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Non-State Shareholder Participation and Technological Innovation in State-Owned Enterprises

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Abstract: The Third Plenary Session of the 18th CPC Central Committee established mixed ownership system as the main policy of SOE reform, and as the main form of SOE "mixed reform", can non-state shareholders' participation promote the technological innovation of SOE? Based on the research samples of China's A-share state-owned listed companies from 2010 to 2017, this paper finds that the participation of non-state shareholders promotes the technological innovation of SOE, and this result is more robust when the participation of non-state shareholders exceeds 10%, i.e., when the participation of non-state major shareholders is more robust. The results of the mediation effect model show that non-state shareholders' equity participation plays a positive role in the level of state-owned technological innovation by improving the incentive channel for executive compensation, while the results of the mediation effect test of the financial assets investment channel are not verified. This paper provides theoretical and empirical support for the rationality and effectiveness of mixed ownership reform from the dimension of technological innovation.

Keywords: Non-State Shareholder Participation; Mixed Ownership Reform; Corporate Innovation.

1. Introduction

In recent years, the problem of zombie enterprises among state-owned enterprises (SOEs) has become more serious in China's economic transition because SOEs usually suffer from the problems of large scale, complicated systems, and political tasks that drag down their performance (Fang Mingyue et al., 2019). The "mixed reform" of SOEs is the destination of SOEs in the period of economic transition. Changes in equity structure will change the resource allocation and governance structure of enterprises, which will ultimately be transmitted to their business performance and innovation investment (Aghion et al., 2013). The Decision of the Third Plenary Session of the 18th Central Committee of the Communist Party of China (CPC) proposes to actively develop a mixed ownership economy, including allowing more state-owned and other ownership economies to develop into mixed ownership economies, and allowing non-state capital to participate in state-owned capital projects. Therefore, the "mixed reform" of SOEs has become one of the major issues in the field of transformation and reform of Chinese SOEs and corporate governance.

There are two kinds of equity structure in SOEs mixed reform: fully privatised and partially privatised. First, full privatisation, in which the nature of ownership is changed to that of a private company, reduces the government's interventionist nature, the political policy burden and institutional redundancy, but at the same time loses the government backing and preferential treatment it once enjoyed (Sun and Tong, 2003), and may be subject to credit constraints (Brandt and Li, 2003). Secondly, partial privatisation is also the case of non-state shareholders' participation as proposed in this paper. The nature of equity ownership is still state-controlled, but due to the entry of non-state capital, it improves and incentivises the motivation and sensitivity of SOE management's remuneration (Cai Guilong et al., 2018), thus improving the agency problem of SOE management, reducing moral hazard at the top level, and facilitating the enterprises to more actively increase their investment in innovation (Li, Wengui, and Yu, Minggui, 2015).

After the "mixed reform" of state-owned enterprises, there are many scholars who have conducted many studies on the impact on enterprises and the economy. The equity structure of mixed ownership improves the performance of the company (Hao Yang and Gong Liutang, 2016), improves the company's risk resistance (Li Wengui and Shao Yiping, 2013), improves equity integration to optimise the level of cash holdings of the enterprise (Yang Xingquan, 2018), promotes the investment of financial assets in SOEs (Ye Yongwei, 2021), and strengthens the quality of internal control of the enterprise (Liu Yunguo et al. 2016).

There are two different accounts of the impact of "mixed reform" of SOEs on corporate innovation. Yu Minggui's (2019) study found that the privatisation of SOEs significantly inhibited corporate innovation, while Li Zengfu et al. (2021) found that the participation of non-state capital in SOEs promoted corporate innovation. And in essence, it is the difference in equity structure that leads to different results in corporate innovation investment.

After the above literature summary, this paper takes the panel data of China's A-share state-owned listed companies from 2010 to 2017 as a sample, examines the impact of non-state shareholders' equity participation on the technological innovation of state-owned enterprises, and further analyses the model test of the mediating effect through effective incentives and financing constraints. After empirical analyses, non-state shareholders' equity participation promotes the technological innovation of SOEs.

Compared with the existing literature, the main contributions of this paper are: firstly, this paper finds that the introduction of non-state shareholders' participation in SOEs promotes the technological innovation of SOEs, which enriches and expands the impact of SOEs' "mixed reform" on enterprise innovation from the perspective of partial privatisation (quantitative change); secondly, this paper describes the impact of non-state shareholders' participation on SOEs' technological innovation based on the two channels

of executive compensation incentives and financial asset allocation. Secondly, this paper elaborates the role mechanism of non-state shareholders' participation in promoting technological innovation of SOEs based on two channels: executive compensation incentives and financial asset allocation, and makes corresponding validation of the mediating effect of SOEs' mixed ownership reform on enterprise innovation, which provides theoretical support and ideological guidance for SOEs' "mixed reform"; thirdly, the research of this paper finds that, if the amount of non-state shareholders' participation in SOEs is more than 10%, there is a non-state shareholder's participation in SOEs. Thirdly, this paper finds that the participation of non-state shareholders in SOEs exceeds 10%, which means that the existence of non-state major shareholders is more robust in promoting technological innovation, providing theoretical support and operational basis for the introduction of non-state major shareholders in subsequent mixed-ownership reform of SOEs.

2. Literature Review and Formulation of Research Questions

2.1. Literature review

2.1.1. Literature Review of Mixed Ownership Equity Structures

Regarding the research on the "mixed reform" of state-owned enterprises, scholars usually analyse the impact of the "mixed reform" of state-owned enterprises on enterprises from the perspectives of qualitative change (full control) and quantitative change (non-state capital participation). From the perspective of qualitative change, the transfer of state-owned equity control, that is, the privatisation of state-owned enterprises, is analysed theoretically by Yu Minggui (2019) from the political viewpoint and the managerial viewpoint. The political view is that SOEs are subject to the government and have an obligation to undertake policy objectives as well as social responsibilities, and that resources will be allocated to political needs rather than to the needs of the current development strategy effectively (Shleifer and Vishny, 1994). The managerial view, on the other hand, suggests that the lack of effective incentives as well as monitoring mechanisms for the management of SOEs leads to serious agency problems (Laffont and Tirole, 1993).

From the perspective of quantitative change, that is, the shareholders who are not in a controlling position to participate in the shares, the nature of the state-owned enterprises will remain unchanged, but with the entry of non-state shareholders, the enterprise's shareholding structure is diversified, mutual checks and balances, and the mutual checks and balances between private participating shareholders and state-owned controlling shareholders are conducive to the improvement of the operational efficiency of the enterprise (Hao Yunhong and Wang Xi, 2015).

2.1.2. Literature review on the impact of "mixed reform" on the technological innovation of SOEs

Innovative activities are different from the general economic impact of enterprises, which has the characteristics of high risk, high investment, long cycle and heterogeneity (Hirsh - leifer et al., 2012). According to the political and managerial perspectives described above, the policy objectives and management system of SOEs are difficult to incentivise innovation (Hart et al., 1997). Some scholars believe that the "mixed reform" of SOEs promotes innovation, reduces state control through the participation of non-state shareholders, improves management incentives (Cai Guilong et al., 2018), reduces the agency cost of enterprises, and promotes the investment of enterprises in innovation (Li Wengui and Yu Minggui, 2015). There is also a part of scholars who believe that privatisation inhibits corporate innovation, as most of the assets brought by innovative products are intangible and cannot be used as collateral for corporate credit (Brown et al., 2009), which to a certain extent increases the cost of corporate financing. And as the proportion of state-owned equity decreases, enterprises receive government policy support as well as funding will also decline at the same time resulting in financing restrictions (Yang Xingquan and Yin Xingqiang, 2018), thus inhibiting enterprise innovation investment. Most of the literature basically follows the idea of "influencing factors - mechanism - whether to promote enterprise innovation".

2.2. The formulation of research questions

Through the combing of the literature, we can see that how the participation of non-state shareholders affects enterprise innovation is a question that scholars try to answer. This paper discusses two channels: the influence of corporate innovation inputs by non-state shareholders' equity participation may be based on the channel of financial asset allocation and the channel of management supervision and governance.

2.2.1. The financial asset allocation channel through which SOEs' "mixed reform" affects corporate technological innovation.

There are few scholars who have studied the impact of SOEs' "mixed reform" on enterprises' "de-realisation to virtualisation", and the participation of non-state shareholders promotes enterprises to increase their investment in financial assets by enhancing the precautionary savings motivation of enterprises' financial asset allocation (Ye Yongwei, 2020). And whether corporate financial asset investment promotes or inhibits corporate innovation is discussed by scholars mainly based on the crowding-out effect and motivation of corporate financialisation. It is found that financial assets do not play a "reservoir" effect, but the "crowding out" effect is greater than the "reservoir effect" (Du Yong et al., 2017), and at the same time, for the sake of arbitrage motivation, financialisation will crowd out innovation. At the same time, the enterprise out of arbitrage motivation, financialisation will squeeze out innovation (Wang Hongjian et al., 2017), leading to the consequences of financialisation in the long term will inhibit enterprise innovation.

2.2.2. State-owned enterprises "mixed reform" affects the supervision and governance channels of enterprise technological innovation

In the process of "mixed reform" of state-owned enterprises, with the entry of non-state capital, unlike state-owned shareholders, non-state shareholders generally take the company's profit maximisation as the business objective, and therefore have strong incentives to supervise the management, so as to improve the management's salary or terminate the manager who does not have a common goal and improve the management's sensitivity to performance (Hao Yang and Wang Hongjian et al., 2017). sensitivity (Hao, Yang and Gong, Liutang, 2017) as well as curbing the serious agency conflict problem posed by the pursuit of political promotion and political risk avoidance (Jin, Yuchao et al., 2016). Non-state capital equity participation in SOEs has both the governmental preferences of state-owned property rights and

the profit-seeking motives of private firms, which is conducive to alleviating the problems of management "inaction" or "eagerness to perform" and the lack of supervision in state-controlled enterprises, and thus improving supervision and management (Malian et al., 2017). This will help alleviate the problems of management "inaction" or "eagerness to perform" and the lack of supervision in state-owned enterprises, and thus improve the supervision and management of enterprises (Malianfu et al., 2015).

Based on the above literature summary and discussion, this paper proposes research hypotheses:

Hypothesis 1: Non-state shareholders' participation promotes technological innovation in SOEs.

3. Research Design

3.1. Research sample

This paper takes 2010-2017 China's A-share state-owned listed companies as the research sample to analyse the impact of non-state shareholders' participation on the technological innovation of state-owned enterprises. The data are screened according to the following principles: first, financial as well as ST and ST* companies are excluded; second, companies with seriously missing financial data are deleted. In addition, in order to eliminate the impact of individual outliers on the regression, this paper shrinks the main continuous variables at the 1% and 99% quantiles. The data in this paper are obtained from the Cathay Pacific database (CSMAR).

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3.2. Variable Measures

3.2.1. Non-State Shareholder Participation

This paper defines the participation of non-state shareholders as the participation of shareholders other than state-owned shareholders (including private shareholders, foreign shareholders, etc.) among the top ten shareholders according to the nature of shareholders. Drawing on the definitions of variables mentioned in existing studies (Hao Yang and Gong Liutang, 2017; Ye Yongwei, 2020), this paper measures non-state shareholder participation in terms of two dimensions: total non-state shareholder participation in the top ten shareholders of an enterprise (PrivateTS), and a dummy variable of total non-state shareholder participation of more than 10 per cent (Private10), respectively. The sum of non-state shareholders' participation (PrivateTS) is to indicate the participation of non-state capital, while the dummy variable of non-state shareholders' participation exceeding 10% (Private10) is to represent whether the non-state shareholders participate as majority shareholders. According to China's Company Law, shareholders who individually or collectively hold more than 10% of the company's shares have the right to propose, convene, and preside over extraordinary meetings of the general meeting of shareholders, which can affect the company's operations to a deeper extent, and have a certain degree of influence on the company's financial decision-making as well as the company's strategy. Therefore, this paper considers the top ten shareholders with more than 10% of non-state shareholders as non-state shareholders.

3.2.2. Corporate Innovation

Drawing on existing studies (Jiang Xuanyu, 2016; Zhu Bing, 2018), the number of patents is used to measure corporate innovation. Although a part of the existing literature also measures corporate innovation from the perspective of innovation inputs, i.e. R&D expenditures (Pan Yue et al., 2015), R&D expenditures have certain metric flaws. On the one hand, it is not difficult to find that R&D expenditures in annual reports are prone to have more missing values when collecting data (He and Tian, 2013). On the other hand, R&D expenditures only reflect one aspect of corporate innovation investment (financial resource investment), while corporate human resource investment, technological capital, and organisational and managerial capital investment are not reflected in R&D (Jiu et al., 2013). Therefore, in contrast, using the number of patents as a measure of corporate innovation would be more comprehensive and integrated. In summary, this paper defines corporate innovation as the natural logarithm of the total number of annual patent applications and patent grants plus one for the listed company.

3.2.3. Control Variables

This paper chooses enterprise size (Size), net asset profit margin (Roa), gearing ratio (Lev), enterprise age (Age), enterprise growth (Growth), cash holdings (Cash), and shareholding concentration (Top10) as control variables.

Table 1. Description of variables

	Symbol	Description
Dependent variables	Apply	Logarithm of total number of patent applications plus 1
	Grants	Logarithm of total number of patent grants plus 1
Independent variables	PrivateTS	Sum of non-state shareholders' shareholding in the top ten shareholders
	Private10	Sum of top ten non-state shareholders with more than 10 per cent participation takes 1, otherwise it takes 0
Control variables	Size	Ln (total assets)
	Growth	Growth rate of total assets
	Age	Natural logarithm of the number of years since listing +1
	Roa	Net Profit/Total Assets
	Lev	Total liabilities/total assets
	Cash	Currency capital/total assets
	Top10	Sum of shareholdings of top 10 shareholders

3.3. Model Design

Based on the above variable definitions, observing that the patent data is "Censored Data" with 0 as the lower limit, and drawing on the research design of Zhu Bing et al. (2018) and other literatures, this paper constructs the Tobit regression model as follows:

3.4. Descriptive statistics

The descriptive statistics of the data in this paper are shown in Table 2. From 2010 to 2017, the average value of non-state shareholders' participation in A-share state-owned listed companies was 12.93,and the average proportion of state-owned enterprises with more than 10% participation by non-state shareholders was 40.6%, which is about two-fifths of the total number of samples. The minimum value of patent grants is 0, the maximum value is 8.286, and the standard deviation is 1.617; the minimum value of patent applications is 0, the maximum value is 8.784, and the standard deviation is 1.743, from which it can be seen that there is a large difference in the R&D intensity between different SOEs.

Table 2. Descriptive statistics

Variables	Observations	Average	Meidian	Standard deviation	Minimum	maximum
Grants	7108	1.201	0	1.617	0	8.286
Apply	7108	1.318	0	1.743	0	8.784
PrivateTS	7108	12.93	7.530	13.84	0.160	86.53
Private10	7108	0.406	0	0.491	0	1
Size	7108	22.66	22.50	1.390	19.70	26.72
Lev	7108	0.516	0.526	0.202	0.0820	0.979
Roa	7108	0.0400	0.0360	0.0560	-0.186	0.214
Age	7108	2.580	2.708	0.542	0	3.332
Top10	7108	56.69	56.75	15.97	22.17	92.02
Cash	7108	0.164	0.134	0.117	0.0110	0.615
Growth	7108	0.159	0.0860	0.351	-0.299	2.793
TOP3	7102	703435	543333	599573	93000	3.842e+06
RD	7108	1.587	0.0700	2.593	0	13.46
SA	7108	-3.760	-3.783	0.251	-4.316	-2.737

4. Empirical Analyses

4.1. Main test

Table 3. Hypothesis 1 testing

	(1) Grants	(2) Apply	(3) Grants	(4) Apply
PrivateTS	0.009***	0.013***		
	(3.43)	(4.22)		
Private10			0.373***	0.493***
			(4.93)	(6.02)
Size	0.523***	0.577***	0.517***	0.570***
	(15.51)	(15.77)	(15.37)	(15.61)
Lev	-1.637***	-1.702***	-1.644***	-1.712***
	(-6.84)	(-6.56)	(-6.88)	(-6.61)
Roa	-2.691***	-2.491***	-2.817***	-2.659***
	(-3.47)	(-2.96)	(-3.63)	(-3.16)
Age	-0.979***	-1.219***	-0.956***	-1.189***
	(-13.21)	(-15.14)	(-12.94)	(-14.83)
Top10	-0.023***	-0.030***	-0.023***	-0.029***
	(-8.54)	(-9.81)	(-8.42)	(-9.67)
cash	0.529	0.562	0.484	0.504
	(1.56)	(1.52)	(1.43)	(1.37)
Growth	-0.156	-0.211*	-0.158	-0.212*
	(-1.39)	(-1.71)	(-1.41)	(-1.73)
cons	-7.944***	-8.112***	-7.923***	-8.094***
	(-11.84)	(-11.16)	(-11.83)	(-11.16)
Year	Yes	Yes	Yes	Yes
N	7108	7108	7108	7108

Note: *, **, *** indicate significant at the 10 per cent, 5 per cent and 1 per cent levels, respectively; t-values in parentheses, below.

Table 3 shows the empirical results of this paper using Tobit regression model to test the impact of non-state shareholders' participation on technological innovation of SOEs. Columns (1) and (3) in Table 3 show the regression results with patent

grants as the dependent variable and non-state shareholders' total shareholding (PrivateTS) and the dummy variable of non-state shareholders' total shareholding more than 10% (Private10) as the independent variables. And columns (2) and (4) are the regression results with Patent Application (Apply) as the dependent variable, and the sum of non-state shareholders' participation (PrivateTS), and the dummy variable for the sum of non-state shareholders' participation exceeding 10% (Private10) as the independent variables, respectively.

The results in columns (1) and (2) of Table 3 show that the regression coefficients of total non-state shareholders' participation (PrivateTS) on patent grants (Grants) and patent applications (Apply) are 0.009 and 0.013, respectively, which are significantly positive at the 1% level. The coefficient estimates of the dummy variable (Private10) for non-state shareholders with more than 10 per cent total participation in columns (3) and (4) are 0.373 and 0.493, both of which are significantly positive at the 1 per cent level. Therefore is the empirical results indicate that non-state shareholders' equity participation promotes technological innovation in SOEs.

4.2. Robustness test

4.2.1. Adoption of other regression models

This paper used the ordinary OLS model to conduct the robustness test. The regression results show that after replacing the main regression model with the ordinary OLS model, there is no big change, with patent grants (Grants) as the dependent variable, the regression coefficients of the total participation of non-state shareholders (PrivateTS) and the dummy variable of the total participation of non-state shareholders more than 10% (Private10) are 0.004 and 0.200, respectively, which are all at the 1% level significantly positive. The regression coefficients of the dummy variables of total non-state shareholders' participation (PrivateTS) and total non-state shareholders' participation exceeding 10% (Private10) are 0.006 and 0.248 respectively, both of which are significantly positive at the 1% level, using patent application (Apply) as the dependent variable.

Table 4. OLS regression test

	(1) Grants	(2) Apply	(3) Grants	(4) Apply
PrivateTS	0.004***	0.006***		
	(3.40)	(4.00)		
Private10			0.200***	0.248***
			(5.48)	(6.26)
cons	4.374***	4.449***	4.376***	4.451***
	(-13.40)	(-12.52)	(-13.43)	(-12.55)
Year	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes
N	7108	7108	7108	7108

4.2.2. Changing the measure of innovation indicators

In order to examine the sensitivity of non-state shareholders' equity participation to firms' innovation measures, this paper employs R&D expenditures, which are used in another part of the literature, to test the robustness of the study's findings. R&D expenditure is the ratio of R&D investment to operating revenue. From the test results, the regression coefficients of the two dummy variables, total non-state shareholders' equity participation (PrivateTS) and total non-state shareholders' equity participation over 10 per cent (Private10), are 0.008 and 0.324, respectively, which are significantly positive at the 1 per cent level when RD is used as the dependent variable. This suggests that non-state shareholders' participation and non-state majority shareholders also promote technological innovation in SOEs as measured by different innovation indicators, thus keeping the results robust.

Table 5. R&D test

	(1) RD	(2) RD
PrivateTS	0.008***	
	(3.90)	
Private10		0.324***
		(5.65)
cons	6.182***	6.185***
	(12.03)	(12.05)
Year	Yes	Yes
Control	Yes	Yes
N	7108	7108

4.2.3. Adopting lagged time point of innovation measurement

Since the impact of patent application and patent grant on enterprise innovation has a certain lag, this paper sets the time point of measurement of innovation indicators patent application and patent grant as two years lagged and three years lagged respectively for two samples to regress and examine the impact on enterprise innovation in year t. The test results show that when the patent grant (Grants0_2) is used as the dependent variable, the sum of non-state shareholders' participation (PrivateTS) is used as the dependent variable. As shown in the test results, the regression coefficients of the

dummy variable of total non-state shareholders' participation (PrivateTS) and the dummy variable of total non-state shareholders' participation exceeding 10% (Private10) are 0.010 and 0.356 respectively, which are both significantly positive at the 1% level with patent grants with a lag of two years (Grants0_2) as the dependent variable. The regression coefficients of the dummy variable for total non-state shareholders' participation (PrivateTS) and total non-state shareholders' participation exceeding 10% (Private10) are 0.013 and 0.449, respectively, and both are significantly positive at the 1% level when using patent applications (Apply0_2) with a two-period lag as the dependent variable. The results of the three lagged tests are similar, but are not repeated.The results of the replacement metric time-point test indicate that non-state shareholder participation and non-state majority shareholders' promotion of corporate innovation also remain robust under different time points.

Table 6. Two lag period test

	(1) Grants0_2	(2) Apply0_2	(3) Grants0_2	(4) Apply0_2
PrivateTS	0.010***	0.013***		
	(3.42)	(4.03)		
Private10			0.356***	0.449***
			(4.32)	(5.05)
cons	-7.525***	-7.702***	-7.486***	-7.652***
	(-10.08)	(-9.57)	(-10.04)	(-9.52)
Year	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes
N	6023	6023	6023	6023

Table 7. Three lag period test

	(1) Grants0_3	(2) Apply0_3	(3) Grants0_3	(4) Apply0_3
PrivateTS	0.010***	0.012***		
	(3.00)	(3.57)		
Private10			0.306***	0.409***
			(3.41)	(4.23)
cons	-7.264***	-7.285***	-7.213***	-7.225***
	(-8.67)	(-8.08)	(-8.61)	(-8.02)
Year	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes
N	5012	5012	5012	5012

5. Mechanism of Action

The results of the empirical analyses in the fourth part of this paper indicate that non-state shareholders' equity participation promotes corporate innovation. However, the question that arises is how non-state shareholders' equity participation promotes corporate innovation and through what mechanism of action? This part attempts to empirically test the dimensions of executive compensation incentives and financial asset allocation in order to better recognise and understand the mechanism by which non-state shareholder participation affects corporate innovation.

5.1. Executive compensation incentives of non-state shareholders' equity participation to promote technological innovation in SOEs

Regarding the research and measurement of executive compensation incentives, this paper draws on Cai Guilong et al. (2018) to measure executive compensation incentives by taking the natural logarithm of the mean value of the top three executives' compensation disclosed by the company. And for the test method of mediation effect draws on the method of Wen Zhonglin et al. (2004) and Jiang Xuanyu (2016), the mediation effect test model is as follows:

$$Apply_{t+1}(Grants_{t+1}) = \beta_0 + \beta_1 PrivateTS_t(Private10_t) + \beta_2 Control_t \text{——（1A）}$$

$$Top3_t = \beta_0 + \theta PrivateTS_t(Private10_t) + \beta_2 Control_t \text{——（1B）}$$

$$Apply_{t+1}(Grants_{t+1}) = \beta_0 + \gamma_1 PrivateTS_t(Private10_t) + \gamma_2 Top3_t + \beta_2 Control_t \text{——（1C）}$$

Referring to the research method of Wen Zhonglin et al. (2004), the mediation effect test and research are conducted rigorously according to the following steps. (1) According to model (1A), the regression coefficients are significant as a prerequisite in order to carry out the following mediation effect significance test. In this paper, the main test regression coefficients are all significantly positive, so the premise is met. (2) Estimating model (1B) and (1C), if the regression coefficients of and are significant positive, it indicates that the mediation effect is significant, and the participation of non-state shareholders promotes corporate innovation by enhancing the incentives of corporate executives' remuneration; based on this, if the regression coefficients are significant (insignificant), it indicates that the participation of non-state shareholders plays the role of partially (fully) mediated.

As shown in Table 8, columns (1) and (2) are the test results of the estimated model (1B), showing that the regression coefficients are 0.0065 and 0.1895 respectively, which are both significantly positive at 1% level; columns (3)-(6) are the test results of the estimated model (1C), which show that the regression coefficients of and are both significantly positive, so it can be concluded that the participation of non-state shareholders does play a partially (fully) intermediary role by enhancing the incentives of corporate executives. shareholding does promote corporate innovation by enhancing the channels of corporate executive compensation incentives. Since the regression coefficients are significantly positive, it indicates that non-state shareholders play a part of the mediation effect.

Table 8. Mediating effect test of Top3

	(1) Top3	(2) Top3	(3) Grants	(4) Grants	(5) Apply	(6) Apply
PrivateTS	0.0065***		0.0078***		0.0109***	
	(0.0005)		(0.0028)		(0.0030)	
Private10		0.1895***		0.3306***		0.4513***
		(0.0136)		(0.0767)		(0.0830)
TOP3_average			0.2414***	0.2229***	0.2491***	0.2247***
			(0.0663)	(0.0663)	(0.0719)	(0.0719)
Constant	7.7923***	7.8088***	-9.8510***	-9.6876***	-10.0609***	-9.8548***
	(0.1215)	(0.1213)	(0.8515)	(0.8512)	(0.9218)	(0.9209)
Observations	7,102	7,102	7,102	7,102	7,102	7,102
R-squared	0.3362	0.3380				
Control	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES

5.2. Financial Asset Allocation Mechanism of Non-State Shareholders' Participation in Promoting Technological Innovation in SOEs

For the financial asset allocation pathway, this paper refers to the measurement method of Peng Yuchao et al. (2018), which adopts the ratio of financial assets to total assets to measure financial asset investment (Fin). The specific formula is Fin = (trading financial assets + net available-for-sale financial assets + derivative financial assets + net held-to-maturity investments + net investment property) / total assets. The test for the mediation effect is as above and will not be repeated.

As shown in the test results of Table 9, indicated by the test results of Column (1) and Column (2), the regression coefficients are significantly negative at the 1% level, which can be concluded that the participation of non-state shareholders inhibits the investment in financial assets, but the coefficients are relatively small and not in line with the expectations, which results in the test of the mediation effect is not in line with the theoretical analysis of the direction of the development of the intermediary effect. From columns (3)-(6), it can be seen that the regression coefficients for the dependent variable of patent grants are all significantly negative; while the regression coefficients for patent applications are all significantly positive, and both of them are comprehensively considered for the impact on corporate innovation, which is not a simple sum that can be concluded here. Therefore, the mechanism of non-state shareholders' equity participation affecting corporate innovation through the channel of financial asset allocation is not confirmed in the empirical evidence.

Table 9. Mediating effect test of Fin

	(1) Fin	(2) Fin	(3) Grants0_1	(4) Grants0_1	(5) Apply0_1	(6) Apply0_1
PrivateTS	-0.0003***		0.0073***		0.0103***	
	(0.0001)		(0.0027)		(0.0029)	
Private10		-0.0079***		0.3145***		0.4310***
		(0.0018)		(0.0747)		(0.0809)
Fin			-9.6109***	-9.5613***	10.8777***	10.8163***
			(0.6959)	(0.6951)	(0.7652)	(0.7642)
Constant	0.0643***	0.0635***	-7.5264***	-7.5110***	-7.6478***	-7.6343***
	(0.0159)	(0.0159)	(0.6625)	(0.6613)	(0.7168)	(0.7153)
Observations	7,108	7,108	7,108	7,108	7,108	7,108
Control	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES

6. Conclusion

State-owned enterprises "mixed reform" is an important part of the existing reform of state-owned enterprises, is currently in the "mixed ownership reform" of the key moment, but also put forward the valuation system of Chinese characteristics of the new era. Innovation is an essential strength for building a strong science and technology country,

which is an important strategy for China's development, as President Xi Jinping has repeatedly discussed in his speeches. Therefore, how to study the link between the two clearly, making them complementary, prompting state-owned enterprises to break free from the shackles, making them bigger and stronger, while stimulating their innovation ability is a realistic problem for China's state-owned enterprise reform. This paper is based on the 2010-2017 A-share listed state-owned enterprises disclosed the nature of the top ten shareholders, the proportion of shareholding and the corresponding measure of innovation indicators used in the patent data, as a research sample, the study analysed the role and impact of the mixed reform of state-owned enterprises on the technological innovation of enterprises. The empirical analysis shows that, controlling for the sample of SOEs, non-state shareholders promote technological innovation in SOEs, and this result is more significant and robust when non-state shareholders' participation exceeds 10%. The results of the mediation effect model test show that the participation of non-state shareholders mainly promotes the technological innovation of SOEs by improving the incentive channel of executive compensation, which is not verified from the channel of financial asset allocation.

Based on the findings of this paper, the following policy recommendations are proposed:

First, this paper finds that non-state shareholders' participation of more than 10% has a significant promotion effect on the technological innovation of SOEs, so the entry of large non-state capital is indeed conducive to the promotion of corporate innovation. However, China's mixed ownership reform can not just be a transfer of equity control or a simple injection of funds, but should focus on a deeper level of mixed reform, bring in the high-quality management ethos of the management of the private enterprise as well as the incentive mechanism, and give full play to the role of non-state shareholders in the mixed reform of SOEs.

Specifically, in addition to privatisation, non-state shareholders are encouraged to hold shares and promote the depth of mixed reform with non-state shareholders as the equity structure, while ensuring the legitimate rights of non-state shareholders in the governance of SOEs, so as to further promote the quality of SOEs' "mixed reform".

Secondly, this paper takes investment in financial assets and executive remuneration as intermediary variables, and explains the role of non-state shareholders' participation in the technological innovation of SOEs from the two ways of investment in financial assets and executive remuneration incentives, and finally comes up with the influence of non-state shareholders' shareholding structure on the promotion of corporate innovation, and provides theoretical support for the study of the introduction of non-state capital in SOEs. Therefore, when it comes to the practice of China's state-owned enterprises' "mixed reform", the enterprises should implement the improvement of corporate governance and incentive mechanism, and establish the management remuneration incentive mechanism, so that the non-state major shareholders can fully play their role in monitoring and incentives, so as to realise the vitality of the enterprises, stimulate the innovation power of the enterprises, and enhance the level of innovation of the enterprises.

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