient -0.096), supporting H1b, that is, the shareholding ratio of institutional investors inhibits the development innovation of enterprises. The regression results of model 3 show that the shareholding ratio of institutional investors is significantly negatively correlated with the dual-innovation, $P < 0.01$, and the regression coefficient is -0.282 , supporting H1c, that is, the shareholding ratio of institutional investors inhibits the dual-innovation of enterprises.

5.3.2 The mediating role of senior management team stability

Model 4 verifies the relationship between the stability of the senior management team and the shareholding ratio of institutional investors. The results show that the shareholding ratio of institutional investors significantly affects the stability of the senior management team of enterprises, $P < 0.05$. Models 5, 6, and 7 comprehensively tested the relationship among shareholding ratio of institutional investors, stability of senior management team, and enterprise exploratory innovation, development innovation, and ambidextrous innovation. The results were all significant, and integrated models 1-7 to explore the transfer relationship among the three.

As can be seen from Models 1, 2 and 3, the shareholding ratio of institutional investors has a significant effect on the enterprise's exploratory, developmental and dual innovation; as can be seen from Model 4, the shareholding ratio of institutional investors has a significant effect on the stability of the senior management team. According to Models 5, 6, and 7, the coefficients β_0 and β_1 are significant in the ownership ratio of institutional investors -- stability of senior management team -- exploratory innovation transfer model, indicating that the stability of senior management team plays a partial mediating effect in the impact of ownership ratio of institutional investors on exploratory innovation. Assuming that H2a is established. In the model of ownership ratio of institutional investors -- stability of senior management team -- dual innovation transfer, the coefficients β_0 and β_1 are significant, indicating that the stability of senior management team plays a partial mediating effect on the impact of ownership ratio of institutional investors on dual innovation, assuming that H2c is valid.

5.3.3 Moderating effect of digital transformation

By model 8, 9, 10 regression results can be concluded that the digital transformation to promote institutional investors holding the exploratory, the action of development-oriented and dual innovation relations, namely, H3a, H3b, H3c, that when strong degree of enterprise digital transformation, institutional investors holding for enterprises to explore, open, and the dual effect of innovation.

Table 4 Regression model

Variable	1	2	3	4	5	6	7	8	9	10
<i>s</i>	<i>R</i>	<i>D</i>	<i>RD</i>	<i>STMT</i>	<i>R</i>	<i>D</i>	<i>RD</i>	<i>R</i>	<i>D</i>	<i>RD</i>
<i>Ins</i>	-0.138** (-2.32)	- 0.096** * (-4.56)	- 0.282** * (-4.75)	0.018** (7.36)	0.128** * (-2.14)	0.097** * (-4.57)	0.272** * (-4.58)	0.522** * (-5.54)	0.497** * (-15.09)	0.898** * (-9.61)
<i>Stmt</i>					0.561** * (-2.56)	0.030 (0.38)	-0.527** (-2.42)			
<i>Insh</i>								0.113** * (5.26)	0.118** * (15.74)	0.181** * (8.53)
<i>Size</i>	0.006 (0.42)	0.086* (15.93)	0.067* (4.41)	- 0.001** * (-1.26)	0.006** * (0.40)	0.086* (15.93)	0.067* (4.38)	0.001** * (0.01)	0.079* (14.80)	0.056* (3.74)
<i>Lev</i>	0.163 (2.11)	- 0.189** * (-6.90)	-0.11*** (-1.43)	0.002** * (0.63)	0.164 (2.12)	- 0.189** * (-6.90)	- 0.109** * (-1.42)	0.184 (2.37)	- 0.167** * (-6.18)	- 0.077** * (-1.01)
<i>Cf</i>	0.315 (0.55)	-0.194 (-0.71)	0.124 (1.41)	0.299 (0.52)	-0.194 (-0.71)	0.004** * (-8.02)	0.001* (2.03)	0.003** * (-6.31)	0.001** (2.23)	0.014** (1.43)
<i>Tobinq</i>	- 0.007** * (-1.92)	- 0.075* (-7.00)	0.068* (-3.51)	0.001** * (-3.08)	- 0.008** * (-1.99)	- 0.075* (-6.98)	0.068* (-3.58)	- 0.015** * (-1.57)	- 0.068* (-6.01)	- 0.057* (-2.95)
<i>Roa</i>	2.946 (-0.73)	- 0.525** * (18.32)	2.286 (5.87)	0.006** * (0.84)	2.949 (-0.71)	- 0.525** * (18.31)	2.289 (5.89)	2.927 (-1.27)	- 0.545** * (16.78)	2.254 (4.98)
<i>Shr1</i>	0.007** * (13.69)	- 0.003** * (-6.91)	0.004** * (10.69)	- 0.001** * (0.72)	0.007** * (13.71)	- 0.003** * (-6.92)	0.004** * (10.70)	0.007** * (13.61)	- 0.002** * (-7.25)	0.004** * (10.57)
<i>Gro</i>	- 0.236** * (8.30)	- 0.022** (-10.66)	- 0.201** * (5.10)	0.004** * (-2.54)	- 0.234** * (8.24)	- 0.022** (-10.65)	- 0.199** * (5.04)	- 0.246** * (8.67)	- 0.011** (-9.59)	- 0.218** * (5.72)
<i>Constant</i>	0.04** (-7.35)	- 1.716** * (1.97)	-1.14*** (-6.32)	0.910 (2.75)	0.553 (-7.28)	- 1.742** * (1.96)	- 0.660** * (-6.26)	0.192 (-7.67)	- 1.559** * (1.01)	- 0.899** * (-6.86)
<i>Year</i>					control					
<i>Ind</i>					control					
<i>Adjust R²</i>	0.0319	0.0508	0.0272	0.1848	0.0324	0.0507	0.0275	0.0340	0.0693	0.0328
<i>N</i>	12398	12398	12398	12398	12398	12398	12398	12398	12398	12398

6. Research conclusions and innovative features

6.1 Research Conclusions

As the trend of global economic integration continues to strengthen, the shareholding ratio of institutional investors determines the innovation strategy and resources of enterprises to a certain extent, thus affecting the innovation activities and performance of enterprises [65]. How to better improve corporate governance and promote innovation performance is the key issue discussed in this paper. Based on the resource-based view and the environment-based view, this project analyzes the effect mechanism of shareholding ratio of institutional investors on enterprise exploratory innovation, exploratory innovation and dual innovation. The research finds that shareholding ratio of investors inhibits enterprise exploratory innovation, developmental innovation and dual innovation. Furthermore, it is found that TMT stability plays a partially mediating role in the relationship between

the shareholding ratio of institutional investors and exploratory innovation, developmental innovation and ambidextrous innovation. Digital transformation promotes the influence of shareholding ratio of institutional investors on enterprise exploratory innovation, development innovation and dual innovation.

6.2 Innovative features of the project

Most of the existing literature discusses the dual innovation of enterprises from the perspective of business model, leadership style, etc., but few of the literature discusses its impact on the dual innovation of enterprises from the perspective of the shareholding ratio of institutional investors. This project takes the shareholding ratio of institutional investors as a new perspective and based on behavioral finance theory. The analysis of how exploratory innovation and exploitative innovation are affected by the behavior of institutional investors has enriched the research on the influencing factors of binary innovation. In addition, the current research on the mechanism of institutional investors' ownership on enterprises' innovation behavior is not comprehensive enough. This paper introduces the stability of senior management team as an intermediary variable to explore the transmission path of institutional investors on enterprises' innovation management behavior, and further supplements the existing research. Moreover, digital transformation is introduced as a new situational factor to explore the new law of its influence on the relationship between the shareholding ratio of institutional investors and dual innovation, which is fully combined with the current background of The Times when innovation changes promote enterprise development. It not only expands the existing theory of dual innovation, but also provides experience for enterprise innovation management.

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