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Hou, Yang and Wu, Manling

School of Accounting, Finance and Economics, Waikato Management School, University of Waikato

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An empirical study on the influencing factors for the over-investment of Chinese SOEs

Yang (Greg) Hou

School of Accounting, Finance and Economics,

Waikato Management School,

University of Waikato

Hamilton, New Zealand

Manling Wu

School of Accounting, Finance and Economics,

Waikato Management School,

University of Waikato

Hamilton, New Zealand

Abstract

The efficiency of investment affects the future development of the enterprises. The relevant literature on the corporate investment shows that the information asymmetry and the conflict of agency between the executives and the shareholders of the enterprises have a significant influence on the investment decision-makings. This study uses data of Chinese SOEs to analyze the factors affecting the efficiency of capital allocation of these Chinese SOEs from the perspective of free cash flow, ownership structure, agency costs, financing constraints and government intervention. The results of this study show that the phenomenon of over-investment is relatively obvious among the Chinese state-controlled listed enterprises. The results also show that substantial free cash flow, relatively high ownership concentration and government intervention are the major factors that lead to the over-investment in these Chinese state-owned listed companies. At the meantime, the financing constraints play a positive role in restraining the over-investment of Chinese SOEs, but their effect is quite weak. Moreover, the distortions of the senior executives' value goals lead to the failure of executive compensation mechanism and the construction of a proper governance system needs to begin with the property rights relations.

Keywords: Over-investment; Chinese SOEs; Investment efficiency

1. Introduction

The development of economy has always faced the problem of resource constraints. Therefore, the goal pursued by a larger number of academics is to optimize the allocation of resources under the conditions of limited resources. As a key part of the allocation of the capital resources, investment directly affect the cash flow of a company and become the driving force of the daily operation, subsequent growth and further development of the company. Also, the efficiency of corporate investment is the basis of the corporate financing. In the system of measuring the value of an enterprise, the investment efficiency is regarded as an important indicator for the performance evaluation of the corresponding enterprises. The efficiency of investment is a fundamental issue that concerns whether a company can maintain its healthy development in the long run. According to Modigliani and Miller (1958), the efficient market hypothesis suggests that there is no friction in the capital market, that is to say, there doesn't exist transaction costs, taxes, bankruptcy costs and therefore everyone can obtain same market information. However, in the real world, enterprises often engage in the inefficient investment due to the prevalence of problems such as information asymmetry, principal-agent problems existing inside the company and the financing constraints. As a matter of fact, over-investment is a type of investment that is not conducive to the development of the enterprises. It not only results in the waste of resources, but also damages the interests of shareholders of enterprises since the valuable funds are invested in the projects whose net present value is less than 0. Jensen (1986) provides the explanations for the over-investment from the perspective of free cash flow and agency theory. Myers and Majluf (1984) explain the over-investment from the perspective of information asymmetry. When enterprises have quite sufficient funds or there are relatively stable and sufficient cash flows, managers may usually increase and expand investment blindly so that they can obtain more resources and gain greater power. In this paper, I will mainly focus on the

discussions on the Chinese state-owned enterprises to examine the main factors that lead to over-investment.

Since the open reform of China, the rapid development of Chinese economy has attracted great attention around the world. There is no doubt that investment is the main driver of China's economic growth. However, the efficiency of investment is not ideal, especially for the issue of over-investment in Chinese state-owned enterprises, which has been criticized by many people. In terms of the corporate investment efficiency, countries with developed market economies have carried out a series of relatively more systematic and in-depth research. However, China is still in the transitional period of market economy. It is generally agreed that the Chinese capital market is still immature, the legal system is not yet perfect, and the degree of economic freedom is still not high. As a result, the factors affecting the corporate investment efficiency are more complicated, especially for the Chinese state-owned enterprises. In China, the state-owned enterprises are the pillar of the Chinese national economy and they are dominant in the key sectors and important areas of the national economy. These Chinese SOEs cover key areas of the national economy such as finance, aviation, railway, marine, oil and natural gas, wood, tobacco, tap water, electronic steam, coal and ferrous metal smelting and they occupy more than 70 percent of the total market share. Under the special political and economic background of China, these Chinese SOEs have superior financing conditions and it's easier for them to get access to the capital, since they have more financing channels such as equity refinancing which includes share allotments and secondary public offering and bank loans. Moreover, the governance structure of Chinese state-owned listed enterprises is quite special. As a matter of fact, a minority of shareholders monopolize the ownership of the company. As a result, the general meetings of shareholders which represent the rights and interests of the company's shareholders may fail to exercise their original functions properly and eventually they become useless. At the same time, the Chinese government tries to ensure their control on

these state-owned enterprises through the appointment of senior management, especially appointing those who have working experience in the government sectors (Chen, Sun, Tang & Wu, 2011). With this in mind, the governments can perform their intervention in these Chinese SOEs to affect the decision-makings of the enterprises and they try to accomplish their political and social goals by internalizing a series of non-efficient goals into corporate investment objectives (Chen, Sun, Tang & Wu, 2011). According to Dollar and Wei (2007), Chinese state-owned enterprises have been associated with relatively low economic efficiency and relatively high asset-to-liability ratio for a long time, due to the multiple tasks undertaken by these companies such as providing employment, regulating and controlling the economy and ensuring the social stability. In the practice of Chinese state-owned enterprises, accompanied with high profits, many of these companies have engaged in the over-investment. Consequently, this phenomenon has been criticized by a great number of people.

This paper analyzes the factors affecting the efficiency of capital allocation of the Chinese state-owned enterprises from the perspective of free cash flow, ownership structure, agency costs, financing constraints and government intervention based on the sample of the state-owned companies in China from 2007 to 2016, which totals to 10 years. The main purpose of this paper is to use empirically test to examine the determinants of the over-investment of Chinese state-owned listed enterprises. The major findings of this paper are shown as follows: First of all, the problem of over-investment in the Chinese state-owned enterprises is quite common. Second, substantial free cash flow, relatively high ownership concentration and government intervention are the main factors that lead to the over-investment in China's state-controlled listed companies. Meanwhile, the political relationship between executives of enterprises affects the corporate decision-making processes, thus resulting in the over-investment of the company. Third, the financing constraints play a positive role in restraining the over-investment of Chinese SOEs, but their effect is

quite weak. The level of debt does not have a constraint effect on the contingent governance of these Chinese state-owned enterprises. Fourth, in China, these top executives of state-controlled listed companies are merely agents of the government. Due to the lack of reasonable property rights relations, it can easily lead to the distortions in these top managers' value target. At the same time, the imperfect corresponding assessment and supervision mechanisms make them prone to pursue the expansion of the company's scale and invest state-owned assets in projects with negative net present values, which eventually lead to the over-investment in the company. In fact, the system of independent directors and the executive compensation have not been well established and improved in China. These two kinds of mechanisms have not actually played their due role in the practice.

This paper makes contributions to the literature in the following ways. First, the evidence provided by this paper enriches the existing literature on corporate investment efficiency. The previous research on the over-investment mainly focuses on the agency conflict which is caused by the information asymmetry. This paper shows that the political connections lead to the over-investment of state-owned enterprises. It indicates that political force also affects the process of corporate investment directly. Second, while studying the influencing factors of over-investment in Chinese state-owned listed enterprises, this paper does not only fully consider the complex relationship between free cash flow and financing constraints, but also takes into account the related mechanisms of ownership structure and corporate governance, especially in the aspect of the role played by the checks and balances ownership and the independent directors. The unique failure of check-and-balance as well as independent directors in the Chinese SOEs provides important implications for finding out the measures to curb the over-investment decision-makings of management.

The remainder of this paper is organized as follows. Section 2 reviews the related

literatures which can provide the theoretical basis for the research on the over-investment of Chinese state-owned listed enterprises and presents relevant research hypotheses. Section 3 describes the sample selection and data sources of this research and provides detailed information on the model design and the definitions of variables. Section 4 presents the empirical results and provides relevant analysis and discussions based on the research findings. Section 5 presents the overall conclusion of this paper and provides the corresponding recommendations for Chinese government.

2. Literature review and hypotheses development

The issue of investment efficiency has always been a hot topic in the field of academic research. In an imperfect capital market, the theories including principal-agent theory, information asymmetry theory, free cash flow hypothesis and financing constraint theory all provide theoretical support for the over-investment of the company. In order to further empirically examine the effects of free cash flow, ownership structure, agency cost, financing constraints and government intervention on the over-investment in Chinese state-owned listed enterprises, the hypotheses of this paper are put forward.

2.1 Principal-agent problem and over-investment

According to Adolf and Means (1932), based on the questioning of the relevant traditional theory of shareholders' rights and equity, the principal-agent theory was put forward. That is to say, the separation of the ownership and control is quite common in modern enterprises and it also creates the principal-agent relationship between these shareholders and managers of the company (Adolf and Means, 1932). Many scholars have studied the principal-agent theory through the design of empirical models, which can be summarized as the following three types: The first type is

represented by state space formulation, where the contract is designed through methods include utility functions, uncertain information distribution and so on, therefore the principal-agent relationship is modeled (e.g., Wilson, 1968; Spence & Zeckhauser, 1971; Ross, 1973). The second type is regarded as the standardized method for solving the principal-agent problem, which is called parameterized distribution formulation, was first proposed by Mirrlees (1976) and Hölmstrom (1979). The third type is called general distribution formulation, although this model is relatively simple, it still has defect that it cannot properly explain the actions of agents and it does not provide the explanations for the incurred related costs.

Jensen and Meckling (1976) believed that the arrangement of the ownership structure is a kind of agency costs, under the principal-agent theory, the principal-agent relationship between managers and shareholders is formed by signing the contract. According to Jensen and Meckling (1976), when the objectives of the managers differ from the objectives of the shareholders, managers are more likely to take actions based on the considerations for their own benefits, rather than try to realize the maximization of the owners' rights and equity. Therefore, business owners do not have a good understanding of whether managers are working hard or not due to the information asymmetry. The firm value can be lower when the ownership and control rights are separated. Based on a series of strict assumptions, the corporate investment theories in the neoclassical framework propose the most important influencing factors in its perceived investment expenditures. These theories include the irrelevance theory of Modigliani and Miller (1958), the neoclassical investment theory of Jorgenson (1963) and Tobin's q theory of Tobin (1969).

Blanchard, Lopez-de-Silanes and Shleifer (1994) find that when enterprises get windfalls, the managers of the company will not choose to give these windfalls back to the shareholders and will use them to invest in some poor projects. The separation of ownership and control rights will result in inconsistent goals between shareholders

and management of the company, the former aims to maximize their economic benefits, while the latter aims to maximize their control rights (Blanchard et al., 1994). Scharfstein and Stein (2000) analyzed the two-tiered agency model of shareholders and managers and pointed out that due to the power struggles, rent-seeking behaviors, and agency problems of department managers, the efficiency of internal capital markets is low, which in turn seriously damages the corporate value. Aggarwal and Samwick (1999) illustrated the first layer of principal-agent relationship through their empirical analysis and concluded that when managers can obtain private benefits, they are likely to have the motivation to engage in the over-investment.

The company's agency costs can be measured by the executive compensation. Based on the arguments shown above, the first hypothesis is proposed.

Hypothesis 1: The agency costs are negatively related to the over-investment in Chinese SOEs.

2.2. Corporate governance and over-investment

Alchian (1969) explored the efficiency of investment within the company and argued that when there is no cost for information disclosure and there is no incentive issue of external capital market, the company is in the position of information superiority. Stulz (1990) pointed out that the greatest advantage of diversification is to provide various channels for investment, since diversified operations can involve projects in different field and the company can use more projects with positive net present value of investment to effectively solve the problem of under-investment, which provides a channel for increasing the firm value. Narayanan (1988) stated that the key to improving the corporate investment efficiency lies in the implementation of incentive policies which combined the monetary compensation with the equity incentives. Since the payments of cash compensation to the managers of the company may cause the company to encounter the cash deficiency on the long-term investment projects;

however, if only the equity incentive approach is adopted by the company, it will easily lead to the over-investment of the company. Therefore, the payment of compensation has a direct impact on the investment behavior of corporate investors and good corporate governance has a significant suppressive effect on the overinvestment of the company.

According to Nowak and McCabe (2003), the independent corporate directors with high professional skills usually have a strong sense of responsibility; therefore they can identify and suppress the over-investment behaviors of the managers in time. The research results show that companies with higher corporate social responsibility performance have higher investment efficiency (Samet and Jarboui, 2017). According to Samet and Jarboui (2017), it is in line with their expectations, socially responsible companies often featured by lower sensitivity between corporate investment and cash flows, lower constraints in capital and better access to financing and high management quality, which helps to ease the inefficient investment. Chen and Chen (2017) found that there exists a positive relationship between a more effective process of investment allocation and higher independence of the board of directors, ownership of outside directors and CEO's equity-based compensation. Richardson (2006) also argued that the corporate governance can inhibit the over-investment behaviors in enterprises and managers' shareholdings can reduce the agency costs and realize the decline in the phenomenon of companies' over-investment. Li and Wang (2010) state that higher quality of financial report can alleviate the issue of over-investment in enterprises and improve the total corporate investment efficiency.

Jung, Lee & Weber (2014) believed that the frictions of financing derived from the asymmetric information may cause the investment decision-makings to become unsatisfactory. The shareholder governance pattern is advocated by Adolf and Means (1932), Jensen and Meckling (1976), Fama and Jensen (1983) and Shleifer and Vishny (1997). At the same time, the stakeholder governance pattern which is advocated by Cochran and Wartick (1988) and Blair (1995). In fact, corporate

governance includes ownership, capital structure, ownership structure, and managerial control and so on. The senior executives of the company affect the corporate investment decisions directly since they are a key part of corporate governance structure and the excellent top management guarantees the human resources of the enterprise. How to effectively motivate the company's top executives to work harder and further improve the management and corporate performance has become a major issue for the development of enterprises. The function of independent directors is to supervise, restrict and evaluate, improve the corporate governance structure and reduce the control of insiders.

For the state-owned listed companies in China, the controlling shareholders are state-owned enterprises and the state act as the owner does not have enough supervision on the managers chosen by it. Therefore, the introduction of independent directors is quite necessary.

The higher the shareholding ratio of the largest shareholder, the greater the influence of major shareholders on investment decisions is. A series of researches focus on the agency problems found that large shareholders would damage the interests of minority shareholders, especially when the listed companies have residual earnings, these major shareholders usually decide not to pay dividends for their own interests and for the purpose of expanding the scale of listed companies and then this portion of funds are used by managers for new investments. Zhu, Zhao and Bao (2016) state that high shareholding ratio of controlling shareholders and high degree of separation of control rights and cash flow rights will promote the positive impact of investor sentiment on over-investment. Chen, Sung and Yang (2017) argue that the concentration of ownership is negatively correlated with the corporate investment efficiency and this effect is more pronounced in state-owned enterprises than in private enterprises. The research results of Lai and Liu (2017) show that better features of top management team can mitigate the distortions caused by

over-investment in the enterprises. The company's corporate governance can be measured by the shareholding ratio of the largest shareholder, the check-and-balance ownership and the number of independent directors of the company. Therefore, these findings mentioned above lead to the second hypothesis of this paper.

Hypothesis 2: The shareholding ratio of the largest shareholder is positively correlated with the over-investment in Chinese SOEs; check-and-balance ownership and the number of independent directors of Chinese SOEs are negatively related to the over-investment in Chinese SOEs.

2.3 Free cash flow and over-investment

The level of cash holdings is quite relevant since it is related to whether the internal capital can meet the investment needs of enterprises and whether the enterprises need external financing. Therefore, it has a certain impact on the financing costs of enterprises. There is no doubt that the corporate decisions on the cash holdings are crucial to the development of the company.

It is believed that managers have strong motivation to improve their personal performance, with this in mind, many of them will invest the free cash flow of enterprises in with negative net present value in order to expand the scale of business (Fazzari, Hubbard, Petersen, Blinder & Poterba, 1988). Stulz (1990) and Strong and Meyer (1990) all found that the correlation between corporate investment and its cash flow is very high. Harford (1999) studied whether the excess capital of enterprises produced effective mergers and acquisitions policies and pointed out that companies that hold surplus capitals are more likely to engage in M&A activities, however, the scientific nature of their M&A behavior is not high. Therefore, the effectiveness of mergers and acquisitions will not be high since they may damage the interests of stakeholders.

Vogt (1994) employed the intersection of cash flow in the Vogt model and investment opportunities and showed that the correlation between corporate investment and cash flow is the major reason lead to the over-investment of enterprises. Malmendier and Tate (2005) explored the status of excess cash flow of enterprises from the perspective of management, they believed that many managers become overconfident when they identify the company has excess capitals and these managers will blindly invest with these capitals in order to expand the firm size, which eventually lead to the over-investment. Richardson (2006) examined the relationship between free cash flow and over-investment empirically and explained the positive correlation between cash flow and over-investment in different ways. According to Cai (2014), companies whose free cash flow is greater than zero are more likely to incur over-investment, companies whose free cash flow is less than zero are more likely to incur under-investment. In consistent with these findings and arguments mentioned above, the third hypothesis of this paper is proposed.

Hypothesis 3: The enterprises' free cash flow is positively related to the over-investment in Chinese SOEs.

2.4 Financing constraints and over-investment

The senior executives with information advantages have better understandings of the company's operations due to the universal existence of information asymmetry. The uncertainty of information brings more doubts to these investors and thus raises the cost of external financing. The difference between internal financing and external financing which is objectively formed makes internal financing become more favorable than external financing. Myers and Majluf (1984) argued that the internal staff of the company holds the advantage of information and can obtain internal financing at a relatively low financing costs based on the internal information, therefore the difference of financing costs is formed, it strengthens the constraints on the external financing. With this in mind, internal financing is preferred by many

companies. Gertler and Gilchrist (1994) emphasized that the imperfect competition in the competitive market is mainly caused by information asymmetry. As a result, higher transaction costs are incurred, which directly increases the external financing costs. Therefore, the external financing pressure increased at the same time. Under the dual influence of higher transaction costs and the need to obtain more funds for investment, the financing constraints imposed on the company are continuously expanding.

The study show that the information asymmetry exists objectively and the transaction costs should be considered at the same time, which determines that the internal and external financing cannot be equal. The costs of internal financing are usually far more less than the costs of external financing. Therefore, the dependence of corporate investment on its internal funds has increased dramatically due to relatively lower internal financing costs, relatively higher external financing costs and limited source of funds (Fazzari, Hubbard, Petersen, Blinder & Poterba, 1988). The modified pecking order theory of Myers and Majluf (1984) indicates that corporate managers follow a hierarchy to choose their financing sources, the first choice is internal financing, the second choice is debt financing and the third choice is equity financing. When the enterprises' free cash flow is insufficient, they may turn to the external debt financing, at this time, these managers are faced with the pressure to repay the interest and principal periodically, therefore debt can restrain the over-investment behaviors to a certain extent.

Hart and Moore (1995) suggested that if these managers choose debt financing, they would have to be affected by the regular payments of debt, at the same time, such constraints make it impossible for managers to consume on the job or blindly expand the firm size. With this in mind, debt financing can effectively suppress the over-investment in the enterprises. The analysis of Chava and Roberts (2008) show that the financing constraint has the following advantages: the existence of debt will

prompt the management to invest the free cash flow in the projects with positive net present value; these creditors may indirectly interfere with the company's investment decisions in order to prevent from investing in projects with high risk. At the meanwhile, the regular payments make management face a shortage of operational liquidity. As a result, multiple aspects of evaluations will be carried out when managers are making investment decision-makings, which helps to control the risk of over-investment in the companies.

Faulkender and Wang (2006) analyzed the financing constraints in groups by selecting factors such as dividend payout rate, size of the company and the level of commercial paper and showed that when the managers of enterprises realize that they are subject to the high financing constraint, they will become more active in the accumulation of capital. Almeida, Campello and Weisbach (2004) studies from the theoretical perspective and showed that companies which facing financing constraints often usually set relatively high limit on the reserves since they are relatively cautious in investing; however, companies which do not subject to the financing constraints would not do so. According to Mande, Park and Son (2012), the higher the degree of information asymmetry, the greater obstacle for implementing the equity financing is and the more apparent the financing constraints on the companies are.

Poncet, Steingress and Vandenbussche (2010) collected data on Chinese listed companies from year 1998 to year 2005 and pointed out that private companies in China are heavily constrained by financing, however, these Chinese state-owned enterprises which are closely related to state-owned commercial banks do not subject to the financing constraints. According to Huang, Jin and Chen (2016), based on the effect of increased capital, higher investors' sentiments and increased credit financing, enterprises have mitigated their financing constraints, and this also facilitated the abuse of enterprises' capitals. Therefore, investor sentiment is positively related to the over-investment in companies. The company's financing constraints can be measured

by the leverage ratio of the company. The discussion mentioned above leads to the fourth hypothesis of this paper.

Hypothesis 4: Financing constraints are negatively related to the over-investment in Chinese state-owned listed enterprises.

2.5 Government intervention and over-investment

In terms of the relationship between the government and enterprises, in order to achieve its political objectives, the government internalize the inefficient goals into the investment activities of enterprises by intervening the operational decision-makings of enterprises, which lead to the over-investment of these intervened enterprises. Frye and Shleifer (1997) suggested that the government's intervention in corporate investment activities has two kinds of effects which include the invisible hand and the grabbing hand. The government intervention will inevitably transform the target function of the state-owned enterprises into the government's preferred function, resulting in the low investment efficiency of SOEs (e.g., Lin, Cai & Li, 1998; Li and Zhou, 2005; Chen, Sun, Tang & Wu, 2011). A series of consistent evidences show that the negative impact of government intervention on corporate investment efficiency maybe further exacerbated by SOEs' tight budgets since these state-owned enterprises need to receive governments' support in order to obtain financing (e.g., Sapienza, 2004; Khwaja and Mian, 2005; Leuz and Oberholzer-Gee, 2006; Fan, Rui & Zhao, 2008).

According to Faccio (2006), political relations are a common phenomenon in the stock markets around the world. Many researches show that political relations enhance the value of companies (e.g., Fisman, 2001; Johnson and Mitton, 2003; Faccio, Masulis & McConnell, 2006). Chen et al. (2011) argued that the phenomenon of government intervention in corporate investment exists in many countries, however, among them, the governments' intervention is relatively significant in China. On the

one hand, the Chinese government controls ownership by holding a great number of shares in state-owned enterprises. On the other hand, the government directly appoints the senior executives of state-owned enterprises; thereby it can increase the control over state-owned enterprises. According to Chen et al. (2011), a majority of senior executives of Chinese state-owned listed enterprises have the political experience that working as a government official. The government intervention on the company can be measured by the political relations between the firm and the Chinese government. Therefore, based on the findings and discussions shown above, the fifth hypothesis of this paper is proposed.

Hypothesis 5: The government relations are positively related to the over-investment of Chinese state-owned listed enterprises.

2.6 The measurement of investment inefficiency

Jensen (1986) believes that when the net present value of the project is negative, and the investment decision makers of the company still invest the free cash flow of the company into the project, then they are engaged in the over-investment. Similarly, when the company has sufficient cash flow and the net present value of the project is positive, the investment decision makers passively or voluntarily give up the investment opportunity. Then they are engaged in the under-investment. When measuring the efficiency of investment, there are mainly three typical methods of measurement in the academic world.

2.6.1 The model of investment-cash flow sensitivities

According to Fazzari, Hubbard, Petersen, Blinder and Poterba (1988), when studying the financing constraints and corporate investment, the following models is established:

$$(I/K)_{it} = f(X/K)_{it} + g(CF/K)_{it} + u_{it} \quad (1)$$

where I_{it} stands for the investment in the fixed assets, X stands for a vector variable

for investment opportunity, CF stands for the internal free cash flows of the company, all variables are standardized by the capital stock K of the enterprise at the beginning of the period. f stands for the function that depends on the variable for investment opportunity, g stands for the function that depends on the variable for corporate internal free cash flows. The stronger the financing constraints that faced by the company, the greater the dependence of corporate investment on its free cash flow, the larger the value for coefficient CF/K , therefore, the relationship between investment expenditure and cash flow can become more sensitive (Fazzari et al., 1988). The FHP model links the free cash flow with the corporate investment behavior and extends the research field of free cash flow. However, this model is not perfect mainly in the following aspects: First, it is unable to distinguish whether the sensitivity of the relationship between investment expenditure and cash flow is caused by over-investment or under-investment. Second, this model only considers one factor that affects the sensitivity of investment and cash flow, which is the financing constraint of the company, while ignoring the existence of many other potential relevant factors such as the size of the company, the characteristics of the industry that the company belongs to and the opportunistic behavior of these managers. Third, the actual situation in the economic environment may aggravate the measurement deviation of the variable investment opportunity X .

2.6.2 The discriminative model of the intersection of cash flow and investment opportunity

Vogt (1994) studied the relationship between the cash flow of the company and corporate investment and established the model as follow:

$$(I/K)_{i,t} = \beta_1(CF/K)_{i,t} + \beta_2(DCASH/K)_{i,t} + \beta_3(SALES/K)_{i,t} + \beta_4(Q_{i,t-1}) + \beta_5(CF/K)_{i,t}(Q_{i,t-1}) + u_i + \tau_t + \varepsilon_{i,t} \quad (2)$$

where I stands for the investment for fixed assets, CF stands for the cash flow of the enterprise, $DCASH$ stands for the changes in the cash dividends of the enterprise,

SALES stands for the sales revenue of the enterprise, *Q* means that investment opportunities are measured by Tobin's *Q* (1969). u_i stands for the control variable for company and τ_t stands for the control variable for year. *K* stands for the fixed assets at the beginning of the period. The Vogt model can make up for the defect of the FHP model that the FHP model cannot distinguish between over-investment or under-investment through the intersection of cash flow and investment opportunity. However, this model can only be used to identify whether there exists over-investment phenomena or under-investment phenomena in the companies. This model does not measure the degree of over-investment or under-investment of the sample company.

2.6.3 The investment expectation model

Richardson (2006) uses the accounting data to construct a quantitative analysis framework that measures the over-investment and the under-investment of enterprises for the first time. Richardson (2006) points out that the total investment of the company should be divided into the required investment expenditure to maintain the current business and investment expenditures for new projects. Among the new investment expenditures, the optimal part of investment is determined by the company's financing constraints, growth opportunities, industry and other factors, and a part of it is inefficient expenditure, that is, over-investment or under-investment of the enterprises (Richardson, 2006). The relevant models are shown as follows:

$$\begin{aligned}
 I_{NEW,t} = & \alpha + \beta_1 V/P_{t-1} + \beta_2 Leverage_{t-1} + \beta_3 Cash_{t-1} \\
 & + \beta_4 Age_{t-1} + \beta_5 Size_{t-1} + \beta_6 Stock\ Returns_{t-1} + \beta_7 I_{NEW,t-1} \\
 & + \sum Year\ Indicator + \sum Industry\ Indicator + \varepsilon_t
 \end{aligned} \tag{3}$$

$$V_{AIP} = (1-\alpha r) BV + \alpha (1+r) X - \alpha rd \tag{4}$$

$$FCF = CF_{AIP} - I_{NEW}^* \tag{5}$$

Among Equations (3) (4) (5), $I_{NEW,t}$ stands for the company's new investment in the

year t . V/P_{t-1} stands for the expected growth opportunities in the market. $Leverage_{t-1}$ stands for the asset to liability ratio. $Cash_{t-1}$ stands for the level of cash. Age_{t-1} stands for the number of years after the company become listed. $Size_{t-1}$ stands for the logarithm of the company's total assets. $Stock\ Returns_{t-1}$ stands for the stock returns in the year before the investment. BV stands for the book value of the company, r is the discount, X stands for the dividends of the company, rd stands for the expenditures for research and development activities of the company. $\alpha = \omega / (1 + r - \omega)$, ω is the fixed continuity parameter that between 0 and 1. I_{NEW}^* stands for the optimal new investment. $\sum Year\ Indicator$ stands for the dummy variable for year, $\sum Industry\ Indicator$ stands for the dummy variable for industry. The residual ε_t stands for the inefficient investment expenditures. When ε_t is greater than 0, then it indicates that the company is experiencing over-investment. When ε_t is less than 0, then it means that the company is experiencing under-investment. The value of the absolute value of the residuals represents the amount of over-investment or under-investment of the company.

The investment expectation model of Richardson (2006) makes up for the shortage of the Vogt model, it can measure whether each company is over-invested or under-invested and it can come up with a specific value at the same time. With this in mind, this model provides a reliable measure for further analysis of the causes of over-investment and under-investment of the enterprises. Therefore, this model has been used by a great number of scholars in recent years.

3. Data and methodology

3.1 Model design and definition of variables

Based on the discussions and analysis on the investment efficiency model mentioned above, as well as the characteristics of the China's economic development, this paper

mainly employs the investment expectation model of Richardson (2006) and uses a multiple linear regression to analyze the influencing factors of inefficiency of Chinese state-owned listed enterprises' capital allocation.

3.1.1 The investment expectation model

First, the investment expectation model of Richardson (2006) is used to estimate the expected level of these Chinese state-owned listed enterprises' new investment. The predicted value of the regression model is the expected level of new investment and the residual value is the estimate of over-investment or under-investment of these Chinese SOEs. In line with the previous research, we employ the model of Richardson (2006) to measure the over-investment in the Chinese SOEs. The model (6) used by this paper in the first step is shown as follows:

$$\begin{aligned}
 I_{NEWi,t} = & \alpha + \beta_1 V/P_{i,t-1} + \beta_2 Leverage_{i,t-1} + \beta_3 Cash_{i,t-1} \\
 + & \beta_4 Age_{i,t-1} + \beta_5 Size_{i,t-1} + \beta_6 Stock\ Returns_{i,t-1} + \beta_7 I_{NEWi,t-1} \\
 & + \sum Year\ Indicator + \sum Industry\ Indicator + \varepsilon_{i,t}
 \end{aligned} \tag{6}$$

where

The dependent variable, $I_{NEWi,t}$, is the amount of company's new investment expenditures in the current year. It is calculated as the difference between the company's total investment expenditures and its investment expenditures for the maintenance of the assets;

$V/P_{i,t-1}$ is the growth opportunity of the company. It is calculated as the ratio of Total assets at the beginning of the year and the sum of company's market value and its total debt at the beginning of the year;

$Leverage_{i,t-1}$ is debt-to-equity ratio of the company in the previous year. It is calculated as the ratio of company's total liabilities to total assets at the beginning of the year;

$Cash_{i,t-1}$ is the cash holdings of the company. It is calculated as the ratio of monetary fund holdings to total assets at the beginning of the year;

$Age_{i,t-1}$ is the number of years the company has been listed on the Shanghai Stock

Exchange and Shenzhen Stock Exchange;

$Size_{i,t-1}$ is the logarithm of the total assets at the beginning of the year;

$Stock\ Returns_{i,t-1}$ is the earnings per share for the year before the investment year;

$I_{NEWi,t-1}$ is the company's new investment expenditures in the previous year;

$\sum Year\ Indicator$ and $\sum Industry\ Indicator$ are dummy variables for controlling the annual and industry fixed effects, respectively $Year$ equals to 1 for the current year, otherwise 0. According to the three-industry classification method proposed by the British economist and statistician Clark (1940) based on the work of New Zealand economist Fisher (1935), this sample mainly includes secondary and tertiary industry.

$Industry$ equals to 1 when the company belongs to secondary industry, otherwise 0;

$\varepsilon_{i,t}$ refers to the deviations from the expected investment. The positive value of residuals is the amount of over-investment in the company.

The variable $V/P_{i,t-1}$, $Leverage_{i,t-1}$, $Cash_{i,t-1}$, $Age_{i,t-1}$, $Size_{i,t-1}$, $Stock\ Returns_{i,t-1}$ and $I_{NEWi,t-1}$ are the main variables to examine. The variable $Year$ and $Industry$ are acting as the control variables.

3.1.2 Empirical model

Following the research design of Richardson (2006), Xin, Lin & Wang (2007), Bai & Lian (2013) and Ding, Knight & Zhang (2016), the following model (7) is established to examine the impact of different factors on the Chinese SOEs' over-investment.

$$\begin{aligned} Overin_{i,t} = & \alpha + \beta_1 Fcf_{i,t-1} + \beta_2 Leverage_{i,t-1} + \beta_3 Pay_{i,t-1} \\ & + \beta_4 Top_{i,t-1} + \beta_5 Er_{i,t-1} + \beta_6 Idr_{i,t-1} + \beta_7 Gov_relation_{i,t-1} \\ & + \beta_8 Cash_{i,t-1} + \beta_9 Age_{i,t-1} + \beta_{10} Size_{i,t-1} + \beta_{11} Stock\ Returns_{i,t-1} \\ & + \beta_{12} Adm_{i,t-1} + \sum Year\ Indicator + \sum Industry\ Indicator + \varepsilon_{i,t} \end{aligned} \quad (7)$$

where

The dependent variable, $Overin_{i,t}$, is the company's over-investment in the current year. It is the positive residuals of the first model;

$Fcf_{i,t-1}$ is the free cash flow of the corresponding company in the last year. It is calculated as the ratio of company's operating cash flow to its total assets at the

beginning of the year;

$Leverage_{i,t-1}$ is debt-to-equity ratio of the company in the previous year. It is calculated as the ratio of company's total liabilities to total assets at the beginning of the year;

$Pay_{i,t-1}$ refers to the company's executive compensation. It is calculated as the ratio of the top three executives' compensation to the sum of the executive compensation of all directors, supervisors and other executives;

$Top_{i,t-1}$ refers to the ownership concentration of the company, which is the shareholding ratio of the largest shareholder of the Chinese state-owned. It is measured as the shareholding ratio of the largest shareholder of the Chinese state-owned enterprises;

$Er_{i,t-1}$ refers to the check-and-balance ownership of the company. It is calculated as the ratio of the sum of the shareholding ratio of the second to the tenth largest shareholders of the corresponding company to the shareholding ratio of the largest shareholders;

$Idr_{i,t-1}$ is the number of independent directors in the company, which is measured as the proportion of independent directors in the total number of board of directors;

$Gov_relation_{i,t-1}$ refers to the government intervention which represented by the company's political relationship with Chinese government. Gov_relation is equal to 1 if the top management has a working experience in the government sectors, otherwise 0;

$Adm_{i,t-1}$ is the administration costs of the company and it is calculated as the ratio of management costs to the total revenue of the company. The definitions of remaining variables are the same as before.

The variable $Fcf_{i,t-1}$, $Leverage_{i,t-1}$, $Pay_{i,t-1}$, $Top_{i,t-1}$, $Er_{i,t-1}$, $Idr_{i,t-1}$ and $Gov_relation_{i,t-1}$ are the main variables to examine. The control variable includes $Cash_{i,t-1}$, $Age_{i,t-1}$, $Size_{i,t-1}$, $Stock\ Returns_{i,t-1}$, $Year$ and $Industry$.

The significant negative relationship between variable $Pay_{i,t-1}$ and $Overin_{i,t}$ suggests that the Hypothesis 1 is accepted. The significant negative relationship

between variable $Idr_{i,t-1}$, $Er_{i,t-1}$ and $Overin_{i,t}$ indicates that the relevant statements in the Hypothesis 2 is not rejected. The significant positive relationship between variable $Top_{i,t-1}$ and $Overin_{i,t}$ suggests that the relevant statement in the Hypothesis 2 is accepted. When there exists a significant positive relationship between variable $Fcf_{i,t-1}$ and $Overin_{i,t}$, we accept the Hypothesis 3. When there exists a significant positive relationship between variable $Leverage_{i,t-1}$ and $Overin_{i,t}$, we reject the Hypothesis 4. The significant positive relationship between variable $Gov_relation_{i,t-1}$ and $Overin_{i,t}$ indicates that the Hypothesis 5 is not rejected.

3.2 Sample selection and data source

The sample of this paper selects companies listed in the Shanghai Stock Exchange or Shenzhen Stock Exchange during the period from 2007 to 2016 as a sample. At present, there are two major stock exchanges within the mainland of China, including the Shanghai Stock Exchange established in November 1990 and the Shenzhen Stock Exchange established in December 1990. There are two kinds of shares traded in China, that is, A- and B- shares. A-shares are shares which are issued by the Chinese enterprises in the mainland and are only allowed to be traded by domestic investors. As a result, they are not available for foreign investors to trade. We collect the data which determine the nature of corporate ownership from the annual reports of the corresponding companies. The state-controlled company refers to the company whose large shareholders are state-owned enterprises controlled by the central government of China and the government organizations in the provinces, cities and counties. It should be noted that for those companies, the shareholding ratio of state-owned enterprises is greater than 50 percent.

Moreover, we manually collected the relevant background information of the senior managers of these companies from their annual reports. If a company's chairman of board of directors or chief executive officer has an experience of working in the Chinese government department, then this company is regarded as the company

which has a political relationship with the Chinese government. The relevant data are mainly collected from CSMAR Databases, as well as the Shanghai Stock Exchange and the Shenzhen Stock Exchange.

As a result, we have obtained a total of 1,106 annual observations for 120 A-share companies in China's state-controlled listed companies from the CSMAR database from 2007 to 2016. The information is disclosed by the annual reports from the two major stock exchanges and these observations constitute a preliminary sample for this research. The preliminary sample is screened based on the criteria proposed by Chen, Sun, Tang & Wu (2011) and Bai & Lian (2013) shown as follows: (1) Companies in the financial industry are excluded. This is due to the fact that the balance sheet structure and the investment expenditures of the financial companies are quite different from those of the general companies due to the special nature of their applicable accounting standards. (2) Companies with missing financial data or incomplete indicators are excluded. Since the incomplete data or indicators will result in the incomplete data collection, which is not conducive to the entire research. (3) Companies with negative value of new investment expenditures are excluded. (4) Companies whose listed years do not cover the observation period are excluded. This is because some of the variables are required to have financial data and information for relevant indicators in the previous year to ensure the integrity of the sample data. After the screening, the final sample of this paper includes a total of 830 observations for 83 companies during the period from 2007 to 2016.

4. Empirical results

4.1 Regression results for inefficient investment of Chinese SOEs

4.1.1 Descriptive statistics of variables in the first step

Table 1. Descriptive Statistics of major variables

Variable	No. of Obs	Mean	Median	Std. Dev.	Min	Max	Variance
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<i>inewt</i>	830	19.9553	20.0624	1.9075	13.4417	26.4624	3.6385
<i>VP</i>	830	0.5892	0.5735	0.2814	0.1001	2.1317	0.0792
<i>LEV</i>	830	0.4995	0.5154	0.2077	0.0394	0.9876	0.0431
<i>Cash</i>	830	0.1703	0.1315	0.1278	0.0070	0.9999	0.0163
<i>Age</i>	830	12.6651	13.0000	5.0413	0.0000	24.0000	25.4148
<i>Size</i>	830	22.7341	22.6850	1.5186	1.9900	27.3200	2.3060
<i>Ret</i>	830	0.4800	0.3000	1.0673	-1.9600	13.2500	1.1392
<i>inewt1</i>	830	19.8709	19.9730	1.8834	13.2988	24.9590	3.5472

Note: The mean, median, standard deviation, minimum value, maximum value and variance are reported. The variable *inewt* represents the new investment expenditures for the current year. The variable *size* represents the size of the company. The variable *age* represents the number of years that the company has been listed. At the same time, the variable *Cash* represents the holdings of the monetary fund of the company. The variable *LEV* represents the (leverage ratio) debt-to-equity ratio of the company in the last year. The variable *VP* represents the growth opportunity of the company. The variable *Ret* represents the profitability of the company.

Table 1 shows the descriptive statistics for all the variables used in the first stage of this study. The relatively high mean value of new investment expenditures in the current year indicates that the investment level of Chinese state-controlled listed companies is relatively higher than other companies and the variable *inewt* has larger variation than others. The large difference between the maximum value and the minimum value of *inewt* shows that there are great discrepancies in new investment expenditures between different Chinese SOEs. The relatively high value of standard deviation suggests that it is more volatile than others.

From these results, it can be seen that firm size has the highest mean value among all variables. This indicates that the scale of the company has experienced largest variation among all, that is to say, there exists great differences in the firm size. Indeed, among the state-controlled companies, there are giant companies that control the potential developments of the national economy, as well as high-tech research-based small businesses.

The average number of listing year in the sample is 12.67 years, indicating that the selected Chinese state-controlled listed enterprises are all relatively mature.

According to the results, this variable has the lowest mean value among all variables, which means that the corporate cash holdings has the lowest variation, that is, the companies in the sample have relatively stable cash holdings during the observing years.

The average value of this variable is approximately 50 percent, this means that the debt ratio of the company is at a relatively high level and most of these companies are exposed to greater risk than others.

With an average value which is greater than 50 percent, it suggests that these Chinese state-controlled listed enterprises have greater growth potentials than other enterprises. Also, the relatively low standard deviation indicates that these Chinese SOEs have relatively stable growth opportunities during the observing years. The lower the value of VP represents the company have greater growth opportunities.

There is a big gap between the maximum value and the minimum value of the enterprises' stock returns, which shows that there are great differences in the profitability of state-controlled listed companies and usually manifested in the uneven level of their earnings.

4.1.2 Correlation matrix for variables in the first step

Table 2. Correlation matrix of major variables

	V/P	LEV	Cash	Age	Size	Ret	inewt1
V/P	1						
LEV	0.3645	1					
Cash	-0.2197	-0.2983	1				
Age	0.1011	0.0199	0.0077	1			
Size	0.4973	0.2874	-0.0987	0.1746	1		
Ret	-0.1891	-0.2242	0.3219	-0.0305	0.1646	1	
inewt1	0.3629	0.1218	-0.1105	0.0742	0.6645	0.1779	1

Note: This table reports the Pearson correlation matrix of major variables in model (6).

According to the results of Pearson correlation table, these variables can well explain the changes of dependent variable since the cross-correlation between each pair of variables are not very strong. Therefore, each variable will affect the dependent variable inewt separately. In short, the results shown above indicate that this model does not have serious multicollinearity.

4.1.3 Regression results in the first step

According to Hausman (1978), the Hausman test (which also called the Hausman specification test) is a useful tool to differentiate between the fixed effect regression model and the random effect regression model when analyzing the panel data. In the null hypothesis (H_0) of Hausman test, the random effect (RE) regression model is more preferred than the fixed effect (FE) regression model (Hausman, 1978). When the null hypothesis is rejected, the fixed effect regression model is preferred (Hausman, 1978).

Table 3. Hausman tests for model (6)

<i>Null hypothesis: difference in coefficients is not systematic</i>	
<i>Chi-square (7)</i>	123.86***

Note: The null hypothesis of the Hausman test suggests random-effects regression model is better than fixed-effects regression model. The test statistic follows a Chi-square distribution with degree of free equal to 7. *** denotes significance at the 1% level.

According to the results of the Hausman test, the H_0 is rejected at the 5% level, then fixed effect (FE) regression is considered to be better than random effect (RE) regression and a fixed-effects regression model should be used here.

Table 4. Major regression results for model (6)

Fixed-effects (within) regression	
Variables	inewt
Intercept	6.5908*** (6.24)
VP	-0.8683***

	(-4.61)
LEV	-0.3593
	(-1.18)
Cash	1.7948***
	(3.93)
Age	0.0678***
	(4.52)
Size	0.1343***
	(2.82)
Ret	0.0965*
	(1.72)
inewt1	0.4927***
	(14.42)
Year	Yes
Industry	Yes
Adj-R ²	58.50%
N	830

Note: *, ** and *** indicate the 0.1, 0.05 and 0.01 levels of significance, respectively. t-statistics are reported in parentheses. The major regression results of inefficient investment in Chinese SOEs are reported.

The p-value is 0.000, which is less than 0.05, indicating that the relationship between inewt and VP is statistically significant. According to the regression results shown in the above table, the negative coefficient between variable inewt and VP suggests that there is a negative relation between company's new investment expenditures in the current year and its VP. That is to say, when the company's VP decreases, the growth opportunities of state-controlled listed enterprises increase, the corresponding new investment expenditures of these enterprises for that year will also increase. Therefore, the better the growth of the company in the previous period, the better the company's expectations for the future development and the higher the level of investment will be. At the meanwhile, since the p-value is greater than 0.05, then it means that the

relationship between *inewt* and LEV is not statistically significant. The negative coefficient between variable *inewt* and LEV indicates that there exists a negative relationship between company's new investment expenditures in the current year and its debt-to-equity ratio. When the leverage ratio of these Chinese SOEs increases, the corresponding new investment expenditures of these companies in the same year will decrease proportionately. Therefore, the higher the company's leverage ratio at the beginning of the year, the greater the pressures on the company's own funds. These pressures are mainly reflected in the level of the company's investment and are usually manifested by the reduction in the new investment expenditures. To a certain extent, it also shows that state-owned holding enterprises are less constrained by the debt since these enterprises possess relatively abundant resources and own relatively convenient financing channels.

Meanwhile, the p-value is 0.000, which is less than 0.05, indicating that the relationship between *inewt* and Cash is statistically significant. Moreover, the positive coefficient between variable *inewt* and Cash indicates that there exists a positive relation between company's new investment expenditures in the current year and its cash holdings. When the cash holding rate of these Chinese state-holding enterprises increases, the corresponding new investment expenditures of these companies in the current year will also increase. Therefore, when these companies have relatively sufficient free cash flows, the desire of the company's senior managers to make new investments will become stronger and they are more likely to achieve these new investments.

The p-value is 0.000, which is less than 0.05, indicating that the relationship between *inewt* and Age is statistically significant. The positive coefficient between variable *inewt* and Age shows that there is a positive relationship between the new investment expenditures of the company and its age. When the number of listing year of these Chinese state-controlled listed enterprises increases, the corresponding new investment expenditures of these companies in that year will also increase. Therefore, mature listed companies are more likely to maintain good and stable investment.

According to the results shown above, the p-value is 0.005, indicating that the relationship between *inewt* and *size* is statistically significant at the 5% level. The positive coefficient between variable *inewt* and *size* suggests that there is a positive relationship between the new investment spending of the company and its scale of assets. When the assets scale of state-owned holding companies increases, the corresponding new investment expenditures of these companies will also increase proportionately. It is generally agreed that when the size of the company becomes larger, its capacity to cover risk will become stronger and finally its probability of bankruptcy will be reduced. Therefore, the senior executives of these Chinese state-controlled companies will continue to increase new investment while pursuing the expansion of the company's scale.

The p-value is 0.085, suggesting that the relationship between *inewt* and *Ret* is statistically significant at the 10% level. Furthermore, the positive coefficient between variable *inewt* and *Ret* suggests that there exists a positive relationship between the new investment expenditures of the enterprise and its stock returns. Thus, when the stock returns of these Chinese state-owned holding companies increase, the corresponding new investment expenditure of these companies will also increase. Therefore, the higher the stock returns of the company in the previous period, the better the company's profitability. Indeed, good profitability enables enterprises to possess better abilities to repay their debts, distribute the dividends, raise capitals and expand the investments and provides greater possibilities for companies to achieve the reinvestment in the near future.

The p-value is 0.000, indicating that the relationship between *inewt* and *inewt1* is statistically significant at the 5% level. The positive coefficient between variable *inewt* and *inewt1* indicates that the company's new investment expenditures in the last year is positively related to those in the current year. Therefore, if the new investment expenditures of these Chinese SOEs in the previous year increased, then the expenditures on new investments tend to increase significantly in the current year.

4.2 Regression results for over-investment of Chinese SOEs

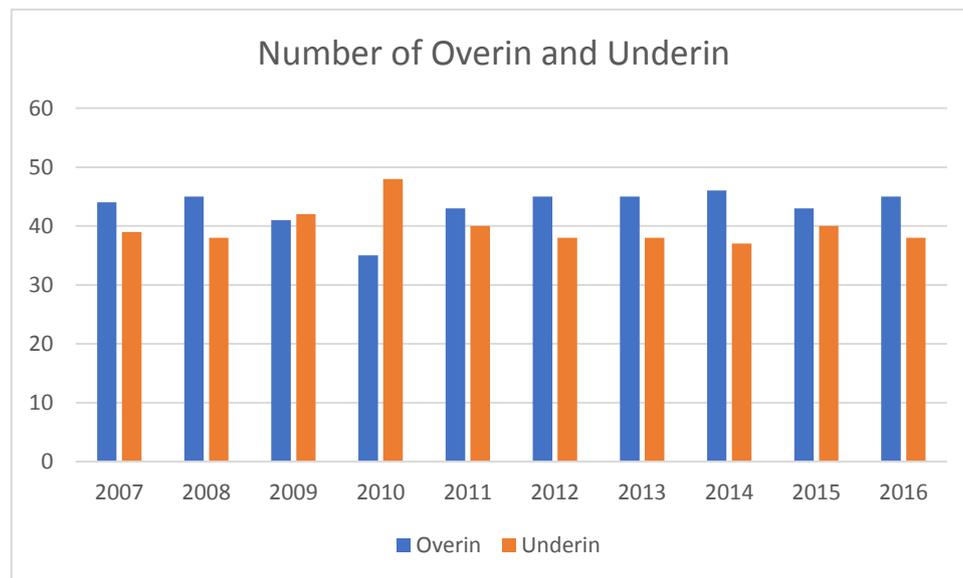
4.2.1 Descriptive statistics of variables in the second step

Table 5. Number of over-investment and under-investment

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	total
<i>Overin</i>	44	45	41	35	43	45	45	46	43	45	432
<i>Underin</i>	39	38	42	48	40	38	38	37	40	38	398

Notes: *Overin* denotes SOEs with over-investment while *Underin* denotes SOEs with under-investment.

Figure 1. No. of over-investment and under-investment for 10 years



According to the statistical results of the capital allocation efficiency of sample companies, there are 432 Chinese SOEs conducting the over-investment, which accounts for 52.05 percent of the sample. Moreover, during the period from 2007 to 2016, the number of companies with over-investment exceeds that with under-investment in eight out of ten years. It indicates that the problem of over-investment is quite common in these companies.

Table 6. Descriptive Statistics of major variables for model (7)

Variable	No. of Obs	Mean	Median	Std. Dev.	Min	Max	Variance
Overin	432	0.9880	0.9036	0.6311	0.0357	3.3769	0.3982
fcf	432	0.0944	0.0388	0.3215	-0.4167	4.1903	0.1034
lev	432	0.5329	0.5590	0.1924	0.0394	0.9608	0.0370
pay	432	0.4033	0.3895	0.1185	0.0044	0.7918	0.0140
top	432	0.5589	0.5582	0.1326	0.2509	0.8411	0.0176
er	432	0.2355	0.1545	0.2332	0.0081	1.0270	0.0544
idr	432	0.3039	0.3000	0.0454	0.1111	0.4706	0.0021
Gov_relation	432	0.2662	0.0000	0.4425	0.0000	1.0000	0.1958
adm	432	0.0611	0.0451	0.0466	0.0041	0.2699	0.0022
Cash	432	0.1437	0.1202	0.1031	0.0070	0.6694	0.0106
Age	432	11.7454	12.0000	4.7572	0.0000	23.0000	22.6311
Size	432	23.2453	23.2950	1.2432	19.9900	26.9600	1.5456
Ret	432	0.4201	0.3295	0.5243	-1.7400	2.7020	0.2748
Industry	432	0.7037	1.0000	0.4572	0.0000	1.0000	0.2090

Notes: The mean, median, standard deviation, minimum value, maximum value and variance are reported. The variable *Overin* represents the amount of company's over-investment in the current year. The variable *fcf* represents the free cash flow of the corresponding company in the last year. The variable *lev* represents the leverage ratio (debt-to-equity ratio) of the company. The variable *pay* represents the executive compensation, which is the ratio of the top three executives' compensation to the sum of the executive compensation of all directors, supervisors and other executives. The variable *top* represents the ownership concentration of the company, which is the shareholding ratio of the largest shareholder of the Chinese state-owned enterprises. The variable *er* represents the check-and-balance ownership of the company. To be specific, it is the ratio of the sum of the shareholding ratio of the second to the tenth largest shareholders of the corresponding company to the shareholding ratio of the largest shareholders. The variable *idr* represents the number of independent directors in the company, that is, the proportion of independent directors in the total number of board of directors. The variable *Gov_relation* represents company's political relationship with Chinese government. The variable *adm* represents the administration costs of the company, which reflects the governance costs of the company.

Table 6 shows the descriptive statistics for all the variables used in the second stage of

this study. According to the results shown above for descriptive statistics, there are 432 observations relating to the over-investment. The relatively large difference between the maximum and minimum values of Overin indicates that the degree of over-investment in the different Chinese state-owned listed enterprises is also quite different.

The large gap between the maximum and minimum values of the company's free cash flow indicates that there exist significant differences in the available cash flows of different Chinese state-owned listed companies. Some Chinese state-controlled listed companies have quite sufficient free cash flow and it serves as the capital foundation for them to engage in the over-investment; however, at the same time, some companies may even associate with negative free cash flow. The average value of this variable is greater than 50 percent, which shows that the companies involved in the over-investment have relatively higher debt ratios than others.

According to the results shown above, there are large differences in the executive pay of the top management, therefore, the degree of motivation to make investments can be differ among these top managers in the Chinese SOEs. It can be seen that the average value of this variable is greater than 50 percent, which suggests that companies involved in the over-investment are usually companies with high ownership concentration, where large shareholders monopoly the ownership of the company and have greater influence on the company's investment decision-makings.

The average value of this variable is around 24 percent, which suggests that the mechanism of check-and-balance is not working well. The difference on this variable between different companies is large and the proportion is not so high at the same time. It also shows that the phenomenon of the absolute holding by large shareholders is relatively common and prominent in these China's state-controlled listed companies.

The proportion located in the range of 11 percent to 47 percent and the average value is around 30 percent, indicating that the setting on the independent directors is relatively reasonable. Gov_relation is equal to 1 if the top management has a working

experience in the government sectors, otherwise 0. In terms of the input of Chinese state-controlled listed companies on the governance costs, it can be seen that the overall level is not high.

4.2.2 Correlation matrix for variables in the second step

Table 7. Correlation matrix of major variables in model (7)

	fcf	lev	pay	top	er	idr	Gov_relation
fcf	1						
lev	-0.0442	1					
pay	-0.0667	-0.1061	1				
top	0.1232	-0.0413	0.1095	1			
er	-0.0336	0.0738	-0.0633	-0.6228	1		
idr	0.0016	0.0344	-0.0142	0.1473	-0.1305	1	
Gov_relation	-0.0737	0.0113	0.0755	0.1001	-0.1228	0.0730	1

Note: This table reports the Pearson correlation matrix of major variables in model (6).

According to the results of Pearson correlation table, these variables can well explain the changes of dependent variable since the cross-correlation between each pair of variables is not very strong. Therefore, each variable will affect the dependent variable Overin separately. To sum up, the results shown above indicate that this model does not have serious multicollinearity.

4.2.3 Regression results in the second step

Table 8. Results of Hausman tests for model (7)

<i>Null hypothesis: difference in coefficients is not systematic</i>	
<i>Chi-square (12)</i>	9.70

Note: The null hypothesis of the Hausman test means random-effects regression model is better than fixed-effects regression model. The test statistics under the null follows a Chi-square distribution with degree of freedom equal to 12.

According to the results of the Hausman test, the null hypothesis is not rejected at any

conventional level. Then random effect (RE) regression model is considered to be better than fixed effect (FE) regression model and a random-effect GLS estimation should be used here.

Table 9. Major regression results for model (7)

Random-effects GLS regression	
Variables	Overin
Intercept	-3.1708*** (-3.46)
fcf	0.0919** (0.97)
lev	-0.0848 (-0.42)
pay	0.0691 (0.24)
top	0.1842* (0.53)
er	0.4885*** (2.89)
idr	1.7704** (2.29)
Gov_relation	0.1000** (1.00)
adm	0.5168 (0.61)
Cash	-0.0788 (-0.22)
Age	-0.0227*** (-2.71)
Size	0.1569***

	(3.80)
Ret	0.0654
	(1.00)
Year	Yes
Industry	Yes
Adj-R ²	16.78%
N	432

Note: *, ** and *** indicate the 0.1, 0.05 and 0.01 levels of significance, respectively. t-statistics are reported in parentheses. The major regression results of over-investment in Chinese SOEs are reported.

The p-value is 0.808, which is greater than 0.1, it indicates that the relationship between company's executive compensation and the over-investment in the company is not statistically significant at the 10%, 5% or even 1% level. The positive coefficient between Overin and pay indicates that the executive compensation system does not form a constraint on the over-investment in the company. Therefore, the Hypothesis 1 is rejected. It is generally agreed that implement the necessary incentives for top executives of the company and properly increase their remuneration are conducive to the further development of the company since this corporate policy encourages these managers to enhance their sense of responsibilities. However, in China, these top executives of state-controlled listed companies are merely agents of the government. Due to the lack of reasonable property rights relations, it can easily lead to the distortions in these top managers' value target. At the same time, the imperfect corresponding assessment and supervision mechanisms make them prone to blindly pursue the expansion of the company's scale at the expense of potential future gains and invest state-owned assets in new projects with negative net present values so that achieve the improvement in their personal performance, which eventually lead to the over-investment in the company.

Furthermore, the p-value is 0.022, which is less than 0.05, suggesting that the relationship between variable Overin and idr is statistically significant at the 5% level. The positive coefficient between variable Overin and idr indicates that there exists a

positive relationship between the company's over-investment and the number of its independent directors. Therefore, the statement relevant to the number of independent directors in the Hypothesis 2 is rejected. As a matter of fact, the major purposes of the mechanism of independent directors is to enable independent directors to play an important role in improving the operating quality of listed companies, enhancing the decision-making ability of the board of directors and protecting the interests of investors, thereby effectively restrain the company's excessive investment. Therefore, based on the results shown above, it also shows that this mechanism is still in its initial stage since it lacks systematic and comprehensive supervision and it has not really played its due role in these Chinese SOEs.

At the same time, the p-value is 0.059, indicating that the relationship between *Overin* and *top* is statistically significant at the 10% level. Also, the positive coefficient between variable *Overin* and *top* suggests that the ownership concentration of the company is positively correlated with the over-investment and the relationship between these two is quite close. Therefore, the statement relevant to the shareholding ratio of the largest shareholder in the Hypothesis 2 is accepted. In terms of the variables which represent the ownership structure of the company, using the shareholding ratio of the largest shareholder to measure the degree of ownership concentration of China's state-controlled listed companies is mainly based on the consideration of the special institutional background of these companies. The higher the shareholding ratio of the largest shareholder, the stronger their control over major corporate decision-makings is. It shows that the relatively high ownership concentration is the major factors that lead to the over-investment of these Chinese SOEs. Since the largest shareholder of Chinese state-controlled listed companies are the agent of the government, pursuing high-speed growth has often become their goals, and consequently the over-investment in these Chinese SOEs can easily occur. The results are in line with the viewpoints of Zhu, Zhao & Bao (2016) and Chen, Sung & Yang (2017).

At the meanwhile, the p-value is 0.004, which is less than 0.01, indicating that the

relationship between *Overin* and *er* is statistically significant at the 1% confidence level. Moreover, the positive coefficient between variable *Overin* and *er* indicates that the company's check-and-balance ownership is positively related to the over-investment in the company. Therefore, the statement relevant to the check-and-balance ownership in the Hypothesis 2 is rejected. This indicates that the ownership structure of the company is not reasonable and the mechanism of checks and balances has not yet been truly established in these Chinese SOEs since a minority of shareholders still monopolizes the ownership of the company.

At the same time, the p-value is 0.033, which is less than 0.05, suggesting that the relationship between *Overin* and *fcf* is statistically significant at the 5% confidence level. According to the regression results shown above, the positive coefficient between variable *Overin* and *fcf* indicates that there exists a positive relationship between company's over-investment and its free cash flows. That is to say, when the free cash flow of these Chinese state-controlled listed companies increases, the corresponding amount of over-investment in the current year will also increase. Therefore, the Hypothesis 3 is accepted. The more sufficient the free cash flow in the companies, the more available the funds which can be used by senior executives of the company are. Based on the solid foundation of capital, these companies are prone to engage in the over-investment. This also directly shows that free cash flow is the main factor leading to over-investment in Chinese SOEs, which is consistent with the viewpoints of Jensen (1986), Vogt (1994), Malmendier & Tate (2005) and Richardson (2006).

Meanwhile, the p-value is 0.677, suggesting that the relationship between *Overin* and *lev* is not statistically significant at the 1%, 5% or 10% level. Therefore, the Hypothesis 4 is rejected. The level of debt does not have a constraint effect on the contingent governance of these Chinese state-owned listed enterprises. In China, the Chinese government and commercial banks impose double soft budget constraints, which make it more convenient for state-controlled listed companies to obtain financing channels and subject to relatively lower debt constraints. With this in mind,

the overall capital structure of the company is not a major factor which leads to the over-investment of the company. The results are in line with the findings of Poncet, Steingress & Vandenbussche (2010).

At the same time, the p-value is 0.032, suggesting that the relationship between *Overin* and *Gov_relation* is statistically significant at the 5% confidence level. The positive coefficient between *Overin* and *Gov_relation* indicates that the company's political relationship is positively correlated with the over-investment in the company. The stronger the company's political relations, the higher degree of over-investment it may involve in. Therefore, the Hypothesis 5 is accepted. In the sample of this paper, if the company's chairman of board of directors or chief executive officer has an experience of working in the Chinese government department, the corresponding company is considered to have a political relationship with the government. Among the 830 sample observations, there are 580 sample observations are determined to have political relations with the Chinese government, which accounts for 69.88% of the total. When there is a political relationship between the company and the government, the government will often appoint people who have government working experience to serve as senior managers of these state-controlled listed companies, thereby affecting the operations and decision makings of these companies through the people who are chosen by the government. In this way, the Chinese government combines its working goals with the company's development goals through their intervention and this can lead to the over-investment in Chinese SOEs. It shows that the government intervention is the main factor that leading to the over-investment problem in Chinese SOEs, which is in line with the findings of Chen et al. (2011).

4.2.4 Robustness checks

In order to examine the robustness of the empirical results, the following sensitivity test is conducted in this paper. Since the investment expectation model of Richardson (2006) ignores the circumstance where companies are engaging in the modest investment, we assume that there is no pure overinvestment in the company, following Xin, Lin & Wang (2007) and Bai & Lian (2013). According to Xin, Lin & Wang

(2007) and Bai & Lian (2013), the 20% of the total amount of residuals that are greater than 0 are regarded as a reasonable investment part. The Chinese state-controlled listed enterprises which have positive residuals based on the regression results of the first model are still used to constitute the initial sample. The sample observations are ranked by their residual values. And 20% of the total observations within the initial sample whose residuals are close to the zero are removed to avoid the potential influence of the company's modest investment on the results. Therefore, the remaining 346 sample observations form a new final sample for conducting the empirical analysis. The results are shown as follows.

Table 10. Regression results for robustness check

Random-effects GLS regression	
Variables	Overin
Intercept	-0.6698 (-0.68)
fcf	0.1018** (1.19)
lev	-0.0637 (-0.30)
pay	0.2009 (0.71)
top	0.0251* (0.07)
er	0.4188** (2.52)
idr	2.2555*** (2.76)
Gov_relation	0.1996* (1.79)
adm	0.3871

	(0.41)
Cash	-0.3306
	(-0.88)
Age	-0.0149*
	(-1.66)
Size	0.0503
	(1.13)
Ret	0.0198
	(0.31)
Year	Yes
Industry	Yes
Adj-R ²	0.11
N	346

Note: *, ** and *** indicate the 0.1, 0.05 and 0.01 levels of significance, respectively. T-statistics are reported in parentheses. The regression results for robustness check are reported.

According to the regression results of robustness check shown above, the relationships between fcf, er, idr and Overin are statistically significant at the 5% level. At the same time, the relationships of top and Gov_relation with overinvestment are statistically significant at the 10% level. Therefore, in terms of the significance of the relationships, the results are consistent with the main regression results for Equation (7). Also, pay, fcf, er, idr, top and Gov_relation are positively related to the Overin, while lev is negatively related to the Overin. This is also in line with the major results for equation (7). Overall, the regression results are robust based on the above analysis.

5. Conclusions

This paper set out to develop detailed discussion and analysis on the factors affecting the over-investment of these Chinese SOEs from the perspective of free cash flow,

ownership structure, agency costs, financing constraints and government intervention based on the sample of the Chinese state-owned listed companies during the period of year 2007 to year 2016. It is generally agreed that the efficiency of corporate investment play an important role in the healthy development of the company in the long-run. However, in the recent years, there are more and more Chinese state-owned listed enterprises engaged in the over-investment and it has gradually become a common phenomenon in China. Therefore, in order to seek a theoretical basis for standardizing the corporate governance and improving the efficiency of investment, this paper focuses on the over-investment in Chinese SOEs and presents relevant evidence on the factors affecting over-investment behaviors in these enterprises.

The empirical results of this paper reveal several key findings. First, the phenomenon of over-investment is relatively obvious among the Chinese state-controlled listed enterprises. According to the statistical results on the efficiency of capital allocation for 830 sample observations, there are 432 observations relate to the over-investment problems, which accounts for the 52.05% of the total. It suggests that a majority of Chinese state-controlled listed enterprises have engaged in the over-investment. It also shows that most of the Chinese state-owned holding companies have investment impulsion and it usually manifested as the company's over-investment in terms of their capital allocation efficiency. Therefore, to a certain extent, it has caused the waste of social resources. Second, substantial free cash flow, relatively high ownership concentration and government intervention are the main factors that lead to the over-investment in China's state-controlled listed companies. At the same time, the government intervention also play an important role in causing the over-investment in these enterprises since the Chinese government has appointed people with government working experience to serve as the top management and lead these companies to non-efficiency investment activities. Third, the financing constraints play a positive role in restraining the over-investment of Chinese SOEs, but their effect is quite weak. The level of debt does not have a constraint effect on the contingent governance of these Chinese state-owned listed enterprises. In China, the

Chinese government and commercial banks impose double soft budget constraints, which make it more convenient for state-controlled listed companies to obtain financing channels and subject to relatively lower debt constraints. Fourth, the distortions of the senior executives' value goals lead to the failure of executive compensation mechanism and the construction of a proper governance system needs to begin with the property rights relations. For a long time, top executives of state-controlled listed companies are merely agents of the government and they tend to pursue the expansion of the company's scale and invest state-owned assets in projects with negative net present value, which eventually result in the over-investment. It shows that the system of independent directors and the executive compensation have not been well established and improved in China.

Therefore, based on the findings and analysis mentioned above, a basic conclusion can be drawn from this paper. In China, the development vitality of state-controlled listed companies has been significantly constrained by its property rights system. With this in mind, it is quite necessary for Chinese government to implement the reform of the corporate ownership system. In order to achieve the sustainable development of these Chinese state-owned enterprises, the following recommendations provide a guideline for addressing the identified issues. The Chinese governments need to change the excessively concentrated ownership structure of state-owned holding companies and try to introduce private capital for cooperation. Moreover, it would be better for Chinese government to design a performance evaluation index system scientifically and appropriately suppress the power of executives and large shareholders of the company. At the same time, the government intervention should be weakened. Furthermore, the government should guide these state-owned listed enterprises to truly establish a governance system that meet the science of modern corporate governance and can foster the improvement of the company's competitiveness and innovation. Fortunately, at present, the Chinese government has embarked on the reform of mixed ownership of Chinese state-owned companies.

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