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Does the System of Turning over State-Owned Capital Gain Restrain Enterprise Innovation Investment?---Empirical Evidence from China's Capital Markets

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Abstract. As an important part of China's innovation system, central state-owned enterprises shoulder the responsibility of realizing the national strategic task. Since 2007, when the Chinese government promulgated “Interim Measures for the Administration of the Collection of State-owned Capital Gains from Central Enterprises” and gradually deepened its reform, the operating environment and financial policies of central enterprises have changed significantly. Under the background of this change, this study uses propensity score matching (PSM) and "difference-in-differences" (DID) methods to analyze the impact of the state-owned capital income turning-over system on the innovation input of central enterprises. The results show that the implementation of the system to a certain extent has inhibited the innovation investment in central enterprises.

Keywords. State-owned capital income turning-over system, central state-owned enterprise, innovation investment

1. Introduction

The new economic growth theory emphasizes that the R&D and innovation activities of enterprises are the key factors to promote the productivity promotion and the sustained economic growth [1]. R&D Innovation not only enhances the independent innovation and market competitiveness of enterprises at the micro level, but also promotes the technological development and transformation of the whole economy at the macro level. Since the reform and opening-up, China's economic system is gradually transforming from a planned system to a market economy.China's state-owned enterprises have been the backbone to conquer the core technology, the central enterprises shoulder the mission of stabilizing the development of the state-owned economy and realizing the appreciation

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of state-owned capital. In order to improve the efficiency and competitiveness of state-owned enterprises and strengthen the Macroeconomic regulation and control capacity of the government and promote strategic adjustments in the layout and structure of the state-owned economy, The Chinese government began to explore new mechanisms for state-owned asset management. It promulgated the "Provisional Measures for the administration of the collection of state-owned capital gains by Central Enterprises" in December 2007, clearly take the central enterprise as the pilot unit, turn over the state-owned capital income to the state, and gradually transition to the capital management-based model . This pilot reform marks the formal establishment of China's state-owned capital operation budget system. Since then, the Ministry of Finance and the State-owned Assets Supervision and Administration Commission have jointly issued a series of documents specifying the proportion of profits to be turned over by central enterprises. The implementation of these policies aim to reduce the government's direct intervention in the daily business activities of enterprises, give enterprises more operational autonomy, and stimulate the vitality and innovation capabilities of enterprises, mark the end of China's central state-owned enterprises low dividend distribution or non-dividend situation. Although studies have extensively explored the impact of private firm performance [2], enterprise value[3], and innovation efficiency [4], the specific impact of the state capital gains surrender system on innovation investment in Chinese private firms remains poorly understood.In view of the current academic research on the impact of the state-owned capital income turning-over system on the enterprises economy is still insufficient, this paper takes China's central state-owned listed companies from 2008 to 2022 as the research object, this paper investigates the impact of the system of turning over state-owned capital income on the innovation investment of central enterprises, and discusses the mechanism of the impact of China's state-owned capital income on innovation investment.

2.Research Design

2.1 Research Hypothesis

The inherent uncertainty and risk of innovation activities mean that enterprises need to face not only the explicit cost including long R&D cycle and huge capital demand, but also the implicit cost like sunk costs associated with project failure[5]. Because of Information asymmetry problems, it is difficult for outside investors to assess the true value of innovative projects, resulting in limited access to external financing and higher financing costs. Stable source of funds is very important for enterprise innovation, which makes internal funds become a key channel to support innovation investment [6].

Research and development (R&D) investment is an important part of an enterprise's investment behavior, and to a large extent determines the success or failure of innovation activities. According to the traditional NPV investment decision theory, firms decide whether to invest after evaluating the expected cash inflows and outflows of R&D projects [7]. However, by reducing the retained earnings of enterprises, the state-owned capital income turning-over system aggravates the financing constraints faced by enterprises. The managerial myopia hypothesis proposes that in order to avoid potential wealth loss to shareholders, corporate managers have to reduce long-term investments that can not be accurately valued by the market in an effort to increase the current profitability of the company[8]. Under the pressure of handing over state-owned capital

gains, managers may use their limited resources to meet short-term operating goals at the expense of projects that produce more company's long-term interests, particularly long-term R&D. At the same time, behavioral corporate finance theory points out that managers' decision-making is influenced by many irrational factors. Handing in state-owned capital gains may change managers' risk preference and innovation tendency[9]. For example, they may cut R&D to avoid risk, or adopt a more conservative operating strategy to meet the government's submission requirements. Based on this, this paper proposes the following hypothesis:

Ha: The System of Turning over State-owned Capital Gain Restrain Enterprise Innovation Input.

The core of the system is to adjust the financial relationship between the state-owned enterprises and the state. Under the system, state-owned enterprises are required to hand over a proportion of their profits to the state treasury in order to ensure that the state, as the ultimate owner of capital, receives a reasonable return on its investments. This mechanism not only reflects the exercise of the state-owned assets management right, but also is an important means to promote the reform of state-owned enterprises and enhance the state financial revenue.

From the perspective of incentive theory, the state-owned capital income turning-over system may make state-owned enterprises pay more attention to the improvement of operating efficiency and profitability. Within this framework, managers are encouraged to adopt a long-term perspective, focusing on the sustainability of the enterprise rather than merely pursuing short-term profit maximization[10]. Therefore, in order to continuously increase the level of profits to meet the surrender requirements, and on this basis to achieve enterprise growth, state-owned enterprises may put more energy and resources into innovation activities. Innovation, after all, is a key driver of improving a company's core competitiveness, expanding its market boundaries, and adding value to a product or service[11].

Central state-owned enterprises play a special role in China's economic system, and they tend to enjoy financing advantages and face soft budget constraints [12] . This means that even after the implementation of the state-owned capital income turning-over system, these enterprises may not be subject to too severe financial pressure. In fact, China is currently committed to building an innovative society, with central state-owned enterprises pursuing not only commercial interests but also the mission of promoting the country's technological progress and industrial upgrading. Thus, while the handing-over system may reduce the free cash flow of enterprises, it is likely that the management of central state-owned enterprises will take measures to ensure that their innovation strategies and established R&D investment plans will not be affected. Therefore, this paper proposes the opposite hypothesis:

Hb: The system of *t*urning over state-owned capital gain will promote enterprise innovation investment.

2.2 Sample Selection and Data Source

Data on the listed companies used in the study are all from CSMAR databases, while indirect data such as turn-in rates are hand-collated by industry. To reduce the interference of extreme values, we applied 1% and 99% tail-down treatments to all continuous variables. Based on the data of listed companies in China from 2003 to 2022, this paper makes the following selection: eliminate the observation of financial industry. Eliminate the observation of ST and * ST companies. Eliminate the observation of

missing value. Annual observations of 19,916 companies were obtained. Using propensity score matching method, we finally get the annual observation data of 13230 companies for empirical analysis.

2.3 Research Variables

2.3.1 Explained Variable

Explained Variables is enterprise innovation investment (Innovation) , which is defined as the ratio of enterprise R&D investment to operating income.

2.3.2 Explanatory Variable

This paper refers to the practice of Deng et al. [13] , defines Treat and Post as grouped dummy variables and annual dummy variables respectively: the nature of the company belongs to the central state-owned enterprises, that is, when belongs to the experimental group Treat takes 1, otherwise 0; Post takes 1 for the year and thereafter affected by the policy, otherwise zero; Treat×Post is a dummy variable used to measure whether the company was affected by the policy in that year.

2.3.3 Control Variables

Referring to the previous literatures[3][14][15] , the following control variables were selected: enterprise size (Size), natural logarithm of total assets at the end of the year; leverage ratio (Lev) , proportion of total liabilities to total assets; Profitability (Roa) , net income to total assets; operating cash flow (Cfo) , net cash flow from operating activities to total assets; Tobin Q (Tobinq), market value/replacement cost; capital expenditure (Capex), net cash for purchase and construction payment, disposal and recovery of fixed assets intangible asset and other long-term assets to total assets; equity concentration (Top) , share proportion of the largest shareholder; equity balance (Balance), the sum of the shareholding ratio of the second to fifth largest shareholders to the share proportion of the largest shareholder; management ownership (Msh) , management ownership to the total number of shares. Detailed variable definitions and measurements are shown in Table 1.

Table 1. main variable definition and description

variable name	variable symbol	variable definition and description
Innovation capability	Innovation	ratio of enterprise R&D investment to operating income., %
Grouped dummy variables	Treat	Treat takes 1 as company belongs to the experimental group, otherwise 0
Annual dummy variables	Post	Post takes 1 for the year and thereafter affected by the policy, otherwise zero
Asset size	Size	natural logarithm of total assets at the end of the year
Leverage ratio	Lev	proportion of total liabilities to total assets
Profitability	Roa	ratio of net income to total assets
Operating cash flow	Cfo	ratio of net cash flow from operating activities to total assets
Tobin Q	Tobinq	market value/replacement cost

Capital expenditure	Capex	ratio of net cash for purchase and construction payment, disposal and recovery of fixed assets intangible asset and other long-term assets to total assets
Equity concentration	Top	share proportion of the largest shareholder
Equity balance	Balance	the sum of the shareholding ratio of the second to fifth largest shareholders to the share proportion of the largest shareholder
Management ownership	Msh	management ownership to the total number of shares
Duality of CEO and Chairman	Dual	as both the chairman and the general manager is 1, otherwise 0

2.4 Model Design

As an exogenous shock independent of internal decision-making, the state-owned capital gain turning-over system can alleviate the endogenous problems of corporate decision-making[16]. For central enterprises are the implementation objects of the state-owned capital gains turning-over system, the central enterprise holding listed companies can be taken as an experimental group; non-state-owned listed companies as a control group for they are not affected by the state-owned capital gains turning-over system. The following regression model is designed to test the research hypothesis.

$$innovation = \beta_0 + \beta_1 post \times treat + \beta_i \sum controls_{it} + \tau_t + \varepsilon_i + \delta_{it} \quad (1)$$

Model (1) is a multi-period difference in difference model controlling individual and time point. Among them, the explanatory variable of innovation is innovation investment; controls are sample control variables; ε_i、τ_t respectively are individual and time-point fixed effects.

3. Empirical Test and Analysis

3.1 Descriptive Statistical Analysis

Table 2 is the descriptive statistics of the main variables after propensity score matching. The ean of R&D investment of the sample companies is 4.827% , that is, the ratio of R&D investment to operating income is 0.048; the standard deviation is 5.511% and it shows that there is little difference or fluctuation in R&D expenditure relative to revenue in the sample companies. The results of the control variables show that the average size of the companies is 22.19, indicating that the PSM-matched companies are all large in size, which is consistent with the size characteristics of the central enterprises; the average leverage ratio (lev) is 0.394, which shows that the liabilities of the sample companies are at a reasonable level. The distributions of other variables are in a reasonable range, basically consistent with the results in the existing literature.

Table 2. descriptive statistics

VARIABLES	N	mean	sd	min	max
Treat×Post	13,230	0.502	0.500	0	1
Innovation	13,230	4.827	5.511	0	88.56
Size	13,230	22.19	1.377	17.81	27.96
Lev	13,230	0.394	0.198	0.00797	1.033
Cfo	13,230	0.757	7.821	-74.11	709.7
Roa	13,230	0.0429	0.0458	-0.115	0.196
Tobing	13,230	2.227	1.891	0.641	92.25
Capex	13,230	0.0503	0.0500	-0.403	0.450
Top	13,230	32.55	14.80	2.790	89.09
Balance	13,230	0.845	0.674	0	4
Msh	13,230	13.09	19.09	0	89.18
Dual	13,230	0.275	0.447	0	1
Number of id	2,654	2,654	2,654	2,654	2,654

3.2 Baseline Regression Result Analysis

In order to investigate whether the state-owned capital income surrender system inhibits the innovation input of the central enterprises, this paper uses the DID method to evaluate the policy effect. The explained variable is enterprise innovation investment (innovation).The explanatory variable is the interaction term obtained by multiplying the treatment group dummy variable (Treat) and the treatment period dummy variable (Post), that is, the policy impact dummy variable (Treat × Post). Among them, the treatment group dummy variable (Treat) represents whether the enterprise is affected by the policy, while the treatment period dummy variable (Post) represents whether it is within the time range of policy implementation. This interaction term can reflect the difference in changes in the treatment group compared with the control group after the policy is implemented, allowing us to identify and evaluate policy effects. In order to further enhance the robustness of the model, the fixed-effect model is used to regress the model, with the robust standard error used. The results of the regression are shown in table 3(1) .

The results show that the estimated coefficient of the virtual variable of policy impact (Treat×Post) is significantly negative under the control condition, which indicates that it has a significant negative correlation with enterprise innovation, that is, the state-owned capital gain turning-over system inhibits the innovation of state-owned enterprises, supporting the research hypothesis of Ha.

In order to effectively avoid the selection bias of the samples, the research uses the propensity-matching method (PSM) to Match the original samples with reference to the practice of Deng et al.[13]. The variables chosen to match include enterprise size (Size), leverage (Lev), profitability (Roa), operating cash flow (Cfo), Tobin Q (Tobinq), capital expenditure (Capex), equity concentration (Top), and equity balance (Balance). The selection of these variables aims to comprehensively capture key characteristics such as a company's financial status, market valuation, investment behavior and corporate governance structure.

Following the 1:1 nearest neighbor matching principle, a similar control group for each experimental group can be found, resulting in a paired sample of 6615 groups (13,230) . In order to verify the quality of matching, we conducted a balance test, and the results showed that there was no statistically significant difference in the distribution of

key covariates between the treatment group and the control group, which indicated that the paired samples had reached balance on key characteristics, thus effectively Controlled sample self-selection bias.

Regression results of paired samples using propensity score matching (PSM) are shown in the Table 3 column (2). The estimated coefficient of Treat×Post is -0.493, which is significant at 1% level, indicating that compared with the 6615 control enterprises with no significant difference. The conclusion can be drawn that the state-owned capital gain turning-over system inhibits the innovation of the central holding enterprises, supporting the study hypothesis of Ha.

Table 3. baseline regression result

	(1)	(2)
VARIABLES	**Innovation**	**Innovation**
Treat×Post	-0.375***	-0.493***
	(-3.13)	(-3.02)
Size	-0.219***	-0.306***
	(-4.69)	(-4.85)
Lev	-3.620***	-3.616***
	(-17.13)	(-12.70)
Roa	-7.390***	-9.376***
	(-21.18)	(-16.07)
Cfo	0.000	0.002
	(0.54)	(0.64)
Tobing	0.044***	0.045**
	(2.59)	(2.23)
Capex	3.963***	4.889***
	(7.92)	(7.18)
Top	-0.024***	-0.031***
	(-6.31)	(-5.84)
Balance	0.027	-0.038
	(0.35)	(-0.37)
Msh	0.014***	0.016***
	(5.89)	(4.85)
Dual	0.136**	0.148*
	(2.31)	(1.89)
Constant	12.754***	15.914***
	(11.52)	(11.32)
Observations	19,916	13,230
Number of id	3,246	2,654

3.3 Robustness Test

Although this paper confirms that the state-owned capital gain turning-over system inhibits the innovation of state-owned enterprises, the result may still have some deviations. Drawing on the practice of Liao et al. (4), we conduct the regression analysis again by using the proportion of enterprise innovation investment to total assets as a substitute variable of the explained variable. Table 4 (1) shows that the regression coefficient of Treat×Post was significantly negative at the 1% statistical level, consistent

with the results of the main regression, which strengthens our previous evidence that the state-owned capital gain turning-over system inhibits the innovation input of state-owned enterprises.

Table 4. robustness test and placebo test

	(1)	(2)	(3)
VARIABLES	**Innovation**	**Innovation**	**Innovation**
Treat×Post	-0.011***	-0.011***	0.240
	(-6.56)	(-4.53)	(0.71)
size	-0.002***	-0.002	-0.171
	(-2.60)	(-1.43)	(-0.87)
lev	-0.012***	-0.012***	-2.624***
	(-4.30)	(-2.72)	(-3.09)
roa	0.035***	0.035***	-8.480***
	(6.17)	(4.40)	(-8.31)
cfo	0.000	0.000	0.003***
	(1.36)	(1.58)	(4.17)
tobing	0.001***	0.001	-0.021
	(2.62)	(1.60)	(-0.51)
capex	0.015**	0.015	4.820***
	(2.31)	(1.44)	(4.24)
top	-0.000***	-0.000	-0.017
	(-2.59)	(-1.41)	(-1.31)
balance	0.002**	0.002	-0.020
	(2.16)	(1.39)	(-0.08)
msh	0.000***	0.000***	0.006
	(8.54)	(6.31)	(0.95)
Dual	-0.010***	-0.010***	0.050
	(-6.39)	(-4.43)	(0.55)
Constant	-0.011***	-0.011***	12.140**
	(-6.56)	(-4.53)	(2.30)
Observations	13,230	13,230	13,230
Number of id	2,650	2,650	2,650

When performing the robustness test, robust regression on the sample is also carried out, and the Table 4 column (2) results show that the regression coefficient for the core explanatory variable Treat×Post is -0.007 and pass the 1% significance level test, the results are consistent with the main regression.

3.4 Placebo Test

In order to enhance the credibility of the research hypothesis, this research adopts an alternative testing method-the placebo test to verify whether the decline in R&D efficiency indeed stems from the implementation of the state-owned capital gains turn-over policy. The core logic of this test is that if the reduction in R&D efficiency is indeed caused by a specific policy, then the coefficient estimate of the difference-in-difference (DID) model should no longer be significant after changing the effective time point of the policy. This study draws on the research methods of Caliendo et al.[17] and

artificially moves the time point of policy implementation forward, setting it as two years before enterprises begin to turn over state capital gains. On this basis, the relationship between policy changes and R&D efficiency is re-evaluated. According to the placebo test results shown in the third column of Table 4, the regression coefficient of the policy impact dummy variable (treat × post) as the core explanatory variable is 0.001, which is no longer statistically significant after testing. This finding provides strong empirical support for the view that the policy of turning over state capital gains has a substantial impact on corporate R&D efficiency, strengthens the robustness of the research conclusion, and further confirms that the policy of turning over state capital gains inhibits the R&D investment of central enterprises. effect.

4. Discussion and Policy Recommendations

4.1 Discussion

The current academic community still lacks an in-depth understanding of the state-owned capital income remittance policy adopted by China's central state-owned enterprises and its impact on corporate innovation activities. The current academic community still lacks an in-depth understanding of the state-owned capital income remittance policy adopted by China's central state-owned enterprises and its impact on corporate innovation activities. We aims to fill this research gap, with a special focus on how state-owned capital income turnover policies affect corporate innovation investments. The study found that this policy may actually have a negative impact on the R&D investment of central enterprises. The analysis results of this study point out that the policy of turning over state-owned capital gains may weaken the financial investment of these enterprises in innovation.

Free cash flow is an important source of funding for R&D activities because it allows companies to invest in long-term R&D projects without the pressure of external financing[18]. By reducing the free cash flow of enterprises, the system of handing over state-owned capital gains increases the financing constraints of enterprises. Companies may have to cut back or delay their research and development programs to maintain financial flexibility and meet government turn-over requirements. Such funding constraints may result in companies being unable to undertake innovative projects with potentially high returns but also high risks [19].

According to the agency theory, management may act shortsighted because of the pressure to hand over state capital gains, prioritizing meeting short-term financial goals over long-term innovation and growth. In this context, R&D investment may be neglected because R&D results often take longer to become commercialized and profitable[20]. In addition, due to the uncertainty of R&D activities and the lag of results, management may be more inclined to cut R&D budgets to maintain short-term profit levels when faced with pressure to turn over profits.

The research results of this article show that from 2003 to 2022, this system inhibited the innovation investment of enterprises controlled by central enterprises. In the short term, it will not affect the business development of the company. But in the long run, reducing investment in innovation may have a negative impact on the long-term development of state-owned enterprises and the growth of the national economy as a whole. For example, a reduction in innovation investment may weaken the leadership position of state-owned enterprises in key technologies and strategic emerging industries,

and may have a negative impact on the innovation vitality and growth potential of the overall economy [21]. The conclusions of this study are in sharp contrast to the views in the existing literature, emphasizing the need to more comprehensively consider its impact on corporate innovative behavior when evaluating state-owned capital income remittance policies. This not only involves improving the efficiency of innovation output, but also includes the scale of investment in innovation resources. Both of them jointly determine the company's long-term innovation capabilities and market competitiveness.

4.2 Policy Recommendations

Firstly, establish a dynamic adjustment mechanism. The government can consider establishing a dynamic mechanism for adjusting the proportion of state capital gains after taking into account the characteristics of the industry, the stage of enterprise development and macroeconomic conditions. For enterprises that are in the research and development period of key technologies or need a large amount of research and development investment, on the premise of not affecting the overall interests of the country, the proportion of contributions should be appropriately reduced, leaving enterprises with more funds for innovation activities. Secondly, the government should increase the weight of innovation indicators in the performance appraisal system of state-owned enterprise managers, and encouraged enterprise management to attach much more importance to research and development and innovation activities. In addition, part of the profits can be linked to the innovation performance of the enterprise, and the enterprise can be encouraged to invest more resources in innovation by way of return or reward. Through the above methods, it not only ensures that the country gets stable earnings, but also promotes enterprises, especially state-owned enterprises, to increase innovation investment and enhance their core competitiveness.

5. Conclusion

Based on agency theory and investment decision theory, this paper uses propensity score matching (PSM) and difference-in-difference method (DID) to empirically test the influence of state owned capital gain turning-over system on enterprise innovation investment. The results show that the state capital gain turning-over system inhibits the innovation input in central state-owned enterprises. This further improves the theoretical analysis framework of the state capital gain turning-over system and the economic impact of enterprises, provides new evidence for the economic impact of the state capital gain turning-over system on enterprises, and broadens the application scenario of the state capital gain turning-over system's impact mechanism on enterprise innovation. This study is helpful to provide reference for government policy formulation, and also provides useful suggestions for improving the innovation ability of state-owned enterprises. However, this study focuses on the impact of China's state capital gain handing-over system on the R&D investment in central state-owned enterprises, and has not yet explored the influencing mechanism of the relationship between the two. In the future research, the test of the mechanism of the state capital gain handing-over system on the economic impact of enterprises should be conducted, in order to provide more abundant theoretical support for the high-quality development of central state-owned enterprises.

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