Do Executive Equity Incentives Improve the Efficiency of Corporate Investment?

-- An Empirical Analysis from Chinese Listed Companies

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Abstract

This paper empirically tests the impact of executive equity incentives on corporate investment efficiency based on the data of Chinese A-share listed companies in Shanghai Stock Exchange and Shenzhen Stock Exchange from 2006-2017. The results show that executive equity incentives have a significant impact on the efficiency of corporate investment and may exacerbate the inefficiency of corporate investment, and this impact is more significant for non-state owned, high power concentration, politically connected companies, but the Anti-corruption policy since the 18th CPC National Congress weakens the strength of the impact of executive equity incentives on the efficiency of corporate investment.

Keywords

Executive Incentives; Investment Efficiency; Stock Option Incentive.

1. Introduction

In the context of China's economy entering the "new normal" and the "double circulation" of production factors internationally and domestically, improving the efficiency of capital formation and allocation is an inherent requirement to promote the effective flow of production factors, the transformation of the economic development model and high-quality economic development. As one of the main constituent elements of the economy and society, investment by enterprises is an important way to allocate resources. However, factors such as information asymmetry and poor governance mechanisms lead to corporate investments that often exhibit deviations from optimal levels. It has been shown that the investment efficiency of Chinese listed companies is relatively low (Chen et al., 2011). Inefficient investment in listed companies may be due to the existence of serious information asymmetry and principal-agent problems. Under the arrangement of modern business system, the ownership and operation are separated, and important investment decisions are essentially made and executed by the executives, or at least led by the executives. In this process, the market value of the firm may be reduced if the executives' decisions do not sufficiently consider the overall interests of the firm (Stein, 2003; Fracassi and Tate, 2012). In addition, executives of listed companies may be overinvested due to relatively low salaries and excessive government intervention (Xin et al., 2007; Chen et al., 2011; Wang et al., 2017). There may also be underinvestment due to executives' preference to enjoy a peaceful and quiet life (Liu et al., 2015), and it may even appear that corporate executives are using investment as a cover to pave the way for personal gain (Bhagat and Bolton, 2008). Obviously, the investment decisions of corporate executives will directly affect the efficiency of corporate investment and thus the efficiency of corporate resource allocation.

The separation of operating and management rights in modern enterprises has led to a principal-agent problem between owners and managers of enterprises. Scholars have studied how to effectively reduce agency costs and restrain the negative effects of executive behavior

on the market value of the firm. Jensen (1986) suggested that executive equity incentives are quite effective institutional arrangements for coordinating long-term interests between shareholders and managers. The China Securities Regulatory Commission also promulgated and implemented the Measures for the Administration of Equity Incentives for Listed Companies in 2006. Equity incentives have now become a common incentive method for listed companies in Shanghai and Shenzhen A-shares in China, and more and more listed companies are adopting this method to motivate their executives. In recent years, the number of domestic studies on the influence of executive equity incentives on corporate investment efficiency has gradually increased, and whether executive equity incentives can improve corporate investment efficiency has become a topic of great concern.

2. Literature Review and Theoretical Analysis

2.1. Factors Influencing the Efficiency of Corporate Investment

The existing literature has fruitfully investigated the factors influencing the efficiency of corporate investment at the macro and micro levels. At the macro level, researchers have mainly studied the factors influencing the efficiency of corporate investment from the perspectives of legal environment, government quality, industrial policies, official turnover, Anti-corruption policies, and investor protection (Mclean et al., 2012; Baker et al., 2016; Wan, 2013). More recently, many scholars have focused on the impact of government actions on firms' investment decisions. Some scholars believe that excessive government intervention in corporate investment activities to achieve their performance goals may lead corporate investment to deviate from the optimal goal (Chen S. et al., 2011; Wang et al., 2017). Some scholars also believe that government information disclosure can effectively improve corporate investment efficiency (Yu et al., 2020). At the micro level of firms, scholars have mainly studied the factors influencing the efficiency of corporate investment from the perspectives of dividend distribution, nature of property rights, financing constraints, performance fluctuations, executive compensation, share of independent directors, shareholder chains, allocation of decision-making power, bond governance, and background characteristics of the executive team (Liu et al., 2015; Pan et al., 2020). Unilateral research on the factors influencing the efficiency of corporate investment at the macro or micro level may lead to biased findings, and research on corporate economy should integrate the macro and micro levels to obtain relatively comprehensive conclusions.

2.2. Executive Equity Incentives and Corporate Investment Efficiency

There are no relatively consistent findings on the impact of executive equity incentives on corporate investment efficiency. Some scholars believe that equity incentives for corporate executives can effectively curb overinvestment in that firm (Lu and Zhang, 2011) and also effectively mitigate underinvestment due to the pressure of performance expectations. That is, equity incentives can effectively curb the inefficiency of corporate investment (Luo and Shen, 2013). However, some other scholars hold a different view on this. For example, Li (2017) showed that stock option incentives have a significant effect on overinvestment, while they do not have a significant effect on underinvestment. Yang et al. (2016). On the other hand, argue that there is a U-shaped relationship between the level of equity incentives and overinvestment, and that stock option incentives tend to exacerbate overinvestment. In addition, Gu et al. (2018) find that equity incentives of executives have a positive effect on innovation investment in GEM-listed companies, but show heterogeneity at different stages of the firm's development life cycle. In summary, it can be seen that there are still great differences between the research findings of scholars on the impact of executive equity incentives on corporate investment efficiency, so further theoretical analysis and empirical research on related issues are still needed.

2.3. Theoretical Analysis

Executive equity incentive arrangements are an important institution in the internal governance of modern corporate enterprises. According to principal-agent theory, an effective executive compensation contract can make the personal gains of corporate executives more tied to corporate performance. For example, equity incentives can be used to directly link the interests of executives to those of the company and shareholders by providing them with the right to share in the residual value of the company's operations, and the long-term performance of the company is better as the percentage of equity held by executives increases (Datta et al., 2009). In addition, executive equity incentives facilitate more active investment behavior (Liu et al., 2014), and good corporate investment performance and returns can generate stock or option gains for executives. Therefore, executive equity incentives stimulate the enthusiasm and motivation of corporate executives to invest and guide them to continuously seek investment opportunities to improve corporate performance. However, this behavior requires a very important precondition, namely the effectiveness of the market. Only if the market can truly reflect the results of the investment decision-making behavior of corporate executives and produce the corresponding economic consequences (affecting corporate performance) can it play a real incentive role for corporate executives; otherwise, the incentive of corporate executives may be more reduced to a self-interest tool for corporate executives. In reality, the market is largely ineffective, which allows economically rational executives to "cater" to the corporate executive incentive system by investing on a larger scale. Finally, the goal of corporate executives is often to maximize their personal wealth during their tenure, and it is not inherent in the pursuit of economically rational executives to "plant the tree before them and let others take advantage of it". Therefore, under the modern enterprise system, corporate executives who have the power to make investment decisions have a strong incentive to invest more. Only in this way can corporate executives derive additional income and industry reputation from the "corporate empire" they have built, and even consolidate, strengthen or expand their control position and control value in the enterprise through the pursuit of the scale of investment rather than efficiency considerations. In summary, when there is a large degree of inefficiency in the market, executive equity incentives do not necessarily improve the efficiency of corporate investment, but may increase the inefficiency of corporate investment.

3. Research Design

The current academic research on the efficiency of corporate investment generally adopts the model and method of Richardson (2006). In this paper, we refer to the existing studies (Richardson, 2006; Pan et al., 2020; Yu et al., 2020) and set the following model for empirical analysis.

First, the expected investment size of the firm is estimated by model (1) as follows.

$$\text{Invest}_{i,t} = \alpha_0 + \alpha_1 \text{Invest}_{i,t-1} + \alpha_2 Growth_{i,t-1} + \alpha_3 Cash_{i,t-1} + \alpha_4 Age_{i,t-1} + \alpha_5 Size_{i,t-1} + \alpha_6 Return_{i,t-1} + \alpha_7 Lev_{i,t-1} + \sum_t Year_t + \sum_j Industry_j + \varepsilon_{it} \qquad (1)$$

Where $\text{Invest}_{i,t}$ in model (1) is the total investment of firm i in year t and is calculated as follows.

$$\text{Invest}_{i,t} = [Capex_{it} + Sale_{it}]/Asset_{it} \qquad (2)$$

Where, $Capex_{it}$ is the firm's capital expenditure, equal to "cash paid for the construction of fixed assets, intangible assets and other long-term assets" plus "net cash paid for the acquisition of subsidiaries and other business units". $Sale_{it}$ is the proceeds from the liquidation of assets,

which is equal to "net cash received from disposal of fixed assets, intangible assets and other long-lived assets" plus "net cash received from disposal of subsidiaries and other business units". $Asset_{it}$ is the total assets of the enterprise for the period.

The meanings of the other variables in model (1) are as follows. $\text{Invest}_{i,t-1}$ is the total investment of firm i in the previous year (t-1), with the same algorithm as above. $Growth_{i,t-1}$ is the firm's investment opportunity in year t-1, measured by the previous year's incremental operating income. $Cash_{i,t-1}$ is the total cash and cash equivalents of the enterprise at the end of the previous year, divided by total assets for normalization. $Age_{i,t-1}$ is the listing age of the enterprise, and the listing age at the end of the previous year. $Size_{i,t-1}$ is the total assets of the enterprise at the end of the previous year, taking its natural logarithm. $Return_{i,t-1}$ is the annual return of the firm's stock in the previous year. $Lev_{i,t-1}$ is the firm's gearing ratio at the end of the previous year, which is equal to total liabilities divided by total assets; $Year_t$ is the year dummy variable, $Industry_j$ is the industry dummy variable, and ε_{it} is the random disturbance term.

The expected investment expenditure scale of the firm in year t can be estimated by model (1), and the corresponding residual of model (1) is the difference between the actual investment expenditure and the expected investment expenditure of the firm in that year, so that the investment inefficiency of the firm can be measured based on the regression residual. If the regression residual value > 0, it is over-invested (*Invover*), and if the regression residual value < 0, it is under-invested (*Invunder*). To facilitate analysis and understanding, this study refers to Xin et al. (2007) and Liu et al. (2015) and takes the residuals less than 0 to their absolute values. In this way, the larger the value of *Invover* and *Invunder*, the more serious the over-investment or under-investment of the firm, say, the more serious the degree of investment inefficiency.

Then, the relationship between executive equity incentives and corporate investment efficiency (over or under) is tested by model (3).

$$\text{Inveff}_{it} = \beta_0 + \beta_1 Exe_{it} + \beta_2 \text{Admin}_{it} + \beta_3 \text{SOE}_{it} + \beta_4 Fcf_{it} + \beta_5 Sub_{it} + \beta_6 Fixcap_{it} + \beta_7 Dual_{it} + \beta_8 Top_{it} + \beta_9 Sep_{it} + \beta_{10} TbQ_{it} + \sum_t Year_t + \sum_j Industry_j + \varepsilon_{it} \qquad (3)$$

Investment efficiency (Inveff_{it}) in model (3) is the main explained variable in this paper, measured by two indicators of over-investment (*Invover*) and under-investment (*Invunder*). Executive Equity Incentives (Exe_{it}) is the explanatory variable, measured by whether the firm provided equity incentives to executives during the sample period, taking value 1 if they did and 0 if they did not. The meanings of the other variables in model (3) are as follows. The control variable Admin_{it} indicates the ratio of administrative expenses, which is equal to the ratio of administrative expenses to main operating income of the firm at the t year. SOE_{it} is a state-controlled dummy variable, state-controlled takes the value of 1, otherwise it takes 0. Fcf_{it} is free cash flow, expressed as net cash flow from operating activities [= (net income + interest expense + non-cash expenses) - (increase in working capital + capital expenditures)] divided by total assets. Sub_{it} is the size of government subsidies. $Fixcap_{it}$ is the growth rate of fixed assets. $Dual_{it}$ is the two-position dummy variable, which takes 1 if the chairman and general manager are the same person, otherwise it takes 0. Top_{it} is equity concentration, expressed as the sum of the squares of the shareholdings of the top 5 largest shareholders (HHI)). Sep_{it} is separation of powers, measured as the difference between control and ownership. TbQ_{it} is Tobin's Q, measured as the ratio of market capitalization to total assets; Industry is industry fixed effect, Year is the year fixed effect.

4. Empirical Results and Analysis

4.1. Data Sources and Descriptive Analysis of Variables

In this paper, listed Chinese A-share companies in Shanghai and Shenzhen from 2006-2017 were selected as the initial sample for the study, and the sample was screened according to the following method. (1) Excluding the sample of insurance, banking and other financial industry companies. (2) Excluding the sample of ST and ST* category companies. (3) Excluding the sample of firms that have been listed for less than one year (eliminating the effect of IPOs). (4) Excluding the sample of enterprises with gearing ratio >= 1 or <= 0. (5) The sample of firms with missing data is excluded and all continuous variables are bilaterally Winsorize. The data used in this paper are mainly from the CSMAR database, WIND database, annual reports of listed companies disclosed by the SEC, and the Internet.

The descriptive analysis of the main variables in this study is shown in **Table 1**. As can be seen from Table 1, the mean value of the explained variable investment efficiency (inveff) is about 0.049 and the standard deviation is about 0.038. And the mean value of investment efficiency (inveff) is greater than the standard deviation, indicating that investment efficiency is roughly normally distributed, and its mean, variance, and standard deviation are relatively small, indicating that the data as a whole are relatively smooth and do not have large fluctuations. The explanatory variable executive incentive (exe) is a binary variable, and the trend of change is also relatively smooth.

Table 1. Statistical characteristics of the main variables

Variables	Mean	Variance	S.D.	Min	Max	N
inveff	0.0487193	0.0014399	0.0379465	0	0.960228	11331
exe	0.1697997	0.1409802	0.3754733	0	1	11331
lnadmin	-2.506696	0.6554469	0.8095968	-6.452679	8.137509	11310
lnfreecf	-3.013672	1.137086	1.066342	-10.34548	-0.11432	8502
soe1	0.1648575	0.1376916	0.3710682	0	1	11331
dual	0.44568	0.2470711	0.4970625	0	1	11331
top	0.1411864	0.0128379	0.1133046	0.000483	0.809744	11331
lnsub	15.82582	2.702866	1.644039	3.960813	23.49623	9670
fixcap	0.6642915	476.6948	21.83334	-1	2259.542	11326
sep	5.05572	59.07538	7.686051	0	53.3162	10583
TbQ	2.801743	408.6244	20.21446	0.082643	2123.828	11331

4.2. Main Results

Based on the previous discussion, this paper regresses model (3) using panel OLS, panel fixed effects model and random effects model, and the results are shown in **Table 2**. Note that columns 1-3 in Table 2 show the regression results without industry and year fixed effects, while columns 4-6 with industry and year fixed effects. The results in Table 2 show that the coefficients of executive incentives (exe) are all significantly positive at the 1% statistical level, indicating that there is a significant positive effect of executive equity incentives on the efficiency of corporate investment (inveff). This implies that equity incentives in the form of equity incentives for corporate executives may lead to inefficient corporate investment, that is, overinvestment or underinvestment. In addition, more than half of the firms in the sample of this study that conducted equity incentives were overinvested. This result is consistent with the findings of Yang et al. (2016), which validates the conclusion of the theoretical analysis of this study that executive equity incentives do not necessarily increase the investment efficiency of firms, but may instead exacerbate their investment inefficiency.

Table 2. Main results

Variables	1	2	3	4	5	6
	OLS	RE	FE	OLS	RE	FE
	inveff	inveff	inveff	inveff	inveff	inveff
exe	0.00931***	0.00931***	0.00931***	0.0139***	0.00920***	0.0128***
	(0.00135)	(0.00135)	(0.00112)	(0.00130)	(0.00114)	(0.00129)
lnadmin	0.00149	0.00149	0.00149*	0.00640***	0.00187**	0.00487***
	(0.000947)	(0.000947)	(0.000817)	(0.00128)	(0.000791)	(0.00127)
lnfreecf	0.000567	0.000567	0.000567	0.000122	0.000321	0.000157
	(0.000416)	(0.000416)	(0.000387)	(0.000426)	(0.000376)	(0.000417)
soe1	0.00225	0.00225	0.00225	-0.00149	0.00186	0.00254
	(0.00146)	(0.00146)	(0.00139)	(0.00158)	(0.00138)	(0.00163)
dual	-0.0115***	-0.0115***	-0.0115***	-0.00831***	-0.0119***	-0.00905***
	(0.00103)	(0.00103)	(0.000865)	(0.000973)	(0.000898)	(0.000992)
top	-0.0289***	-0.0289***	-0.0289***	-0.0496***	-0.0306***	-0.0553***
	(0.00535)	(0.00535)	(0.00503)	(0.00803)	(0.00423)	(0.00804)
lnsub	0.00145***	0.00145***	0.00145***	0.000718**	0.000962***	0.000233
	(0.000359)	(0.000359)	(0.000292)	(0.000356)	(0.000285)	(0.000375)
fixcap	1.35e-06	1.35e-06	1.35e-06	-0.000199	-5.80e-06	-0.000171
	(4.48e-06)	(4.48e-06)	(1.51e-05)	(0.000160)	(4.18e-06)	(0.000156)
sep	9.52e-05	9.52e-05	9.52e-05	-4.49e-05	0.000169***	-6.12e-05
	(8.59e-05)	(8.59e-05)	(7.26e-05)	(0.000115)	(5.86e-05)	(0.000113)
TbQ	-0.00233***	-0.00233***	-0.00233***	-0.00132***	-0.00229***	-0.000747***
	(0.000258)	(0.000258)	(0.000203)	(0.000237)	(0.000258)	(0.000262)
Industry	NO	NO	NO	YES	YES	YES
Year	NO	NO	NO	YES	YES	YES
Constant	0.0458***	0.0458***	0.0458***	0.0720***	0.0330***	0.0688***
	(0.00649)	(0.00649)	(0.00545)	(0.00700)	(0.00885)	(0.00692)
Observations	6,795	6,795	6,795	6,795	6,795	6,795
R-squared				0.064		0.114

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

The reasons for the inefficiency of corporate investment that may result from incentivizing corporate executives in the form of equity are manifold. First, the equity incentive binds the corporate performance and the executives' personal income together, forming a direct and close interest chain, which makes the executives more active when facing investment opportunities and more aggressive when making investment decisions, and more inclined to invest in "short and quick" projects in order to make quicker results, which may result in short-sighted investment. Secondly, although it is well known that high risk and high return coexist, it is also common that "people die for money and birds die for food", and corporate executives are more likely to try to "take a chance" and make irrational investment decisions under the double temptation of huge profits and good reputation. Third, during the sample period of this paper, China's economic development was generally good, and the investment atmosphere in the industry was active. In such a positive investment environment, coupled with the stimulation of equity incentives, corporate executives' investment enthusiasm was high, and it was also very easy to lead to follow the trend of investment, resulting in non-efficient investment. Fourth, after receiving the equity incentive, some executives may tend to make steady profits rather than risky investments, resulting in inefficient corporate investment; in addition, there may be a small number of executives who use corporate investment as a pretext

to make personal gains, which leads to inefficient corporate investment. In summary, appropriate equity incentives can improve the situation of corporate under-investment, but it may also lead to over-investment and intensify the inefficiency of corporate investment.

4.3.   Robustness Check Results

On the one hand, the total corporate investment (invest1), the return on corporate investment (ROI1), and the dichotomous variable that generates the inefficiency of corporate investment based on the Richardson investment efficiency model (inveff2) are used as proxy variables for the efficiency of corporate investment for robustness testing, respectively. Among them, in the robustness test of the dichotomous variables for generating corporate investment inefficiency based on Richardson's investment efficiency model, if the residuals of the investment efficiency regression model are greater than 0 then inveff2 takes the value of 1, otherwise inveff2 takes the value of 0. The specific regression results are shown in **Table 3**. As can be seen in Table 3, the regression coefficients of executive equity incentives (exe) are significantly positive, both on total investment (invest1), return on investment (ROI1) and investment inefficiency dichotomous variable (ineff2). This in fact further illustrates that executive incentives in the form of equity incentives can make corporate investment tend to expand or even over-invest, while the investment shows a greater degree of inefficiency. The results of the robustness test show a good agreement with the sign and significance of the basic regression results, indicating that the findings of this study have good robustness.

Table 3. Robustness check result

	1	2	3	4	5	6
	OLS	FE	OLS	FE	OLS	Probit
Variables	invest1	invest1	ROI1	ROI1	inveff2	inveff2
exe	1.290e+08*	2.259e+08*	2.094e+06**	3.554e+06**	0.120***	0.336***
	(7.626e+07)	(1.337e+08)	(1.012e+06)	(1.679e+06)	(0.0156)	(0.0509)
Firm	YES	YES	YES	YES	YES	YES
Industry	NO	NO	NO	YES	YES	YES
Year	NO	NO	NO	YES	YES	YES
Constant	-3.036e+09***	-1.092e+09	-177,008	5.610e+06	0.536***	-0.306
	(8.410e+08)	(7.214e+08)	(9.002e+06)	(9.080e+06)	(0.195)	(0.444)
Observations	6,795	6,795	5,687	5,687	6,795	6,766
R-squared		0.004		0.004		

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. "Firm" denotes a set of individual firm characteristics, "Industry" denotes industry fixed effects, and "Year" denotes year fixed effects. To avoid redundancy and to save space, only the regression results for the core variables are reported here, which can be requested from the authors upon request. Same below.

On the other hand, considering that there are different types of equity incentives that may have a differential impact on the efficiency of corporate investment, this paper conducts robustness tests on the basic regressions by type of equity incentives. Based on the type of equity incentive shown in the annual report data, the equity incentive type variable (type) is generated and takes the value of 0 if there is no equity incentive, 1 if it is stock appreciation right, 2 if it is restricted stock, and 3 if it is stock option. the regression results with the type of equity incentive as the explanatory variable are shown in **Table 4**.

The explained variables in columns 1-6 of Table 4 are investment efficiency variables (inveff), which are regressed using OLS, RE and FE econometric models. While the explained variables

in columns 7-8 are dichotomous variables of investment inefficiency (inveff2), which are regressed using Probit and Logit models. It is easy to see from Table 4 that the coefficient signs of the explanatory variables equity incentive type variable (type) are all positive and all are significant at the 1% statistical level. This finding supports the conclusion of the theoretical analysis of this study and indicates the good robustness of the findings of this study.

Table 4. The impact of different equity incentives on corporate investment efficiency

	1	2	3	4	5	6	7	8
	OLS	RE	FE	OLS	RE	FE	Probit	Logit
Variables	inveff	inveff	inveff	inveff	inveff	inveff	inveff2	inveff2
type	0.00257***	0.00257***	0.00484***	0.00321***	0.00321***	0.00463***	0.132***	0.227***
	(0.000704)	(0.000633)	(0.000721)	(0.000612)	(0.000572)	(0.000716)	(0.0297)	(0.0528)
Firm	YES	YES	YES	YES	YES	YES	YES	YES
Industry	NO	NO	NO	YES	YES	YES	YES	YES
Year	NO	NO	NO	YES	YES	YES	YES	YES
Constant	0.0350***	0.0350***	0.0522***	0.0188**	0.0188**	0.0506***	-0.880*	-1.562*
	(0.00705)	(0.00593)	(0.00747)	(0.00900)	(0.00954)	(0.00745)	(0.454)	(0.805)
Observations	6,795	6,795	6,795	6,795	6,795	6,795	6,766	6,766
R-squared			0.052			0.105		

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Note: O=Stock Option=3, R=Restricted Stock=2, A=Appreciation Rights=1 (insufficient sample), none=0, as a comparison.

5. Further Analysis

In order to examine the relationship between executive equity incentives and corporate investment efficiency in a more comprehensive manner, this paper conducts further analysis based on the aforementioned analysis in terms of corporate equity attributes, power concentration, corporate political connections, and Anti-corruption actions, respectively.

5.1. Equity Properties

Corporate equity attributes may have different effects on corporate investment efficiency. This study divides the sample by the equity attribute of the firm (soe1), which is classified in the state-controlled group if it is state-owned (soe1=1) and in the non-state-controlled group otherwise (soe1=0), and the regression results are shown in **Table 5**. The explained variables in columns 1-4 are the efficiency of corporate investment inveff, and the explained variables in columns 5-8 are the dichotomous variables of corporate investment inefficiency inveff2, correspondingly columns 1-2 and 5-6 are the regression results for the non-state-controlled sample, while columns 3-4 and 7-8 are the regression results for the state-controlled sample. From Table 5, it can be seen that the coefficients of executive equity incentives (exe) in the regression results of the non-state-controlled sample are significantly positive, while the coefficients of executive equity incentives (exe) in the regression results of the state-controlled sample have positive and negative signs, and only one is significant, the difference is very obvious, which indicates that the impact of executive equity incentives on investment inefficiency of non-state-controlled firms is stronger than that of state-controlled firms.

The possible reason for the difference in the impact of executive equity incentives on the efficiency of corporate investment depending on the property rights of firms is that firms with different property rights face different financing constraints, while corporate investment is directly affected by the financial constraints, and the sources of corporate finance are not only internal capital accumulation and external fund raising. On the one hand, private enterprises, due to their high degree of market participation, are fully responsible for their own profits and

losses, and the effect of their internal capital accumulation is largely subject to whether or not their executives are diligent and conscientious in making business decisions to maximize economic benefits in accordance with the laws of the market. Unlike SOEs, which not only seek economic benefits, but also assume a certain degree of social responsibility, SOE executives pay much less attention to the effect of internal capital accumulation than private executives. Therefore, the internal capital accumulation effect of SOEs is inevitably weaker than that of private enterprises in terms of incentives for executives. On the other hand, Chinese SOEs also tend to suffer from soft budget constraints, and they can obtain external financial support more easily through government background and political connections, reducing their dependence on internal financial flows, whereas this is not the case for private companies. The more severe financing constraints faced by private firms compared to SOEs make them more motivated to seek signals to alleviate internal and external information asymmetries, and to alleviate external financing constraints through signaling, thereby enabling them to obtain more bank loans. Thus, whether in terms of internal capital accumulation or external capital raising, executive equity incentives in private firms have a greater impact on capital constraints than in SOEs, and thus on investment inefficiency.

Table 5. Equity attribution test results

	1	2	3	4	5	6	7	8
	Non-SOEs		SOEs		Non-SOEs		SOEs	
	RE	FE	RE	FE	Probit	Logit	Probit	Logit
Variables	inveff	inveff	inveff	inveff	inveff2	inveff2	inveff2	inveff2
exe	0.00915***	0.0127***	0.00358*	-0.00427	0.339***	0.595***	0.0775	0.111
	(0.00100)	(0.00131)	(0.00210)	(0.00474)	(0.0516)	(0.0920)	(0.110)	(0.205)
Firm	YES	YES	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.0293***	0.0709***	0.0307*	0.0518***	-0.472	-0.743	-0.580	-1.170
	(0.0105)	(0.00769)	(0.0159)	(0.0142)	(0.503)	(0.884)	(0.809)	(1.472)
Observations	6,027	6,027	2,111	2,111	5,953	5,953	2,005	2,005
R-squared		0.136		0.065				

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5.2. Power Concentration

What role does the concentration of power play in the relationship between equity incentives and corporate investment efficiency? This study measures the concentration of power in a firm by whether the chairman of the firm is also the general manager, and examines how the concentration of power in a firm affects the firm's investment. The regression results are presented in **Table 6**, where the explained variables in columns 1-4 are investment efficiency (overinvestment or underinvestment, inveff), and the explained variables in columns 5-8 are investment inefficiency dichotomous variables (inveff2). As can be seen in Table 6, the coefficient of the equity incentive variable (exe) is significantly positive in all samples with high power concentration, but the sign is positive in samples with low power concentration, but only the coefficients of columns 1-2 are significant, and the regression coefficients of the samples with low power concentration are smaller than the regression coefficients of the corresponding samples with high power concentration, which indicates that equity incentives have a positive effect on corporate investment inefficiency, and this effect is greater and more significant inside firms where the chairman and general manager are the same person.

The reason for this is that when the business and ownership of a firm are separated, the inconsistency of interest claims between the managers and owners of the firm leads to agency problems between the managers and owners of the firm. The emergence of agency problems between corporate managers and owners will inevitably lead to some distortions in corporate investment decisions, which in turn leads to an increased chance of inefficient corporate investment behavior. In this case, the separation of management and decision making can form a good mutual check and balance within the enterprise managers and increase their complicity cost to a certain extent, so that the self-interested enterprise managers may be more rational and scientific when making investment decisions. Therefore, the greater the separation of management and decision making, the greater the cost of complicity of corporate managers; conversely, the cost of complicity becomes smaller. When the cost of complicity is small, it is easier to make self-interested decisions and make inefficient investments under the effect of executive equity incentives.

Table 6. Power concentration test results

	1	2	3	4	5	6	7	8
	Low power concentration		*High power concentration*		*Low power concentration*		*High power concentration*	
	RE	FE	RE	FE	Probit	Logit	Probit	Logit
Variables	inveff	inveff	inveff	inveff	inveff2	inveff2	inveff2	inveff2
exe	0.00418***	0.00700***	0.0127***	0.0126***	0.0371	0.0393	0.517***	0.887***
	(0.00137)	(0.00174)	(0.00145)	(0.00187)	(0.0790)	(0.147)	(0.0653)	(0.115)
Firm	YES	YES	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.0265**	0.0598***	0.0255	0.0565***	-0.869*	-1.689*	-0.500	-0.831
	(0.0120)	(0.00786)	(0.0156)	(0.0123)	(0.512)	(0.896)	(0.699)	(1.248)
Observations	4,292	4,292	3,846	3,846	4,187	4,187	3,819	3,819
R-squared		0.074		0.211				

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

5.3. Political Connection

There are multiple effects of a firm's political background, or whether a firm has political capital, on a firm's investment decision. In this study, the regressions are conducted by dividing the sample by whether the firm has political affiliation, and whether the firm has political affiliation is based on whether any of the firm's executives is or has been a government official, a deputy to the National People's Congress, or other administrative positions. The regression results are shown in **Table 7**. Among them, the explained variables in columns 1-4 are investment efficiency variables (inveff), and the explained variables in columns 5-8 are investment inefficiency binary variables (inveff2). As can be seen from Table 7, the coefficient of the equity incentive variable (exe) is significantly positive in all results, but the regression coefficients of the sample of firms without political affiliation (columns 1-2, 5-6) are smaller than those of the corresponding sample of firms with political affiliation (columns 3-4, 7-8). This means that although there is a positive effect of conducting equity incentives on firms' investment inefficiency, the effect of being affected by equity incentives is more significant and stronger for politically connected firms compared to those without political connections.

This is because political affiliation is an important resource for business investment and an informal system for coping with imperfect market mechanisms. With the government controlling the main factors and resources needed for enterprise development, political affiliation has a certain degree of resource allocation function, which can help enterprises

obtain certain privileges granted by the government, such as breaking through industry barriers, obtaining government subsidies, reducing tax burden, and obtaining financing. Companies with political connections are more likely to have access to more and better investment opportunities and more internal and external resources, and are more likely to enjoy the resulting excess returns. By providing incentives to corporate executives with political affiliations, self-interested corporate executives, in order to maintain the political reputation and status of the corporation, will seek to achieve the government's political goals of increasing jobs and reducing the risk of social stability by planning projects to expand the size of employees and increase their salaries. Thus, corporate executives with political affiliations are more likely to make large-scale investments with the effect of equity incentives.

Table 7. Political connection test results

	1	2	3	4	5	6	7	8
	Non-political connection		*Political connection*		*Non-political connection*		*Political connection*	
	RE	FE	RE	FE	Probit	Logit	Probit	Logit
Variables	inveff	inveff	inveff	inveff	inveff2	inveff2	inveff2	inveff2
exe	0.00645***	0.00744***	0.0118***	0.0135***	0.237***	0.403***	0.477***	0.854***
	(0.00138)	(0.00231)	(0.00112)	(0.00149)	(0.0681)	(0.121)	(0.0596)	(0.109)
Firm	YES	YES	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.0180	0.0613***	0.0332***	0.0641***	-1.142	-1.975	-0.379	-0.776
	(0.0185)	(0.0146)	(0.0105)	(0.00812)	(0.960)	(1.732)	(0.472)	(0.841)
Observations	2,587	2,587	5,551	5,551	2,511	2,511	5,523	5,523
R-squared		0.111		0.131				

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5.4. Anti-corruption Policy

China's social characteristics and historical traditions make enterprises have inextricable ties with the government and officials in the process of production and operation, and some even form alliances of interest, so the investment activities of enterprises are more or less covered with a veil of political connections. Such a strong Anti-corruption campaign can effectively purify the social air, activate market players and create a good free competitive market environment, which may have positive effects on the investment activities of companies, such as reducing the degree and level of ineffective investment. For this reason, this study divides the sample by the implementation of the Anti-corruption policy (anticorr), so the implementation of the current Anti-corruption started at the end of 2012, and the conventional practice is to use 2013 as the cut-off, and so does this paper, and the detailed results are shown in **Table 8**.

Columns 1-4 in Table 8 test the moderating effect of Anti-corruption policy on the relationship between equity incentives and corporate investment efficiency for firms that had equity incentives during the sample period. Columns 1 and 2 show the results of the effect before Anti-corruption, and columns 3 and 4 show the results of the effect after Anti-corruption. Clearly, the coefficient of equity incentives (exe) before Anti-corruption is significantly positive, while the sign of the coefficient after Anti-corruption is negative and insignificant, which indicates that Anti-corruption policy affects the effect of equity incentives on the efficiency of corporate investment and weakens the utility of equity incentives. Columns 5-8 in Table 8 show the regression results for the full sample , with the binary variable of investment inefficiency (inveff2) as the explained variable, similarly, columns 5 and 6 show the regression results

before the Anti-corruption, the coefficient of equity incentive (exe) is significantly positive, while in columns 7 and 8 the regression results after the Anti-corruption, although one column has a significant coefficient, it is smaller than the corresponding regression before the Anti-corruption results, the coefficient of column 8 for equity incentive (exe) is 0.25 < the coefficient of column 6 for equity incentive (exe) is 0.443.

Table 8. Anti-corruption policy test results

	1	2	3	4	5	6	7	8
	Equity Incentives sample				Full sample			
	Before		*After*		*Before*		*After*	
	OLS	FE	OLS	RE	FE	Probit	FE	Probit
Variables	inveff	inveff	inveff	inveff	inveff	inveff2	inveff	inveff2
exe	0.00920***	0.0128***	-0.00540	-0.00540	0.0162***	0.443***	0.000570	0.250***
	(0.00114)	(0.00129)	(0.0141)	(0.0315)	(0.00231)	(0.0906)	(0.00147)	(0.0626)
Firm	YES	YES	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.0330***	0.0688***	-0.306	-0.553	0.0733***	-0.851	0.0603***	0.672
	(0.00885)	(0.00692)	(0.444)	(0.793)	(0.0118)	(0.730)	(0.00890)	(0.606)
Observations	6,795	6,795	1,343	1,343	3,265	3,209	3,530	3,444
R-squared		0.114			0.255		0.066	

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The institutional environment is an important external environment for business management, and can to a certain extent act as a substitute for executive incentives. Before the 18th National Anti-corruption Congress, corporate executives, especially those of state-owned enterprises, could obtain more extra income and industry reputation through the "corporate empire" they built, and their "eagerness for success" motivated them to pursue investment scale rather than investment efficiency, which led to "over-investment" in their enterprises. Of course, there are also some corporate executives who are content to enjoy the excess returns brought by their corporate status and industry reputation, and are not willing to take risks for investment, and the motive of "inaction" makes them reluctant to invest or even not to invest, resulting in the "under-investment" of their companies. After the 18th Communist Party Congress against corruption, the State-owned Assets Supervision and Administration Commission (SASAC) and other relevant departments have accordingly strengthened the management and incentives for corporate executives, for example, the SASAC issued the Measures for Business Performance Assessment for Heads of Central Enterprises in December 2016. These help corporate executives to correlate corporate value with their own interests in business management, which largely avoids the "short-sighted behavior" of corporate executives in the investment process and makes them pay attention to the efficiency of investment, thus the executive equity incentive mechanism can play its role better. Therefore, the reasons behind the more obvious difference of equity incentives on corporate investment efficiency before and after Anti-corruption may be, on the one hand, the Anti-corruption action cut off a lot of the original chain of interests of collusion between government and business, increasing the cost and risk of officials using their public power to seek private benefits, and in the process of interacting with enterprises, clean up their act, keep their distance, and reduce their intervention in corporate investment activities; on the other hand, the Anti-corruption action reduced opportunities and possibilities for enterprises to obtain investment opportunities and speculative behavior

through rent-seeking and bribery, making corporate investment activities truly rational and market-oriented, thus reducing investment non-efficiency.

6. Conclusions and Insights

How Chinese companies motivate their executives to make investment decisions, so that the interests of executives are aligned with those of shareholders and the efficiency of corporate resource allocation and investment is an important issue for companies to sustain their growth. Focusing on examining the economic effects of executive incentives from the perspective of corporate investment decisions, this paper examines the effects of executive equity incentives on corporate investment efficiency based on data from Chinese listed companies, and examines heterogeneity in terms of corporate internal characteristics and external environmental changes such as corporate equity attributes, corporate power concentration, corporate political affiliation, and access to government subsidies. The study concludes that there is a significant effect of executive equity incentives on the efficiency of corporate investment, which may exacerbate the inefficiency of corporate investment, and this effect still holds after changing the measures of key indicators. Further subsample regressions show that the effect of executive incentives on investment inefficiency is more significant for non-state owned firms, firms with higher power concentration, and firms with political affiliation, and that Anti-corruption policies since the 18th National Congress weaken the strength of the effect of executive equity incentives on corporate investment inefficiency.

The findings of this paper have the following implications: First, executive equity incentives do not necessarily improve corporate investment efficiency, but on the contrary, they may lead to investment inefficiency, so firms cannot blindly implement executive equity incentive policies. Secondly, the effect of executive equity incentive policies is not consistent among companies with different internal characteristics, so companies need to develop appropriate executive equity incentive policies with their corporate characteristics. Thirdly, the effect of the executive equity incentive policy is different in different periods because of the different external environment in which the enterprise is located. When the external environment can have a restraining effect on the executive's self-interest behavior, the executive incentive can function properly.

Acknowledgments

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