International Journal of Business and Management Review
Vol.5, No.4, pp.1-24, May 2017
Published by European Centre for Research Training and Development UK (www.eajournals.org)

MANAGERIAL POWER, EQUITY INCENTIVES AND R & D INVESTMENTS--AN EMPIRICAL RESEARCH ON CHINESE LISTED COMPANIES

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ABSTRACT: *Based on managerial power theory, with samples in 2002-2009 year, this study analyzes that executives use power to affect the relationship between equity incentives and R & D investments. This study finds that, compared with non-manager control companies, the power of executives in manager control companies is more prominent. In manager control companies, executives can use power to influence the relationship between equity incentives and R & D investments, and the implementation of equity incentives to executives reduces the R & D investment. The results show that the greater the power, the smaller the incentive role of equity incentives to R & D investments. It provides not only references for the companies to launch equity incentive plans, but also new clues and new ideas for in-deep studies on corporate governance and managerial power effects.*

KEYWORDS: Managerial power, Equity incentive, R & D investment, Manager control company.

INTRODUCTION

The influence of agency problems on the corporate decision-making behavior has always been an important research content in the field of the modern corporate finance. Jensen and Meckling (1976) first explores ways to solve the principal-agent problem from the perspective of equity incentives, and think that it will be conductive to reducing managers' opportunism behavior and decreasing agency conflicts if boards give managers sufficient equity incentives. Since December 31, 2005, Chinese Securities Regulatory Commission formally promulgated the "equity incentive management approach of listed companies", academics and practitioners' discussion on the influence of enterprises' extant equity incentives on investment behavior has been in full swing. Research and development (R & D) as an important strategic investment, and creating value for enterprises and improving business performance, is the driving force of the sustainable development of enterprises (Dosi, 1988), but, at the same time, its high risk, long cycle, slow responses and other characteristics make managers unwilling to make corresponding investments. So, the relationship between executive equity incentives and R & D investments provides a good opportunity for us to examine the effectiveness of the equity incentive system. Compared with western enterprises,

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

Chinese enterprises are in the period of the transition economy, whose problems of the administrative intervention and the insider control are very serious. According to managerial power theory, when the equity is more dispersed, managerial power is greater, it's more likely that management will control the equity incentive contract to obtain private benefits. When personal interests pursued by management and corporate goals are in conflict, there are often less R & D investments in enterprises, which damages the long-term value of enterprises. Until to now, however, there is no research on the relationship between equity incentives and corporate R & D investments from the perspective of managerial power, and no taking the impact of ownership nature into account in China, which makes relevant research conclusions may be wrong.

Executives' equity incentives have incentive effects on R & D investments, this study attempts to explore the impact of managerial power on this incentive. In accordance with the different degree of ownership concentration or dispersion, this study divides all samples into two groups which are the manager control type and the non-manager control type. The conclusion of this study will provide theoretical references for the deepening of enterprise independent innovation, the effective implementation of equity incentive programs, help the regulatory authorities to improve the supervision on listed companies, and provide new clues and evidence for further exploring on corporate governance and managerial power effects at the same time.

THEORETICAL UNDERPINNING

a) *Managerial Power Theory*

According to the traditional principal-agent theory, when managers' actions can be observed, giving managers a certain salary is the optimal compensation contract (Holmstrom, 1989). But, in reality, managers' behavior is unobservability or needing a high cost to observe, the principal usually takes the business performance as an indirect measure of managers' actions, and guides managers' behavior by the contract mechanism which links managers' compensation with the enterprise value, to achieve the enterprise goals maximizing shareholder value. Therefore, to a certain extent, it can verify the validity of managers' compensation contracts by examining the sensitivity between manager compensation and the business performance. Of course, it's based on optimal contract theory, namely, under the circumstances of given information asymmetry, shareholders can always design optimal incentive contracts from the perspective of maximizing their own interests, so as to promote managers to select appropriate actions to maximize shareholders' utility after signing the contract (Bebchuk, 2003). However, optimal contract theory has its range of application, the existence of large shareholders reduces the possibility of manager control (Shleifer, 1986), so the theory is more suitable to explain companies with quite concentrated ownership. However, under the circumstances of the dispersed equity, due to small

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

shareholders' free rider behavior, managers may obtain the working control (Berle, 1932). For example, some studies show that the board of directors is usually controlled by managers in modern companies with the dispersed ownership (Shivdasani, 1999). Moreover, the broker market, the market for corporate control, the product market and the capital market and other external mechanisms are not always effective. So, Bebchuk et al. (2002) put forward a new idea for managers' compensation contracts on the basis of summarizing previous studies, which is managerial power theory[1]. The basic idea of the theory is that: in the premise of insider control, managers often use their power to maximize their own interests in a variety of ways, incentive mechanisms designed to reduce agency costs have become a source of agency costs (Bebchuk, 2002). According to managerial power theory, the cause of irrelevance or low correlation between business performance and executive compensation is the design of compensation contracts deviating from the basic principle which is the maximization of shareholders equity[2] (Li et al., 2004). So, optimal contract theory is more suitable to explain the company with relatively concentrated ownership, and managerial power theory is more suitable to explain the company with dispersed ownership and insider control, in other words, how to decide compensations contract depends on the arrangement of the corporate right of control. Wang (2009) argues that managerial power theory explaining the equity incentive problem is from another perspective of agency problems, which is different from optimal contract theory, managerial power theory thinks the managerial equity incentive is not an effective way to solve agency problems, but a part of agency problems. The equity incentive is not an effective way to motivate managers, and it becomes one of the ways to rent-seeking for managers.

b) Institutional Background Analysis and Research Hypothesis

[1] Bebchuk et al. think that making compensation contracts best needs three kinds of restraint mechanisms: First, the board of directors and management can be fair bargaining; Second,it can be a strong constraint for boards and management if external governance mechanisms are relatively perfect; Third,shareholders have the ability to enforce management by law or other mechanisms to adopt the compensation contract which is in the interest of shareholders (Bebchuk, 2002). However, these constraints often can not effectively play a role in reality. Although, from the perspective of provisions of the company law, it's the board of directors who decides manager compensation contracts, but it's embarrassing that management can influence recruitment and selection of boards in reality, so, it's difficult to maintain sufficient independence to play a supervisory role for boards. And for management, if executives switch to another companies, executives' pay level in the original unit will be reference standards of new companies. From the perspective of M & A market, management will develop "a golden parachute" and other anti-takeover measures to reduce market binding of corporate control. In addition, because of the information asymmetry, shareholders are unable to grasp rights of management and decision-making, and it is difficult to obtain evidence of management infringement, so, it's difficult for shareholders to restrict management. The above reasons will cause that the management compensation plan adopted by boards often deviates from the optimal contract (Li et al., 2004).

[2] Bebchuk and Fried(2003) think that managerial power doesn't treat overthrowing optimal contract theory as the goal, but the supplement of optimal contract theory, managers can't "infringe" interests of shareholders without limitation, otherwise, managers will be replaced. In the scope of "don't irritate shareholders", managers can achieve insider control, affect compensation contracts to maximize their own interests.

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

The resource based view thinks that, it's very important to possess resources with competitive advantages for development of enterprises , and the technological innovation capacity is the key resource, whose characteristics are high-value, inimitable, irreplaceable and so on, and the capacity can create huge profits for enterprises. And continuous R & D investments are the important way to obtain the technological innovation capability for enterprises. Levin et al. (1987) find the incentive mechanism is an important factor to decide R & D activities of enterprises.

The essence of equity incentives is combining the interests of shareholders, interests of companies with personal interests of managers by giving managers a certain residual claim to make mangers attach importance to R & D activities, so as to improve the core competitiveness of enterprises. Jensen and Meckling (1976) argue that, it will reduce managers' opportunistic behavior by giving them sufficient equity incentives, and they have the motivation to work hard for maximizing the long-term value of enterprises, and raise support for R & D investments. Nakahara's (1985) research supports this conclusion, and finds the support of management is an important factor for promoting R & D activities of enterprises. Liu and Liu(2007) also find that the equity incentive is conducive to increasing the intensity of R & D investments in enterprises. So, this study puts forward the following research hypothesis.

H. 1: When other conditions are unchanged, the relationship is between equity incentives and R & D investments is positive.

Compared with western enterprises, there are more serious agency problems, and more complicated contract environments, and equity incentives effected by institutional environments for Chinese enterprises in the economic transition, for example, the administrative intervention, phenomena of insider control are serious, which often makes managers get the working control of enterprises (Berle, 1932).

Therefore, positive effects of equity incentives on R & D activities are effected by the power of managers. Under the circumstances of the dispersed ownership, there are many independent shareholders, shareholders' supervision on managers of enterprises has certain characteristics of "public products", namely, each shareholder expects other shareholders to perform the effective supervision on managers through collection of information, and shareholders will benefit by "following others", this is typical behavior of the "free rider". But, its result is likely to be that everyone does not act, especially, when the contract is incomplete and managers have more information than shareholders, the manager will eventually get the residual control. Grossman and Hart (1986) call the profit grasped by managers through their effective control as the private benefits of control, and the profit is at the cost of the interests of shareholders. In such

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

a case, without effective incentives and supervision mechanisms, there will form the "insider control" problem in the circumstances of “dispersed ownership”, which is an agency problem due to excessive dispersion of ownership and working control grasped by managers. Under these circumstances, managers can use their power to reduce the hard-working level, conduct excessive investments, increase on-the-job consumption and harm interests of shareholders by other ways.

Xia and Zhang(2008) think that the effectiveness of senior managers’ compensation contracts depends on who possess the control power of enterprises. When the control power of enterprises is in the hands of shareholders, shareholders will design compensation contracts which maximizes their own interests; But when managers control enterprises, compensation contracts will make interests of managers as the basic principle. So, studies on the impact of Chinese equity incentives on R & D investments must examine allocation of the control power of the listed companies in China, so as to solve design problems of equity incentives, and apply medicine according to indications. The core of the reform of property rights is decentralization of the use right of enterprise assets and redistribution of the corporate residual claim in China from the1980s to 1990s. Although the effect of the reform is obvious, corporate residual rights of control are still not delegated and are always in the hands of the government, especially the local government. Studies show that local governments have launched fiercely economic competitions after Chinese fiscal decentralization (Gao et al., 1998). Because the listed company is the place where social resources are allocated, it undoubtedly becomes an important mean to gain competitive advantages for the local government by controlling more listed companies. It’s necessary to tighten the screws of enterprises in order to merge and reorganize enterprises according to their own intentions, and make "shell" resources of enterprises remain in the local. And, “one dominating stock” of the equity structure and the extant personnel management system make large shareholders (especially the local government) have the ability to control listed companies. Therefore, theoretically speaking, large shareholders of listed companies, especially, the local government can become the main designers of senior managers’ the compensation contract. Relevant survey reports also fully illustrate this point. According to the survey for 3466 business operators from Chinese Entrepreneurs Survey System in 2000, the proportion of enterprises whose the superior department is the subject of the performance appraisal department is up to 87.5% and 79.1% for state-owned enterprises and collective enterprises respectively; Even for companies limited by shares, because most of them are state-controlled enterprises, the proportion of enterprises whose the superior department is the performance appraisal department is Number 1, which is 41.2% and 46.1% respectively.

It looks very clear that the control power in the hands of the government, but the country, as a shareholder, executes power only by government agencies or state-owned asset management companies, and these officials and managers have the control of enterprises in large part, but they don’t take risks, under these circumstances, the

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

asymmetry of power and responsibility causes that people without responsibilities, have the voting rights, and people without the voting rights, have responsibilities, this is what is commonly known as "cheap voting rights" (Zhang and Ma, 1999). The consequence of "cheap voting rights" is that some people who do not have the ability to operate but prefer to "control" (because the control can bring personal benefits) can obtain management positions by bribing people who have the right. As long as managers are not excessively greedy, and keep good relationship with superiors, managers will become owners of the corporate control power in fact. A large number of studies show that there are a serious insider control problems in state-owned enterprises (Qian et al., 1995; Zhang, 1995;Yang and Zhou, 1998; Fei, 1996). It shows that final control or residual claim of listed companies should be owned by the government theoretically, but because the subject of state-owned property rights is absent, managers may become virtual controllers of enterprises.

A large amount of empirical evidence show that the greater power of management, the more likely managers will use the power of the hands to get the excessive rent by the way of self compensation. Li and Lu (2007) argue that managerial power is a kind of control power for compensation contracts or the process of compensation formulation actually. The enterprise is a group of the connection of contracts, and the compensation contract is one of important contracts. Because the equity incentive is a kind of compensation, and according to the support of extant literature and above analyses of the institutional background, the following reasonable inference can be drawn, namely, the equity is more dispersed, managerial power is greater, when goals of management and enterprises are not consistent, management will achieve private benefits of control by controlling the equity incentive contract, so management will reduce R & D investment activities with long-term and high-risk characteristics, and the behavior damages the long-term value of enterprises. So, this study puts forward the following hypothesis.

H. 2: When other conditions are unchanged, the greater executives' powers , the smaller incentive effects of equity incentives on R & D investments.

METHODOLOGY

a) Data Sources and Sample Selection

How to divide companies with ownership dispersion and insider control is the key problem in this study. Complete monopoly market, oligopoly market, monopolistic competition market and perfectly competitive market are four types of market structures in industrial organization. The equity structure of monopolistic competition type refers that the largest shareholder's shareholding ratio has certain advantages, but advantages

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

are not very prominent. The equity structure of perfectly competitive type refers that the shareholder ownership is quite dispersed, and it is difficult for any shareholder to have a substantial impact on corporate control. This type of ownership structure is also called the dispersed ownership structure. This study thinks that ownership structures of the monopolistic competition type and the perfect competitively type are characterized by the relatively dispersed ownership, at this time, corporate working control is often controlled by managers, so, the company which has above characteristics is classified as the manager control company. The manager control company accords with characteristics of the equity dispersion and the insider control. And corporate ownership structures of complete monopoly type or oligopoly type have characteristics which are highly concentrated or relatively concentrated, the company which has above characteristics is classified as the non-manager control company. So, this study learns from the practice of Palmer (1973) , Thonet and Poensgen (1979), Grosfeld and Hashi (2003), Xu Liping et al. (2006) and Li Yuan (2006), to classify listed companies in Shanghai and Shenzhen from 2002 to 2009 into two categories, the criteria of classification are as follows: First, equity structure of the company whose the largest shareholder's shareholding ratio is greater than 10% and less than or equal to 30%, and the sum of shareholding ratio from the second to the fifth is less than the first major shareholder's shareholding ratio is the monopolistic competition type, and equity structure of the company whose the first major shareholder's shareholding ratio is less than or equal to 10% is defined as the perfectly competitive type, the two types are the manager control type; Second, the rest of the sample is the non-manager control type.

In order to understand effects of equity incentives on R & D investments better, the sample interval of independent variable is from 2001 to 2008, and the sample interval of the dependent variable is from 2002 to 2009. Relevant equity incentive data and financial data of listed companies are from the WIND database, and the rest of data are from the CSMAR database. R & D investment data are collected manually from 2002 to 2006, R & D investment data are from the CSMAR database from 2007 to 2009. There are 1210 samples totally, where company samples of the manager control type are 245, after removing samples which are the absence of power data, there are 230 samples eventually; company samples of the non-manager control type are 965.

b) Variable Definitions

At present, there is the main use of 3 indicators to measure managerial power in foreign, which are the executive stock ownership, the general manager's power to appoint an external person to serve as a director and the number of employees supervised and managed by managers (Tor, 2005). Compared with the general manager's power to appoint an external person as director, which is a too qualitative approach, the two methods of the executive stock ownership and the number of employees supervised and managed by managers are easier to operate. However, Chinese executives' stock holding quantities are limited, there are not detailed and public data about the total

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

number of employees in listed companies. So, whether shareholding can play a role, to what degree the voice of the general manager on the number of employees, are not clear. Lv and Zhao (2008) use duality, proportion of executive director[3] and the general manager's tenure to measure managerial power. Quan (2010) uses 5 variables to measure managerial power structures: the corporate CEO duality, the CEO tenure, the size of the board of directors, the proportion of internal directors in the board of directors and the depth of the control chain of pyramid state owned enterprises, and synthesizing comprehensive indicators of managerial power in accordance with the principal component analysis method. Lv and Zhao (2008) think that managerial power is born in enterprises, so it should be measured by the most significantly ultimate power. If the power is owned by executives, executives will control more relevant resources of enterprises correspondingly, and have the ability to conduct a lot of acts. The study of Tang et al. (2011) shows the virtuous circle relationship among equity incentives, R & D investments and enterprise value, should be that equity incentives are implemented for executives, executives improve business performance and enterprise value by increasing R & D investments, so as to achieve vesting conditions of equity incentives, increase executives' personal income, and reduce agency costs between management and shareholders. Once business performance is improved, shareholders will be more likely to tend to implement equity incentives for executives, and executives increase R & D investments again, and improve the performance. But once executives' power is too large, it will change the virtuous cycle process into the vicious circle. The reasons are as follows: Under these circumstances of combining the posts of chairperson and CEO, the big proportion of executive directors in the board of directors, the general manager's long tenure and so on, executives can not only use power of hands to have an impact on formulation process of equity incentive contracts, make equity incentive conditions more relaxed and easy to realize, but also operate performance, achieve vesting conditions in the established premise of equity incentive contracts. The two situations can't achieve the purpose of promoting R & D investments and improving enterprise value. These three variables which are the combining of the posts chairperson and CEO, the big proportion of executive director in the board of directors, the general manager's long tenure can be used as a proxy to managerial power. Variable description is in Table 1.

[3] The executive director is defined as the member of the board of directors and he or she holds executive positions in listed companies.

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

Tab 1 The definition of variables

Variable types	Variable names	Variable symbols	Operational definition of variables
Dependent variables	Intensity of R & D investments	RDA	R & D expenditures of enterprises in this year/ total assets at the beginning of the year
		RDS	R & D expenditures of enterprises in this year/ main business income
Independent variables	Equity incentives	ST	The proportion of equity and options to total executive compensation, which is learning from the practice of Bergstresser and Philippon(2006)
		OS	Corporate executives' shareholding ratio in the year
	Executives power	Tenure	The general manager's tenure since he/she took office
		Ed	The proportion of members who hold executive positions in the board of directors in listed companies
		Dual	Whether the chairperson and the general manager is the same person in the year: 1=part time; 0=separation
Control variables	The nature of the company	Mc	The dummy variable, when the company is the manager control type, Mc is 1,and when the company is the non-manager control type, Mc is 0
	Corporate cash flow	Ncf	Net cash flow from operating activities / Total assets at the beginning of the year
	Board size	Dirsize	The total number of directors

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

Corporate liabilities	Lev	Total Debt / Total Assets
Enterprise size	Size	The natural logarithm of the book value of total assets at the beginning of the year
Industry	Industry	According to the "The Guidelines of Listed Companies Industry Classification", listed companies will be divided into 12 categories (excluding financial industry), treating comprehensive listed companies as reference system, and setting 11 dummy variables
Year	Year	Treating 2002 as the reference system, setting 7 dummy variables which are from 2003 to 2009 in the whole sample

c) Model Design

In this study, five regression models are established to test the proposed hypotheses, the following five models are presented separately. The model (1) examines the impact of equity incentives on R & D investments with full sample and sub sample.

$$RDA_{t+1}(RDS_{t+1}) = \alpha_0 + \alpha_1 ST_t(OS_t) + \alpha_2 Lev_t + \alpha_3 Ncf_t + \alpha_4 Size_t + \sum_{i=1}^{m} \alpha_{4+i} Industry + \sum_{i=1}^{n} \alpha_{4+m+i} Year + \varepsilon \quad (1)$$

The model (2) is based on the sub-sample analysis of managerial power, analyzing the influence of equity incentives on R & D investments in manager control and non-manager control companies.

$$RDA_{t+1}(RDS_{t+1}) = \alpha_0 + \alpha_1 ST_t(OS_t) + \alpha_2 Mc_t + \alpha_3 ST_t(OS_t) \times Mc_t + \alpha_4 Lev_t + \alpha_5 Ncf_t + \alpha_6 Size_t + \sum_{i=1}^{m} \alpha_{6+i} Industry + \sum_{i=1}^{n} \alpha_{6+m+i} Year + \varepsilon \quad (2)$$

The model (3) examines the influence of the general manager's tenure which is one of proxies of managerial power on the relationship between equity incentives and R & D investments in manager control companies.

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

$$RDA_{t+1}(RDS_{t+1}) = \alpha_0 + \alpha_1 ST_t(OS_t) + \alpha_2 Tenure_t + \alpha_3 ST_t(OS_t) \times Tenure_t + \alpha_4 Dirsize + \alpha_5 Lev_t + \alpha_6 Size_t + \alpha_7 Ncf_t + \sum_{i=1}^{m} \alpha_{7+i} Year + \sum_{i=1}^{n} \alpha_{7+m+i} Industry + \varepsilon \quad (3)$$

The model (4) examines the influence of the proportion of executive directors which is one of proxies of managerial power in manager control companies on the relationship between equity incentives and R & D investments.

$$RDA_{t+1}(RDS_{t+1}) = \alpha_0 + \alpha_1 ST_t(OS_t) + \alpha_2 ED_t + \alpha_3 ST_t(OS_t) \times ED_t + \alpha_4 Dirisize + \alpha_5 Lev_t + \alpha_6 Size_t + \alpha_7 Ncf_t + \sum_{i=1}^{m} \alpha_{7+i} Year + \sum_{i=1}^{n} \alpha_{7+m+i} Industry + \varepsilon \quad (4)$$

The model (5) examines the effects of the duality which is one of proxies of managerial power on the relationship between equity incentives and R & D investments in manager control companies.

$$RDA_{t+1}(RDS_{t+1}) = \alpha_0 + \alpha_1 ST_t(OS_t) + \alpha_2 Dual_t + \alpha_3 ST_t(OS_t) \times Dual_t + \alpha_4 Dirsize + \alpha_5 Lev_t + \alpha_6 Size_t + \alpha_7 Ncf_t + \sum_{i=1}^{m} \alpha_{7+i} Year + \sum_{i=1}^{n} \alpha_{7+m+i} Industry + \varepsilon \quad (5)$$

RESULTS

Variable	Mean	Median	S. D.	Minimum	Maximum	Observations
RDS	0．006 9	0．002 9	0．013 9	3．67e-06	0．170 0	1 210
RDA	0．011 7	0．004 5	0．025 4	3．42e-06	0．297 5	1 210
ST	0．058 4	0．000 2	0．185 4	0．000 0	1．000 0	1 206
OS	0．025 9	0．000 0	0．101 8	0．000 0	0．925 8	1 209
Tenure	3．543 4	3．000 0	2．390 3	1．000 0	13．000 0	1 209
Ed	2．155 5	2．000 0	1．603 7	0．000 0	7．000 0	1 209
Dual	0．128 7	0．000 0	0．335 0	0．000 0	1．000 0	1 150
Mc	0．202 5	0．000 0	0．402 0	0．000 0	1．000 0	1 210
Dirsize	9．648 2	9．000 0	2．180 6	3．000 0	19．000 0	1 140
Ncf	0．050 9	0．046 5	0．074 9	-0．335 0	0．447 6	1 156
Lev	0．481 4	0．478 9	0．212 7	0．024 7	3．094 2	1 210
Size	21．348 1	21．227 3	1．024 1	18．650 8	26．978 2	1 156

Tab 2 Descriptive statistics of main variables

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

Table 3 is the correlation analysis table of main variables. As can be seen from Table 3, except for Ed representing executive power, there is no significant correlation between other power variables and equity incentives or R & D investments. As to whether power will affect equity incentives and R&D investments, it needs the further testing.

	1	2	3	4	5	6	7	8	9	10	11
1 RDA	1.000										
2 RDS	0.924***	1.000									
	(0.000)										
3 ST	0.058	0.065	1.000								
	(0.386)	(0.327)									
4 OS	-0.053	-0.032	-0.019	1.000							
	(0.075)	(0.279)	(0.507)								
5 Mc	-0.207***	-0.246***	-0.015	-0.005	1.000						
	(0.000)	(0.000)	(0.602)	(0.862)							
6 Tenure	-0.088	-0.084	0.081	0.029	0.001	1.000					
	(0.189)	(0.207)	(0.224)	(0.326)	(0.965)						
7 Ed	-0.022	-0.039	0.164**	0.071**	0.053	0.444***	1.000				
	(0.737)	(0.555)	(0.013)	(0.016)	(0.068)	(0.000)					
8 Dual	0.022	-0.006	-0.027	-0.029	0.015	0.105	0.072	1.000			
	(0.737)	(0.925)	(0.684)	(0.320)	(0.598)	(0.116)	(0.283)				
9 Dirsize	-0.005	0.001	-0.019	-0.002	0.021	-0.034	-0.000	0.061*	1.000		
	(0.828)	(0.956)	(0.506)	(0.940)	(0.463)	(0.2241)	(0.988)	(0.038)			
10 Ncf	0.006	0.014	0.007	0.013	0.084***	-0.003	0.002	-0.072**	-0.013	1.000	
	(0.828)	(0.620)	(0.802)	(0.649)	(0.004)	(0.901)	(0.933)	(0.015)	(0.647)		
11 Lev	-0.2505***	-0.247***	0.009	0.027	-0.076**	-0.004	0.009	0.046	0.001	-0.002	1.000

Notes: Numbers in parentheses are t-statistics; *** significant at 0.01; ** significant at 0.5; * significant at 0.10(double tailed test); Similarly

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

	(0.000)	(0.000)	(0.742)	(0.355)	(0.010)	(0.883)	(0.760)	(0.120)	(0.973)	(0.940)	
12 Size	0.031	0.030	-0.005	0.021	-0.013	0.080**	0.055	0.057	0.221***	0.047	0.016
	(0.290)	(0.306)	(0.853)	(0.461)	(0.649)	(0.006)	(0.062)	(0.054)	(0.000)	(0.108)	(0.580)

hereinafter

Tab 3 The correlation table of all variables

As shown in Table 4, in the whole sample, the relationship between equity incentives and R & D investments is positive in the 10%, 5%, 10% and 10% significant levels from the model RDA (1) to model RDS (4), respectively. H1 is supported.

Variables	RDA(1)	RDS(2)	RDA(3)	RDS(4)
Constant	- 0.005(- 0.58)	- 0.018(- 0.92)	- 0.006(- 0.62)	- 0.019(- 0.96)
ST	0.002*(1.77)	0.001**(1.96)		
OS			0.003*(1.78)	0.007*(1.87)
Lev	- 0.012**(- 2.45)	- 0.009**(- 2.19)	- 0.011**(- 2.38)	- 0.023**(- 2.15)
Ncf	0.001(0.17)	0.004(0.53)	0.001(0.16)	0.004(0.57)
Size	0.002(0.67)	0.001(0.31)	0.001(0.65)	0.002(0.28)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Adj.R^2	2.13%	2.75%	2.22%	2.87%
F-statistics	1.77**	1.49*	1.82**	1.58*
Observations	1152	1152	1155	1155

Tab 4 Research on the relationship between equity incentives and R & D investments: Full samples

For distinguishing the "manager control company" from "non-manager control company" firstly, and we establish dummy variables and construct interaction items to test the power effect, results can be seen in Table 5, and it shows that, compared with non-manager control companies, the implementation of equity incentives in manager control companies will significantly reduce the intensity of R & D investments. The results of the rest models are similar.

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variables	Column A: Adding MC			
	RDA(1)	RDS(2)	RDA(3)	RDS(4)
Constant	- 0.002 (- 0.018)	- 0.011 (- 0.59)	- 0.002 (- 0.21)	- 0.012 (- 0.62)
ST	0.003* (1.79)	0.007** (2.02)		
OS			0.003* (1.81)	0.006* (1.94)
MC	- 0.002*** (- 3.78)	- 0.001*** (- 3.42)	- 0.001*** (- 3.75)	- 0.001*** (- 3.39)
Lev	- 0.012*** (- 2.84)	- 0.023** (- 2.04)	- 0.011*** (- 2.78)	- 0.022* (- 1.94)
Ncf	0.001 (0.23)	0.006 (0.60)	0.001 (0.23)	0.005 (0.60)
Size	0.001 (0.68)	0.001 (0.31)	0.001 (0.66)	0.001 (0.28)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Adj.R	5.12%	6.12%	5.13%	6.25%
F-statistics	2.07***	1.56*	2.09***	1.62**
Number	1152	1152	1155	1155
Variables	Column B: Comparison between manager control type and non-manager control type			
	RDA(1)	RDS(2)	RDA(3)	RDS(4)
Constant	- 0.001 (- 0.08)	- 0.010 (- 0.52)	- 0.001(- 0.11)	- 0.010 (- 0.55)
ST	0.009*** (3.48)	0.010*** (3.08)		
OS			0.003*** (3.27)	0.006***((3.09)
MC	- 0.002*** (- 4.21)			
ST × MC	- 0.008*** (- 3.38)			
OS × MC				
Lev	- 0.012*** (- 3.04)			
Ncf	0.002 (0.43)			
Size	0.001 (0.41)			
Year	Yes	Yes	Yes	Yes

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Industry	Yes	Yes	Yes	Yes
Adj. R^2	5.77%	6.86%	5.79%	6.90%
F-statistics	2.14***	1.80**	2.17***	1.89***
Number	1152	1152	1155	1155

Notes: adding dummy variables and controlling regression results of linear terms and control variables

Tab 5 Equity incentives and R & D investments: Sample analyses of managerial power

Considering the potential multicollinearity of the cross terms, we examine the VIF values of the variables explained in column B of Table 5, respectively, the results are shown in Table 6.

variables	RDA(1)	RDS(2)	RDA(3)	RDS(4)
ST	4.97	4.97		
OS			4.97	4.97
MC	1.32	1.32	1.32	1.32
ST × MC	4.40	4.40		
OS × MC			4.39	4.39
Mean	1.96	1.96	1.96	1.96

Tab 6 The VIF values of explanatory variables in Tab 5

Next, we have done group tests, samples are divided into manager control and non-manager control type. As shown in Table 7, in the manager control company of column A, there is a negative correlation between equity incentives and R & D investments in the significant level of 5%, 1%, 5% and 10% in the model RDA (1) - RDS (4) respectively.

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Variables	Column A: manager control type				Column B : Non-manager control type			
	RDA(1)	RDS(2)	RDA(3)	RDS(4)	RDA(1)	RDS(2)	RDA(3)	RDS(4)
Constant	0.002	- 0.011	0.006	0.006	- 0.005	- 0.017	- 0.005	- 0.017
	(0.13)	(- 0.40)	(0.33)	(0.20)	(- 0.57)	(- 0.80)	(- 0.45)	(- 0.80)
ST	- 0.048***	- 0.106***			0.003***	0.002***		
	(- 2.45)	(- 3.21)			(2.38)	(2.22)		
OS			- 0.025**	- 0.051*			0.008**	0.010**
			(- 2.03)	(- 1.91)			(2.17)	(2.21)
Lev	- 0.012***	- 0.022***	- 0.012***	- 0.021***	- 0.010***	- 0.021***	- 0.010***	- 0.020***
	(- 3.06)	(- 3.31)	(- 2.93)	(- 3.15)	(- 3.36)	(- 2.92)	(- 3.33)	(- 2.89)
Ncf	0.003	- 0.006	0.003	- 0.007	0.002	0.009	0.002	0.008
	(0.35)	(- 0.37)	(0.29)	(- 0.44)	(0.41)	(1.00)	(0.40)	(0.98)
Size	0.000	0.001	0.000	0.001	0.001	0.002	0.001	0.002
	(0.21)	(0.76)	(0.96)	(0.43)	(0.82)	(0.97)	(0.69)	(0.63)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	6.13%	7.79%	4.50%	4.92%	5.25%	6.41%	5.28%	6.45%
F-statistics	2.02**	2.32***	1.74**	1.82**	1.71**	1.43*	1.72**	1.47*
Number	219	219	222	222	920	920	920	920

Tab 7 Equity incentives and R & D investments: Tests on two groups

This study further examines how executives use power to influence the relationship between equity incentives and R & D investments in manager control companies. We use the model (3), model (4) and model (5) to examine the influence of the three variables of managerial power on equity incentives and R & D investments, respectively. The results are shown in column A of Table 8, and H2 is supported.

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Variables	Column A: Equity sensitive ST (Observations=230)					
	RDA(1)	RDA(2)	RDA(3)	RDS(4)	RDA(5)	RDS(6)
Constant	0.019 (0.68)	0.018 (0.42)	0.015 (0.52)	0.009 (0.20)	0.010 (0.35)	- 0.001 (- 0.02)
ST	0.004*	0.010*	0.019*	0.030*	0.030	0.010
	(1.79)	(1.77)	(1.70)	(1.70)	(0.62)	(0.13)
Tenure	- 0.001*	- 0.002*				
	(- 1.91)	(- 1.95)				
ST × Tenure	- 0.001*	- 0.003*				
	(- 1.80)	(- 1.66)				
Ed			- 0.001*	- 0.001*		
			(- 1.73)	(- 1.71)		
ST × Ed			- 0.008*	- 0.013		
			(- 1.87)	(- 1.83)		
Dual					- 0.062 (- 0.61)	- 0.004 (- 0.74)
ST × Dual					- 0.016 (- 0.64)	- 0.006 (- 0.15)
Dirsize	- 0.001 (- 0.92)	- 0.001(- 0.87)	- 0.001 (- 0.78)	- 0.001 (- 0.71)	- 0.001 (- 0.89)	- 0.001 (- 0.82)
Lev	- 0.018***	- 0.031***	- 0.021***	- 0.035***	- 0.019***	- 0.034***
	(- 2.67)	(- 2.99)	(- 2.85)	(- 3.06)	(- 2.89)	(- 3.23)
Size	0.001 (0.46)	0.02 (0.73)	0.000 (0.25)	0.001 (0.57)	0.001 (0.45)	0.002 (0.81)
Ncf	- 0.008 (- 0.51)	- 0.014 (- 0.58)	- 0.012 (- 0.76)	- 0.021 (- 0.83)	- 0.008 (- 0.54)	- 0.013 (- 0.57)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	3.25%	3.98%	3.30%	3.73%	2.24%	3.10%
F-statistics	1.59*	1.80*	1.63*	1.70*	1.35*	1.49
Variable	Column B : Equity sensitive OS (Observations=230)					
	RDA(1)	RDS(2)	RDA(3)	RDS(4)	RDA(5)	RDS(6)

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Constant	- 0.009(- 0.31)	- 0.012 (- 0.27)	0.001 (0.05)	0.002 (0.03)	- 0.003 (- 0.01)	- 0.007 (- 0.15)
OS	0.001*	0.002*	0.015*	0.026*	0.004	0.008*
	(1.67)	(1.81)	(1.66)	(1.73)	(0.44)	(0.53)
Tenure	- 0.001**	- 0.002**				
	(- 2.11)	(- 2.17)				
OS × Tenure	- 0.001**	- 0.002**				
	(- 2.11)	(- 2.17)				
OS × Ed			- 0.001*	- 0.001*		
			(- 1.72)	(- 1.68)		
0S × Ed			- 0.006*	- 0.012*		
			(- 1.76)	(- 1.76)		
Dual					- 0.002 (- 0.64)	- 0.004 (- 0.81)
OS × Dual					- 0.034 (- 0.58)	- 0.015 (- 0.16)
Dirsize	- 0.001 (- 0.96)	- 0.001 (- 0.88)	- 0.001 (- 1.17)	- 0.001 (- 1.03)	- 0.001 (- 0.93)	- 0.001 (- 0.81)
Lev	- 0.018***	- 0.031***	- 0.019***	- 0.033***	- 0.019***	- 0.034***
	(- 2.65)	(- 2.95)	(- 2.86)	(- 3.12)	(- 2.90)	(- 3.23)
Size	0.001 (0.94)	0.002 (1.08)	0.001 (0.59)	0.002 (0.77)	0.001 (0.71)	0.002 (0.910
Ncf	- 0.003 (- 0.21)	0.002 (1.08)	0.001 (0.59)	0.002 (0.71)	0.001 (0.71)	0.002 (0.91)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	3.17%	4.93%	3.05%	3.66%	1.72%	2.72%
F-statistics	1.56*	1.85*	1.60*	1.65*	1.25	1.41

Tab 8 Regression analyses of managerial power on equity incentives and R & D investments

DISCUSSION

As shown in Table 4, in the whole sample, the relationship between equity incentives and R & D investments is positive in the 10%, 5%, 10% and 10% significant levels

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from the model RDA (1) to model RDS (4), respectively. It shows that equity incentives do have a significantly positive impact on R & D investments, H1 is supported. In addition, debts and R & D investments are negative correlation in the 5% significant level, indicating that debts have a certain inhibitory effects on R & D investments.

In order to examine the impact of managerial power on the relationship between equity incentives and R & D investments, this study conducts two levels of empirical analyses. First, we examine whether managerial power effect is more prominent in manager control companies than in non-manager companies. Therefore, we make the distinction between manager control companies and non-manager control companies (dummy variable), and construct interactive items to examine the power effect; Then, we make the sub-sample test for manager control companies and non-manager control companies so as to define the difference. Second, on the basis of the first level test, we make the in-depth study to examine whether the greater managerial power, the smaller the incentive effects of the equity incentive on the R & D investments in the manager control company.

Based on above analyses, distinguishing the "manager control company" from "non-manager control company" firstly, and establishing dummy variables and constructing interaction items to test the power effect. Of course, it is necessary to examine regression results of linear terms and control variables before adding the interactive items, the results are shown in column A of Table 5, there is a significantly negative correlation between the dummy variable representing the nature of the company and the R & D investment in four models, which shows that compared with non-manager control companies, R & D investments in manager control companies are significantly lower. Adding the cross terms and examining further, the results are shown in column B of Table 5, the correlation between equity incentives and R & D investments in 1% level is significantly positive in model RDA(1), the relationship between the cross terms of the equity incentive and the nature of the company and R & D investments are significantly negative in 1% level. The results of above three factors show that, compared with non-manager control companies, the implementation of equity incentives in manager control companies will significantly reduce the intensity of R & D investments. The results of the rest models are similar.

Considering the potential multicollinearity of the cross terms, we examine the VIF values of the variables explained in column B of Table 5, respectively, the results are shown in Table 6.As can be seen from Table 6, whether a single variable or an overall result, their VIF values are less than 10, the results indicate that there is no significant multicollinearity among explanatory variables in column B of Table 5.

Next, we have done group tests, samples are divided into manager control and non-manager control type. As shown in Table 7, in the manager control company of column A, there is a negative correlation between equity incentives and R & D investments in the significant level of 5%, 1%, 5% and 10% in the model RDA (1) - RDS (4)

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respectively. This shows that, in the manager control company, the equity is more decentralized, and the greater the power of management, managers are more likely to control the equity incentive contract, in order to obtain control of the private benefits. When the opportunistic behavior that management pursues private benefits is inconsistent with corporate goals, it often reduces R & D investments, damages the long-term value of enterprises; In the non-manager control company of column B, equity incentives still have some incentive effects on R & D investments. Based on the above results, it shows that managerial power effect is more prominent in the manager control company than in the non-manager control company.

This study further examines how executives use power to influence the relationship between equity incentives and R & D investments in manager control companies. We use the model (3), model (4) and model (5) to examine the influence of the three variables of managerial power on equity incentives and R & D investments, respectively. The results are shown in column A of Table 8: Model RDA (1) and model RDS (2) show that equity incentives are positively correlated with R & D investments in the 10% level, while the power index represented by the general manager term is negatively correlated with R & D investments in the 10% level, indicating that the greater managerial power, the smaller R & D investments. The cross term of equity incentives and power is a negatively correlated with R & D investments significantly. It indicates that the greater managerial power, the weaker the relationship between equity incentives and R & D investments. Model RDA (3) and model RDS (4) also show that equity incentives are positively correlated with R & D investments in the 10% level, whereas the power index represented by executive directors is negatively correlated with R & D investments in the 10% level, and the cross term of managerial equity incentives and power are negatively correlated with R & D investments in the 10% significant level. It also indicates that the greater managerial power, the weaker the relationship between equity incentives and R & D investments. Only in the model RDA (5) and RDS (6) where the power index represented by the combining the posts of general manager and chairperson, are results not significant, but the symbol is the same with previous models. In addition, we use OS as a substitute variable of equity incentives and regress it again, the results are shown in column B of Table 8, the results are the same with column A. Based on above results, H2 is supported.

IMPLICATION TO RESEARCH AND PRACTICE

According to the above conclusions, we have implications to research and practice. The research implication: The results show that the greater the power, the smaller the incentive role of equity incentives to R & D investments. It provides not only references for the companies to launch equity incentive plans, but also new clues and new ideas for in-deep studies on corporate governance and managerial power effects, and we verify and enrich the agency theory. The policy implications of this study are: First of

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all, in the manager control company with dispersed ownership and the insider control, the implementation of equity incentives can not promote R & D investments, therefore, when the commission and the local government introduce a series of measures for the administration of equity incentive, in addition to considering the nature of the industry, they should consider the nature of equity of the company, not one size fits all; Second, it needs continue to improve corporate governance, such as the way of independent directors to hire a special commissioner of the remuneration committee, which means the executives will be excluded from the remuneration committee to limit the manager of excessive power; Third, to strengthen the external supervision on state-owned enterprise compensation system, especially, on the equity incentive contract from news media, the public, the market intermediary institutions and so on, and promoting formulation of executive equity incentive contracts and improving the disclosure transparency of exercise by strengthening external supervision, thereby increasing the difficulty of the operation of equity incentive contracts for executives , and narrowing the space of executive manipulation.

CONCLUSION

Based on managerial power theory, this study chooses listed companies from 2002 to 2009 as samples to examine the effects of managerial power on the relationship between equity incentives and R & D investments. In this study, firstly, we use the whole sample to examine the relationship between equity incentives and R & D investments, and the results show positive relationships in the 10%, 5%, 10% and 10% significant levels from the model RDA (1) to model RDS (4), respectively. It shows that equity incentives do have a significantly positive impact on R & D investments, H1 is supported. Secondly, we examine the impact of managerial power on the relationship between equity incentives and R & D investments. In this part, we have two levels of empirical tests, first step, examining whether managerial power effect is more prominent in manager control companies than in non-manager companies. Second part, we make the in-depth study to examine whether the greater managerial power, the smaller the incentive effects of the equity incentive on the R & D investments in the manager control company. The study finds that, compared with the non-manager control company, the effects of managerial power are more prominent in the manager control company; In manager control company, executives can influence the relationship between equity incentives and R & D investments, the implementation of equity incentives for executives will reduce the intensity of R & D investments, in other words, the greater the power, the smaller the incentive effects of equity incentives on R & D investments.

FUTURE RESEARCH

Despite this study's significant contributions and implications, it is not without limitations. First, we choose Chinese listed companies as our study's object, because of

ISSN: 2052-6393(Print), ISSN: 2052-6407(Online)

characteristics of Chinese institutional background (for example, China is in the transitional economy), companies in other developing countries may have different research results. What's more, in the model RDA (5) and RDS (6) where the power index represented by the combining the posts of the general manager and chairperson, results are not significant, but the symbol is the same with previous models. Future research can make further research.

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