Free Cash Flow, Over-Investment and Corporate Governance in China

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Abstract: we investigate whether and how free cash flow and corporate governance characteristics affect firm level investments, using a sample of 865 Chinese listed firms. Consistent with the agency cost explanation, we find that firms' over-investment is more sensitive to current free cash flow and that over-investment is more pronounced in firms with positive free cash flows. Also, we find that certain corporate governance characteristics are significantly related to firm level investment. Further, we divide the full sample into two subsamples: over-investment firms and under-investment firms. For over-investment firms, our evidence indicates that higher state-ownership concentration boosts over-investment, while firms with higher proportion of tradable shares, larger board size of supervisors or higher leverage mitigate over-investment. For under-investment firms, our evidence shows that firms with higher state-ownership concentration, larger board size of directors or higher proportion of outside directors are associated with severer under-investment, while firms with higher leverage or higher proportion of tradable shares alleviate under-investment.

JEL classification: G30; G31; G32; G34

Key words: free cash flow, over-investment, corporate governance, China

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1. Introduction

Using a sample of Chinese listed firms, this paper examines whether and how free cash flows and corporate governance characteristics are associated with firm level investments. In perfect capital markets, there would be no link between free cash flows and firm level investments (Modigliani and Millier, 1958). However, prior research has documented a positive relation between them (Hubbard, 1998). There are two explanations for the relation: one is information asymmetry; the other is agency costs. For the information asymmetry explanation, Myers and Majluf (1984) show that, in imperfect capital markets, information asymmetries increase the cost of capital and it is costly for firms to raise external finance. Hence, external financing constraints force firms to reduce feasible investments and to invest more in the presence of internally generated free cash flows due to its lower cost of capital (Fazzari, et al, 1988; Hoshi, et al, 1991; Whited, 1992; and Hubbard 1998). Another explanation is agency costs. Agency costs stem from the separation of corporate ownership and control, exhibiting over-investment where managers in firms with free cash flows have strong incentive to invest in negative NPV projects (Jensen, 1986; Stulz, 1990). The agency cost explanation indicates that management is likely to invest in projects which are beneficial from a management perspective but may not be good for corporate owners, especially when the monitoring to management is weak. Richardson (2006) examines firm level over-investment of free cash flow, and finds that over-investment is concentrated in firms with the highest levels of free cash flow, which is consistent with the agency cost explanation. The evidence also suggests that certain corporate governance structures appear to mitigate over-investment. His study is based on a large sample from the *Compustat* annual database. Further, his study uses an accounting-based framework to measure over-investment and free cash flow, thereby allowing a more powerful test of the agency cost explanation.

Our paper is different from prior research in two ways: first, we apply Richardson's accounting-based constructs of over-investment and free cash flow to a sample of 865 Chinese listed firms. Second, we study both over-investment and under-investment, while

Richardson (2006) focuses mainly on over-investment. We choose Chinese listed firms as the research target because prior literature studying the links between free cash flow, over-investment and corporate governance of Chinese firms is very limited. Huang et al. (2011) also examine the effect of agency cost using the data from Chinese listed companies. However, they focus on the relationship between top executives' overconfidence and investment-cash flow sensitivity, and find that agency cost has a significant impact on the relationship. Our paper does not address executives' overconfidence. We focus on the relationship between free cash flow, corporate governance, and over-investment or under-investment.

Further, we choose Chinese listed firms as the research target, because China's capital market and the corporate governance of Chinese firms are unique. First, we need to know China's unique stock market and government supervision. China's stock market was established in early 1990s by the government as a vehicle to convert its "socialist planning economy" into a "socialist market economy". Since China's *Company Law* was enacted in 1994, Chinese firms have been undergoing the corporate governance reform. This reform effort was driven by Chinese government, especially by the China Securities Regulatory Commission (CSRC hereafter). It was also motivated by Chinese firms' voluntary efforts in order to reduce the dependence of financing on state-owned banks. Usually Chinese firms may have one or more of the following six different types of shares: state shares, legal person shares, employee shares, A-shares (traded in Renminbi, the currency in mainland China), B-shares (traded in foreign currencies), and H-shares (traded on the Hong Kong Stock Exchange). State and legal person shares are not tradable, but they can be transferred to domestic institutions upon approval from the CSRC. Also, in order to protect outside investors' interest, the CSRC prescribed strict rules for Chinese listed firms to issue seasoned equity offerings (SEO). Thus, China's stock market is an imperfect capital market heavily regulated by the government. It constrains Chinese listed firms from financing in external capital markets, widening the gap between the costs of external and internal funds. Because of this, Chinese listed firms' investment expenditure depends more on internally generated cash flows rather than external funds.

Second, corporate governance in mainland China is a two-tier board system.

Corporate governance varies between countries, especially regarding the board system. There are countries that have a one-tier board system like the U.S., and there are others that have a two-tier board system like Germany. In a one-tier board, all the directors (both executive directors as well as non-executive directors) form one board, called the board of directors. In a two-tier board, there is an executive board (all executive directors) and a separate supervisory board (all non-executive directors). China's corporation law stipulates a limited liability company has a board of directors and a board of supervisors. Regarding Chinese requirements of a board of supervisors, under Articles 52 to 57 of the *Company Law of the People's Republic of China*: a limited liability company requires setting up a board of supervisors, which shall comprise at least 3 persons. A limited liability company, which has relatively less shareholders or is relatively small in scale, may have 1 or 2 supervisors, and does not have to establish a board of supervisors. The board of supervisors shall include representatives of shareholders and representatives of the employees of the company at an appropriate ratio which shall be specifically stimulated in the Articles of Association.

In our study, the sample period is between 2001 and 2004. We select this sample period because the corporate governance data start only from 2001. Besides, the non-tradable shares reform started in 2005, which significantly changed the incentives of controlling shareholders. Therefore, we exclude the period after 2004 in this study. Consistent with the agency cost explanation, we find that Chinese firms' over-investments are more sensitive to current free cash flow, and that firms with higher free cash flow have higher over-investment impulse.

We further investigate whether corporate governance characteristics are associated with over-investment using the full sample. Our evidence shows that certain corporate governance characteristics, such as larger board size of supervisors, appear to mitigate over-investment. Next, we extend our study to examine whether corporate governance characteristics are associated with firm level investment by dividing the full sample into two subsamples: over-investment firms and under-investment firms. We define firms with positive Richardson's measure of over-investment as over-investment firms, and firms with negative Richardson's measure of over-investment as under-investment firms. For over-investment firms, our evidence indicates that higher state-ownership concentration

boosts over-investment, while firms with higher proportion of tradable shares, larger board size of supervisors or higher leverage mitigate over-investment. For under-investment firms, our evidence shows that firms with higher state-ownership concentration, larger board size of directors or higher proportion of outside directors are associated with severer under-investment, while firms with higher leverage or higher proportion of tradable shares alleviate under-investment.

The remainder of this paper is organized as follows. Section 2 describes the sample selection and methodology. Section 3 examines the association between free cash flow and over-investment at the firm level. Section 4 examines the relationship between corporate governance and over-investment or under-investment. Section 5 conducts the robustness checks. Section 6 concludes.

2. Data and Methodology

2.1. Data sources and sample selection

Our sample includes all Chinese public firms listed as A-shares in mainland China before 2000, but excludes financial institutions and utility firms. This is not just because those firms have drastically different operating, investing and financing activities, but also because they are heavily regulated by law including their governance structures. The data sources are the following: (1) Data on financial statements and ownership structures were collected from *Genius Securities Information System*, a database prepared by the Shenzhen GTI Financial Information Limited. The database contains all the historical financial data from annual reports of public companies in China; (2) Market and corporate governance data were obtained from *CSMAR2005 Trading Database Inquiry System*, which was prepared by the China Accounting and Finance Research Center of the Hong Kong Polytechnic University and the Shenzhen GTI Financial Information Limited; (3) We also supplemented those datasets with the annual financial reports of individual companies on the CSRC website. The sample period is between 2001 and 2004. This is because the corporate governance data start from 2001. Besides, the non-tradable shares reform started in 2005, which significantly changed the incentives of controlling shareholders. Therefore, we exclude the period after 2004. Our sample ends up with 865 listed firms or 3460 firm-year observations from 2001 to 2004.

[1]An outside director (also sometimes known as an independent director) is a director (member) of a board of directors who does not have a material or pecuniary relationship with company or related persons, except sitting fees. Outside directors do not own shares in the company.

2.2. Definitions and descriptive statistics

2.2.1. Definitions

Consistent with Richardson (2006), we define free cash flow (*FCF*) as cash flow beyond what is necessary to maintain assets in place ($I_{MAINTENANCE}$) and to finance expected (or optimal) new investments (I^*_{NEW}). Total investment[2] (I_{TOTAL}) is calculated as the sum of capital expenditure (*CAPEX*) and acquisition expenditure (*Acquisitions*), and then subtracts receipts from the sale of property, plant and equipment (*SalePPE*). Also, total investment can be decomposed into two components: (1) investment expenditure to maintain assets in place ($I_{MAINTENANCE}$), and (2) investment expenditure on new projects (I_{NEW}) (Strong and Meyer, 1990). Investment expenditure on new projects can then be split into two components: (2a) expected investment expenditure in new positive NPV projects (I^*_{NEW}), and (2b) abnormal (or unexpected) investment (I^{ε}_{NEW}). The abnormal component of investment can be positive or negative. Positive values correspond to over-investment, and negative values correspond to under-investment. The relations among those components are as follows:

$$I_{TOTAL,t} = CAPEX_t + Acquisitions_t - SalePPE_t$$
$$I_{NEW,t} = I_{TOTAL,t} - I_{MAINTENANCE,t}$$
$$I_{NEW,t} = I^*_{NEW,t} + I^{\varepsilon}_{NEW,t}$$
$$CF_{AIP,t} = CFO - I_{MAINTENANCE,t}$$
$$FCF_t = CF_{AIP,t} - I^*_{NEW,t}$$

Where CF_{AIP} is the cash flow generated from assets in place, which is the difference between cash flow from operating activities (*CFO*) and investment expenditure necessary to maintain assets in place ($I_{MAINTENANCE}$). $I_{MAINTENANCE}$ is measured as reported depreciation and amortization. All investment expenditure variables are scaled by average total assets.

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[2]Richardson (2006) includes the research and development expenditure (*RD*) when computing the total investment (I_{TOTAL}) and (CF_{AIP}), a measure of cash flow generated from assets in place. For Chinese listed firms during our sample period, *RD* is not disclosed as an independent item but as a non-extracting part of operating expense in financial statements, thus we do not include it in computing I_{TOTAL} and CF_{AIP}. Since the level of RD in China is still low, our estimates of I_{TOTAL} and CF_{AIP} are not likely to have significant biases if *RD* is excluded.

2.2.2. Descriptive statistics

First, we report the descriptive statistics of investment expenditure and its decompositions:

[Insert Table 1 about here]

Table 1 reports the descriptive statistics of investment expenditure and its decompositions. The average investment expenditure of firms in our sample is equal to 10% of the total asset base, which is lower than the average level of 13.1% in the United States (Richardson, 2006), where the research and development expenditure is included. After excluding the R&D expenditure, we find the level of investment expenditure in China is very close to that in the United States. The decomposition of I_{TOTAL} shows that the major component of investment is capital expenditure (6.1%), followed by acquisitions (4.4%). The findings indicate that 28% of the total investment expenditure is spent on maintaining existing assets in place and the remaining 72% is spent on new investments. Such findings are quite different from the Richardson's findings in the United States, where 44% of the total investment expenditure is spent on maintaining existing assets in place and only 56% is spent on new investments. The differences suggest a longer duration of depreciation and amortization for firm assets in China.

We also present the descriptive statistics of investment expenditure and its decompositions for three sub-samples classified by the types of the largest shareholders. Consistent with previous research, the state firms have lower total investment (I_{TOTAL}), lower capital expenditures (*CAPEX*), and lower new investment (I_{NEW}) than the other two types of firms. The average I_{TOTAL}, *CAPEX*, and I_{NEW} are 0.092, 0.059, and 0.063 for state firms versus 0.111, 0.063, and 0.079 for state-owned legal person firms, and 0.096, 0.060, and 0.072 for others. However, it does not necessarily mean state firms have less over-investment than other firms. Firms have different levels of free cash flows. Our findings are correct only if we focus on firms with positive free cash flows.

2.3. The investment expenditure model

Next we present the investment expenditure model. This model facilitates the computation of over-investment and expected new investment (Richardson, 2006).

$$I_{NEW,t} = \beta_0 + \beta_1 V/P_{t-1} + \beta_2 Leverage_{t-1} + \beta_3 Cash_{t-1} + \beta_4 Age_{t-1} + \beta_5 Size_{t-1} + \beta_6 Stockreturns_{t-1} + \beta_7 I_{NWE,t-1} + \sum Yeardummy + \sum Industrydummy$$

Where V/P is a measure of growth opportunities. It is calculated as the ratio of the value of the firm (*VAIP*) and market value of equity. *VAIP* is estimated as $VAIP = (1-\alpha r)BV + \alpha (1+r)X - \alpha rd$ where, $\alpha=(\omega/(1+r-\omega))$ and r=5% and ω=0.62. ω is the abnormal earnings persistence parameter from the Ohlson (1995) framework, *BV* is the book value of common equity, *d* is annual dividends and *X* is operating income after depreciation. *B/M* is book to market ratio, which is the ratio of book value of equity divided by market value of equity. *Age* is the log of the number of years the firm has been listed as of the start of the year. *Size* is the log of total assets measured at the start of the year. *Leverage* is the sum of the book value of short term and long term debt deflated by the sum of the book value of total debt and the book value of equity. *Cash* is the balance of cash and short term investments deflated by total assets measured at the start of the year. *Stock Returns* is the stock returns for the year prior to the investment year. It is measured as the change in market value of the firm over that prior year. *Year dummy* is a vector of indicator variables to capture annual fixed effects. *Industry dummy* is a vector of indicator variables to capture industry fixed effects. There are 21 industry indicator variables (using CSRC 2001 groupings) in this regression. All investment expenditure variables are scaled by average total assets.

[Insert Table 2 about here]

Table 2 presents various specifications of the investment expenditure model. The model of investment expenditure in the first column of Table 2 includes only growth opportunities, *V/P* as an explanatory variable. The coefficient estimate for β_1 is -0.061, which is very close to the value of -0.051 Richardson (2006) provided and significant at the level of 1%. The remaining models II to IV expand the set of included determinants and provide very similar results as that in prior literature (Richardson 2006). The second model shows that industry and annual fixed effects explains 11% of the variation in I_{NEW}. The third model shows that control variables leverage, cash balance, firm age, firm size, prior stock returns, and prior firm level investment expenditure explain 23.6% of the

variation. The inclusion of all the variables increases the explanatory power to 24.1% (model IV). Following Richardson's approach (Richardson, 2006), we use model IV to compute over-investment and free cash flow, in which over-investment is the residual from the model IV and free cash flow is the difference between cash flow generated from assets in place (CF_{AIP}) and the fitted value of expected new investment (I^*_{NEW}). We also use market-to-book ratio to replace *V/P* as growth opportunities to reestimate model IV and find very similar results as model IV shows, which suggests that other variables used in prior literature to capture growth opportunities such as market-to-book ratio are also appropriate to compute expected new investment (I^*_{NEW}) in the model. We report the results in model V.

3. Free cash flow and over-investment

The purpose of this section is to examine the association between free cash flow and over-investment at the firm level. Consistent with Richardson (2006), we define free cash flow as cash flow beyond what is necessary to maintain assets in place ($I_{MAINTENANCE}$) and to finance expected (or optimal) new investments (I^*_{NEW}). First, we use model IV in Table 2 to compute the fitted value of expected new investment (I^*_{NEW}), then we use the following equation to calculate free cash flow:

$$FCF_t = CF_{AIP,t} - I^*_{NEW,t}$$

where CF_{AIP} is the cash flow from operating activities after maintenance investment expenditure. It is calculated as cash from operations less $I_{MAINTENANCE}$. Later we investigate the relationship between over-investment and free cash flow by running the following regression:

$$I^{\varepsilon}_{NEW,t} = \beta_0 + \beta_1 FCF<0_t + \beta_2 FCF>0_t + \varepsilon$$

where *FCF*<0 is equal to *FCF* if the value of *FCF* less than zero and zero otherwise. Correspondingly, *FCF*>0 is equal to *FCF* if the value of *FCF* greater than zero and zero otherwise. This model allows us to examine the relationship between over-investment and free cash flow asymmetrically for more information.

Panel A of table 3 provides the descriptive statistics of free cash flow. For the full sample, the average of cash flows from assets in place is equal to 2% of firms' asset bases. After subtracting 7.1% of the expected investment on new projects, the average of free

cash flow equals -5.2%, which is lower than -3.6%, the average of free cash flow in the United States (Richardson, 2006). Next, we find that, on average, state firms have lower level of new investment, over-investment and higher level of free cash flow. However, it does not necessarily mean that state firms have lower impulses to over-invest than the other two types of firms when they face the same level of positive free cash flow. Further analysis in next section indicates that the descriptive statistics of state firms in Panel A stemmed from the mean process in which the impulse effect on over-investment counteracts the exacerbation effect on under-investment.

Panel B of Table 3 presents the empirical results of the association between over-investment and free cash flow. Consistent with prior literature (Richardson, 2006; Malmendier and Tate, 2005), the coefficient of positive free cash flow for either pooled regression estimates or average estimates from annual regressions (the estimate of β_2 is 0.183 for pooled regression, and 0.209 for Fama-MacBeth method, respectively) shows higher value than the coefficient of negative free cash flow (the estimate of β_1 is 0.062 for pooled regression and 0.064 for Fama-MacBeth method respectively), with a difference statistically significant at less than 10% percent level. Such findings suggest that over-investment is concentrated in firms with positive free cash flow, and the possibility of over-investment for listed firms with negative free cash flow is mitigated as the firm is forced to access external markets to raise funds necessary for any additional investment. In Panel B we also present the regression results for the partitions based on the largest shareholdings character. We find that the relationship documented in the full sample reappears, showing that firms with positive free cash flow are more likely to over-invest on average, while firms with negative free cash flow experience less over-investment. The results are consistent with the notion that managers over-invest when they have abundant internal funds, but curtail investment when they require external financing (Jensen and Meckling, 1976; Myers and Majluf, 1984; Malmendier and Tate, 2005).

[Insert Table 3 about here]

Next we analyze the alternative uses of free cash flow. Panel A of Table 4 provides the distributional properties of the free cash flow measure and the various uses of free cash flow. Panel B of Table 4 reports the breakdown of each additional dollar of free cash flow for listed firms with positive and negative free cash flow respectively. However, by

following Richardson's approach, we do not find the structural relationship in which the percentage for all users should be positive and equal to 100% in total. The sum of percentage of all the free cash flow uses is beyond 100%, indicating that some other sources are used to offset the deficit. Here we use *Other* to measure the deficit between the sources and the uses.

For firms with positive free cash flow in full sample partition, the average use of each unit of free cash flow is as follows: 29% is over-invested, 0% is paid out to shareholders, 10% is paid out to debt-holders, 81% is retained in financial assets, 17% is paid out to other investments, and the deficit is 41% which is financed from other sources. For firms with negative free cash flow, the breakdown is quite different. The free cash flow shortfall is financed as follows: 7% is under-invest, 0% is received from shareholders, 47% is received form debt-holders, 0% is financed from existing financial assets, 1% is paid out to other investment, and the deficit is 53% which is financed from other sources. When we switch to the partitions in which subsample is used based on the character of the largest shareholder, we find very similar results to what reported above. Consistent with Richardson's results, Chinese listed firms with positive free cash flow mainly use their free cash flows to over-invest or to buy financial assets. U. S. firms usually finance their additional funds mainly from equity and debt offering in the capital market or by running down existing cash balances when their free cash flows are negative. However, Chinese listed firms with cash shortfalls mainly raise additional funds through bank loans, reflecting the fact that Chinese capital markets cannot support enough equity and debt offering because of strict rules and regulations. Chinese listed firms depend heavily on banks to finance investments while their internal funds are short.

[Insert Table 4 about here]

4. Impact of corporate governance

We further extend our study to investigate the impact of corporate governance on the relationship between over-investment and free cash flow. We first examine the impact of corporate governance variables in full sample, and then check the relationship in two sub-samples where positive and negative over-investment values are used respectively.

4.1. Examining the impact of corporate governance in the full sample

Our governance factors fall into three general categories: the characteristics of

ownership structure, the characteristics of board of directors, and the characteristics of board of supervisors. We choose those factors from an agency perspective and a perspective of ownership concentration, together with Chinese unique two-tier corporate governance mechanism. That is, we take into account the separation of corporate ownership and control. At the same time, we consider whether the most ownership is held by the government, institutions, or individuals. However, the governance factors in China we obtained are different from that in the United States because of Chinese firms' unique institutional background and corporate governance mechanism. The corporate governance mechanism in mainland China is a two-tier board system, while the corporate governance mechanism in the United States is a one-tier board system. In a one-tier board, all the directors (both executive directors as well as non-executive directors) form one board, called the board of directors. In a two-tier board, there is an executive board (all executive directors) and a separate supervisory board (all non-executive directors). China's corporation law stipulates a limited liability company has a board of directors and a board of supervisors. In recent years, in order to improve the effectiveness of corporate governance, several related government regulations were promulgated. For example, starting from 2001, Chinese listed companies were required to form the board of directors with outside directors.

We use 13 variables to capture the impact of corporate governance in Chinese corporations. The first set of six ownership variables include *Largest shareholdings D1*, *Largest shareholdings D2*, *Herfi3*, *State*, *B share,* and *Tradable share,* which are proxies for the characteristics of ownership structure. *Largest shareholdings D1* is a dummy variable which equals one if the largest shareholdings is less than 25%, and zero otherwise. *Largest shareholdings D2* is a dummy variable which equals one if the largest shareholdings is larger than 25%, and zero otherwise. *Herfi3* is the ownership concentration variable, which is defined by the average of the square of the 3 largest shareholders ownership. *State* is a dummy variable which equals one if the largest shareholder is a state shareholder, and zero otherwise. *B share* is a dummy variable which equals one if the listed firm has B shares offered, and zero otherwise. *Tradable share* is the proportion of the tradable shares to total shares. *Largest shareholdings D1*, *Largest shareholdings D2*, and *Herfi3* are used to examine the effects of ownership concentration

on the association between over-investment and free cash flow. *State* is used to investigate the impact on the association between over-investment and free cash flow where state shares are dominant. *B share* and *Tradable share* capture the impacts of monitoring from oversea investors and domestic capital markets on the association.

The second set of five variables includes *CEO duality*, *Board Size*, *Executives Size*, *Outside Directors*, and *Non-paid Directors*, measuring the characteristics of board of directors. Where *CEO duality* is a dummy variable equal to one if the CEO and the chairman of the board of director in a firm is the same person, and zero otherwise. *Board Size* is the total number of directors on the board. *Executives Size* is the total number of executives on the board. *Outside Directors* is the proportion of the number of outside directors of board to the total number of directors on the board. *Non-paid Directors* is the proportion of the number of directors who do not receive compensation from the firm to the total number of directors on the board.

The third set of two variables includes *Supervisor Size* and *Non-paid Supervisors*, measuring the characteristics of the board of supervisors. Where *Supervisor Size* is the total number of supervisors on the board of supervisors, and *Non-paid Supervisors* is the proportion of the number of supervisors who do not receive compensation from the firm to the total number of supervisors on the board.

We examine the impact of the governance factors on the relationship between over-investment and free cash flow by running the following regression:

$$I^{\varepsilon}{}_{NEW,t} = \beta_0 + \beta_1 FCF_t + \sum \phi_i Governance\_Factors_t + \sum \varphi_j Governance\_Factors_t * FCF_t + \varepsilon$$

Based on prior literature (Jensen and Meckling, 1976; Myers and Majluf, 1984; La Porta, et.al, 2000; Malmendier and Tate, 2005; Richardson, 2006), we expect a significantly positive coefficient for β_1, a negative coefficient for each of the interacted governance factors that are increasing in "good" governance (*Largest shareholdings D2*, *Herfi3*, *B share*, *Board Size*, *Executives Size*, *Non-paid Directors*, *Supervisor Size*, and *Non-paid Supervisors*), and a positive coefficient for each of those that are increasing in "bad" governance (*Largest shareholdings D1*, *State*, *Tradable Share*, *CEO duality*, *Outside directors*).

[Insert Table 5 about here]

Table 5 presents the regression results for the full sample. Consistent with the earlier analysis presented in Panel B of Table 3, there is a strong positive relationship between over-investment and free cash flow. Among the 13 governance factors, only *Largest shareholdings D1, Largest shareholdings D2,* and *Herfi3* are statistically associated with over-investment, suggesting that dispersed ownership facilitates management over-investment while concentrated ownership restricts management from over-investment. Among the 13 interaction items between governance factors and free cash flow, however, though all of the coefficients are in the expected directions, only *Supervisor Size* FCF* is statistically significant. As expected, Chinese listed firms with larger size of board of supervisor experience lower levels of over-investment of free cash flow. Collectively, our evidence indicates that certain governance structures, such as concentrated ownership, and the size of board of supervisors, appear to mitigate over-investment.

4.2. Examining the impact of corporate governance in subsamples

Prior literature has established an under-investment-over-investment tradeoff related to free cash flow by invoking asymmetric information, rational agency costs, and managerial optimism. In this section, we examine the impact of corporate governance on both over-investment and under-investment. The approach enables us to test the hypotheses implied in prior literature that over-investment generally stems from agency problems while under-investment is usually exacerbated by both information asymmetry and agency problems together (Jensen and Meckling, 1976; Myers and Majluf, 1984; Bergstresser, 2006). We extend Richardson's work of examining whether firms' governance structures are associated with over-investment of free cash flow by separating positive over-investment from negative. That is, we define listed firms with positive Richardson's measure of over-investment as real over-investment firms, while listed firms with negative Richardson's measure of over-investment as under-investment firms. Although corporate governance mechanisms are developing rapidly in China, we still find that weak corporate governance boosts over-investment while weak corporate governance and information asymmetry deteriorate under-investment.

To examine the impact of the governance factors on the relationship between over-investment / under-investment and free cash flow, we run the following regression:

$$\left|I^{\varepsilon}{}_{NEW,t}\right| = \beta_0 + \beta_1 FCF_t + \sum \phi_i Governance\_Factors_t + \sum \varphi_j Governance\_Factors_t * FCF_t + \varepsilon$$

[Insert Table 6 about here]

Panel A of Table 6 is the descriptive statistics of means and medians between over-investment firms and under-investment firms. We test the difference of free cash flow and other governance factors between over-investment and under-investment firms. We find that most variables are not statistically different between the two sub-samples, suggesting that our results are not driven by the different governance structures between the sub-samples.

Panel B of Table 6 presents the regression results in the sub-sample of positive over-investment firms. Consistent with the regression results of Table 5, there is a strong positive relationship between over-investment and free cash flow. Among the 13 independent governance factors, only *Largest shareholdings D1* and *Largest shareholdings D2* are statistically associated with over-investment, suggesting that dispersed ownership facilitates managers' over-investment while concentrated ownership restricts managers from over-investment. Among the 13 interaction variables between governance factors and free cash flow, all of the coefficients are in the expected directions. However, comparing with the regression results of Table 5, not only *Supervisor Size* FCF*, but also *State* FCF* and *Tradable share* FCF* are statistically associated with over-investment in the sub-sample of over-investment firms. Considering the severe agency problems for state firms and the efficiency of monitoring from outside investors and inside board of supervisors, it is not surprising that *State* FCF* is positively associated with over-investment while *Supervisor Size* FCF* and *Tradable share* FCF* are negatively associated with over-investment. Consistent with our expectation, the control variable *leverage* is negatively associated with over-investment, indicating that managers restrain their investment impulse when firms face heavy debt burden.

Overall, our evidence is consistent with the agency problem hypothesis, indicating that higher state-ownership concentration appears to boost over-investment, while higher proportion of tradable shares and larger board size of supervisors appear to mitigate over-investment.

Panel C of Table 6 presents the regression results in the sub-sample of under-

investment firms. We use the absolute value of the negative measure to represent the magnitude of under-investment. Consistent with earlier analysis, there is a negative relationship between under-investment and free cash flow. Among the 13 independent governance factors, *Largest shareholdings D1* is negatively associated with under-investment; *Largest shareholdings D2*, *Herfi3*, *CEO duality*, *Outside directors*, and *Non-paid directors* are positively associated with under-investment. Our evidence implies that dispersed ownership facilitates managers to alleviate under-investment, while concentrated ownership, CEO duality, and more outside directors induce severer under-investment for firms with cash shortfalls. Among the 13 interaction variables between governance factors and free cash flow, *State* FCF*, *Board Size* FCF*, and *Outside directors* are positively associated with under-investment while *Tradable share* FCF* is negatively associated with under-investment. Interestingly, we note that the signs of the coefficients for *State* FCF* and *Tradable share* FCF* are not inverse when the direction of over-investment measure is changed. The positive and significant coefficient of *State* FCF* shows that, for state-owned firms, the under-investment is more severe when free cash flow is high. The negative and significant coefficient of *Tradable share* FCF* suggests that the under-investment is less severe when free cash flow is high and indicates that the monitoring from outside investors or capital market plays an important role in mitigating under-investment. Consistent with prior literature and our expectation, the coefficients on *Board Size* FCF* and *Outside Directors*FCF* are significantly positive, suggesting that the board size and the proportion of outside directors are associated with severer under-investment. Larger board size of directors implies weaker monitoring for management, and leads to severer under-investment. For outside directors, they do not have very powerful incentives to discipline management, in that they do not have a material or pecuniary relationship with the company except sitting fees. Also, they do not own shares in the company. Thus, more outside directors indicate weaker monitoring for management, and also lead to severer under-investment. However, leverage shows a negative association with under-investment, indicating that under-investment is mitigated when firms finance from banks, because the monitoring from banks are stronger.

To summarize, our results indicate that under-investment is stemming from weaker

monitoring from outside stakeholders. Our evidence shows that, for under-investment firms, the state characteristics of the largest shareholdings, the board size of directors, and the proportion of outside directors appear to induce severer under-investment, while the proportion of tradable shares and the leverage appear to alleviate under-investment.

5. Robustness checks

In this section, we conduct the robustness checks in the following three aspects: the division between subsamples, the cut-off point of the largest shareholdings, and the endogeneity of governance measures.

5.1. The division between over-investment and under-investment

Richardson's (2006) approach is to construct a measure of excessive investment based on an econometric model of expected investment, in which excessive investment is defined as the residual from the model. As a residual, the measured over-investment has a mean of zero. This means that Richardson's approach is incapable of discerning over-investment and under-investment if either of them predominates in aggregate. To avoid this problem, we sort the residuals first, and then define the top one-third sample as over-investment firms and the bottom one-third sample as under-investment firms to repeat analysis of Table 6, the results remain qualitatively the same.

In addition, Richardson (2006) argues that prior literature documented a concentration of over-investment in firms with positive free cash flow, so he limited his analysis of governance structures to this subset of firms. In regressions similar to those in Table 6, we use the subset of firms with positive free cash flow to analyze the relationships again and find similar results.

5.2. The cut-off point of the largest shareholdings

In the regressions of Table 5 and Table 6, we define the *largest shareholdings D1* is a dummy variable which equals one if the largest shareholdings are less than 25 percent and zero otherwise, and the *largest shareholdings D2* is a dummy variable which equals one if the largest shareholdings are greater than 25 percent, and zero otherwise. The reason for choosing the 25 percent as the cut-off point is that we find the 25 percent is a change point based on our analysis. In the robustness check, we run the regressions again by using the 20 percent and 30 percent as the cut-off points, respectively. The results are

presented in Table 7. We find that when the ownership cut-off point is the 20 percent, the coefficients of the dummy variables D1 and D2 are significant. However, when the ownership cut-off point is the 30 percent, the coefficients of the dummy variables D1 and D2 are not significant any more.

[Insert Table 7 about here]

Further, by using a continuous variable of ownership in percentage by the largest shareholder with a spline regression specification as in Morck, Shleifer, and Vishny (1988), we got the results in Table 8. In fact, Chen et al. (2007) also applied the same method of setting variables as that in Morck, Shleifer, and Vishny (1988) to test the relationship between firm performance and the ownership of the largest shareholder, the results are consistent.

[Insert Table 8 about here]

Our findings are consistent with prior literature. For example, Thonet and Poensgen（1979）conclude that if the proportion of ownership held by the largest shareholder is more than 25 percent, the business is called shareholder-controlled; otherwise it is called management-controlled. Leech and Leahy（1991）also find that if the largest shareholder holds more than 25 percent of the voting rights, the largest shareholder usually obtains the support from other shareholders more easily.

5.3. The endogeneity of governance measures

Although Richardson (2006) simply argues that the reverse causality was not a serious concern without reporting the regression results, we still address the endogeneity of governance measures more seriously. For the endogeneity of governance measures, we add the firm and year features to the model, and run the regression using the panel data approach. We find that the results are consistent with that in Table 5. The regression results are presented in Table 9.

[Insert Table 9 about here]

Finally, in order to check whether there exists endogeneity between free cash flow and I^{ε}_{NEW}, we did the 2SLS test using the two instrumental variables: tradable share and outside directors. The two instrumental variables are highly associated with free cash flow, but are not related with I^{ε}_{NEW}. Again, the results are consistent with that in Table 5.

The results are presented in Table 10.

[Insert Table 10 about here]

6. Conclusion

Our study contributes to the literature by examining the relationship between free cash flow, corporate governance, and over-investment for Chinese listed firms. Although there is an extensive literature studying the links between them, similar literature on Chinese firms is very limited. Our study fills the gap. Another contribution is that we study both over-investment and under-investment. We find that corporate governance characteristics have different impacts on the two subsamples. In contrast, prior literature focuses mainly on over-investment.

Using a sample of 865 Chinese listed firms from 2001 to 2004, we investigate how free cash flow affects over-investment and how corporate governance characteristics affect over-investment for the full sample. Consistent with the agency cost explanation, we find that firms' over-investment is more sensitive to current free cash flow, and that firms with higher free cash flow are associated with higher over-investment. When investigating the impact of corporate governance, our evidence suggests that certain governance structures, such as larger board size of supervisors, appear to mitigate over-investment.

We further find that corporate governance characteristics have different impacts on two subsamples: over-investment firms and under-investment firms. For over-investment firms, our evidence indicates that higher state-ownership concentration boosts over-investment, while companies with higher proportion of tradable shares, larger board size of supervisors or higher leverage mitigate over-investment. For under-investment firms, our evidence shows that firms with higher state-ownership concentration, larger board size of directors or higher proportion of outside directors are associated with severer under-investment, while companies with higher leverage or higher proportion of tradable shares alleviate under-investment.

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Table 1: Descriptive statistics of investment expenditure

This table describes investment expenditure and its decompositions by firms with different ownership concentrations. The full sample includes 3,460 firm-year observations with available data in *CSMAR* from 2001 to 2004.

$$I_{TOTAL,t} = CAPEX_t + Acquisitions_t - SalePPE_t$$

$$I_{NEW,t} = I_{TOTAL,t} - I_{MAINTENANCE,t}$$

	Mean	Std Dev	Median	Minimum	Maximum
Panel A: Full sample					
I_{TOTAL}	0.100	0.111	0.070	-0.358	1.413
CAPEX	0.061	0.070	0.038	-0.045	0.835
Acquisitions	0.044	0.089	0.011	-0.287	1.503
SalePPE	0.004	0.021	0.0003	-0.003	0.478
$I_{MAINTENANCE}$	0.028	0.024	0.025	-0.016	0.879
I_{NEW}	0.072	0.111	0.043	-0.546	1.396
Panel B: State firms					
I_{TOTAL}	0.092	0.103	0.066	-0.358	1.413
CAPEX	0.059	0.070	0.035	-0.039	0.835
Acquisitions	0.038	0.081	0.010	-0.065	1.503
SalePPE	0.005	0.027	0.0003	-0.002	0.478
$I_{MAINTENANCE}$	0.029	0.017	0.026	0	0.144
I_{NEW}	0.063	0.103	0.037	-0.381	1.396
Panel C: State-owned legal person firms					
I_{TOTAL}	0.111	0.118	0.081	-0.239	1.388
CAPEX	0.063	0.065	0.042	0	0.593
Acquisitions	0.051	0.103	0.013	-0.287	1.342
SalePPE	0.003	0.012	0.0002	-0.003	0.161
$I_{MAINTENANCE}$	0.031	0.033	0.027	0	0.880
I_{NEW}	0.079	0.120	0.049	-0.546	1.370
Panel D: Other firms					
I_{TOTAL}	0.096	0.110	0.065	-0.222	0.818
CAPEX	0.060	0.077	0.034	-0.045	0.652

Acquisitions	0.042	0.076	0.012	-0.180	0.763
SalePPE	0.006	0.022	0.0003	-0.0001	0.347
$I_{MAINTENANCE}$	0.024	0.016	0.021	-0.016	0.172
I_{NEW}	0.072	0.109	0.042	-0.248	0.809

I_{TOTAL} is total investment expenditure. It is calculated by subtracting *cash receipts from sale of property, plant and equipment* (*SalePPE*) from the sum of *research and development expenditure* (*RD*), *capital expenditure* (*CAPEX*), and *acquisition expenditure* (*Acquisitions*).
$I_{MAINTENANCE}$ is investment expenditure necessary to maintain assets in place, which is estimated by reported depreciation and amortization.
I_{NEW} is the difference between I_{TOTAL} and $I_{MAINTENANCE}$.
State firms are state-controlled firms.
State-owned legal person firms are institution-controlled firms, and the ownership of the institutions is held by the government eventually.
Other firms are firms controlled by individual shares.
Non-state firms include *state-owned legal person firms* and *other firms*.
All investment expenditure variables are scaled by the average of total assets.

Table 2: Analysis of investment expenditure

This table develops a model of investment expenditure. The determinants of investment include the measures of growth opportunities, leverage, firm age, firm size, cash balance, industry fixed effects, and annual fixed effects. The sample includes 3,460 firm-year observations with available data in *CSMAR* from 2001 to 2004.

$$I_{NEW,t} = \beta_0 + \beta_1 V/P_{t-1} + \beta_2 Leverage_{t-1} + \beta_3 Cash_{t-1} + \beta_4 Age_{t-1} + \beta_5 Size_{t-1} + \beta_6 Stockreturns_{t-1} + \beta_7 I_{NWE,t-1} + \sum Yeardummy + \sum Industrydummy$$

Variable	Predicted sign	Model				
		I	II	III	IV	V
V/P	-	-0.061 (-5.76)***			-0.035 (-2.06)**	
B/M	-					-0.022 (-1.66)*
Leverage	-			-0.075 (-7.76) ***	-0.080 (-7.25)***	-0.075 (-7.73)***
Cash	+			0.134 (12.11) ***	0.139 (12.32)***	0.130 (11.41)***
Age	-			-0.003 (-0.68)	-0.004 (-1.06)	-0.004 (-1.10)
Size	+			0.004 (2.13) **	0.005 (2.78)***	0.006 (2.46)***
Stock returns	+			0.220 (4.37) ***	0.246 (3.18)***	0.267 (3.29)***
$I_{NEW, t-1}$	+			0.304 (20.54) ***	0.292 (20.38)***	0.301 (20.05)***
Year dummy		No	Yes	No	Yes	Yes
Industry dummy		No	Yes	No	Yes	Yes
Adjusted R-Square		0.010	0.110	0.236	0.241	0.240
Observations		3452	3409	3410	3410	3410

V/P is a measure of growth opportunities. It is calculated as the ratio of the value of the firm (V_{AIP}) and market value of equity. V_{AIP} is estimated as $V_{AIP} = (1- \alpha r)BV + \alpha (1+r)X - \alpha rd$ where, $\alpha=(\omega/(1+r-\omega))$ and r=5% and ω=0.62. ω is the abnormal earnings persistence parameter from the Ohlson (1995) framework, *BV* is the book value of common equity, *d* is annual dividends and *X* is operating income after depreciation.
B/M is the book to market ratio, which is the ratio of equity book value to equity market value.
Age is the natural logarithm of the number of years the firm had been listed by the start of the year.
Size is the natural logarithm of total assets measured at the start of the year.
Leverage is the book value of total debt divided by the book value of total assets.
Cash is the balance of cash and short-term investments divided by total assets measured at the start of the year.

Stock Returns is the stock returns during the year prior to the investment year. It is measured as the change in market value of the firm over that in prior year.
Year Indicators is a vector of indicator variables to capture annual fixed effects.
Industry Indicators is a vector of indicator variables to capture industry fixed effects. There are 21 industry indicator variables (using China Securities Regulatory Commission 2001 groupings) in this regression.
All investment expenditure variables are scaled by the average of total assets.
t-values are reported in parentheses underneath coefficient estimates based on Huber-White robust standard errors. *, **, *** indicates significance at the 10%, 5%, 1% level respectively.

Table 3: Analysis of free cash flow and over-investment

The table examines the properties of free cash flow and how it relates to over-investment. Panel A presents the descriptive statistics of free cash flow. Panel B examines the relationship between free cash flow and over-investment. All variables are scaled by average total assets. The sample includes 3,460 firm-year observations with available data in *CSMAR* from 2001 to 2004.

Panel A: Descriptive statistics of free cash flow

$$FCF_t = CF_{AIP,t} - I^*_{NEW,t}$$

$I^*_{NEW,t}$ is the fitted value from:

$$I_{NEW,t} = \beta_0 + \beta_1 V/P_{t-1} + \beta_2 Leverage_{t-1} + \beta_3 Cash_{t-1} + \beta_4 Age_{t-1} + \beta_5 Size_{t-1} + \beta_6 Stockreturns_{t-1} + \beta_7 I_{NWE,t-1} + \sum Yeardummy + \sum Industrydummy$$

Sample	Mean	Std Dev	Median	Minimum	Maximum
Full sample					
CF_{AIP}	0.020	0.093	0.021	-0.879	0.722
I^*_{NEW}	0.071	0.054	0.063	-0.086	0.484
I^{ε}_{NEW}	0	0.095	-0.016	-0.746	1.049
FCF	-0.052	0.105	-0.044	-0.837	0.740
State firms					
CF_{AIP}	0.022	0.082	0.023	-0.675	0.489
I^*_{NEW}	0.064	0.049	0.057	-0.039	0.416
I^{ε}_{NEW}	-0.002	0.082	-0.016	-0.424	0.634
FCF	-0.043	0.088	-0.038	-0.686	0.427
State-Owned Legal Person firms					
CF_{AIP}	0.023	0.091	0.022	-0.879	0.595
I^*_{NEW}	0.079	0.056	0.069	-0.086	0.484
I^{ε}_{NEW}	0.001	0.103	-0.017	-0.746	1.049
FCF	-0.055	0.105	-0.049	-0.837	0.566
Other firms					
CF_{AIP}	0.010	0.110	0.014	-0.723	0.722
I^*_{NEW}	0.070	0.057	0.061	-0.056	0.381
I^{ε}_{NEW}	0.002	0.098	-0.013	-0.304	0.674
FCF	-0.059	0.124	-0.048	-0.830	0.740

Panel B: Relationship between over-investment (I^{ε}_{NEW}) and free cash flow (FCF)

$$I^{\varepsilon}_{NEW,t} = \beta_0 + \beta_1 FCF < 0_t + \beta_2 FCF > 0_t + \varepsilon$$

Full sample

Model	β_0	β_1	β_2	*Adjusted* R^2

Pooled	0.001	0.062	0.183	0.012
	(0.55)	(3.09)***	(4.78)***	
F-statistic for test $\delta_1=\delta_2$:				6.31**
Fama-MacBeth	0.001	0.064	0.209	
(4 years)	(0.29)	(1.68)	(2.51)	
T-statistic from annual coefficient estimates for test $\delta_1=\delta_2$:				2.21*

State firms

Model	β_0	β_1	β_2	*Adjusted* R^2
Pooled	-0.0005	0.093	0.229	0.020
	(-0.17)	(2.72)***	(3.48)***	
F-statistic for test $\delta_1=\delta_2$:				2.66*
Fama-MacBeth	-0.001	0.091	0.280	
(4 years)	(-0.20)	(1.31)	(2.04)	
T-statistic from annual coefficient estimates for test $\delta_1=\delta_2$:				3.93**

State-Owned Legal Person firms

Model	β_0	β_1	β_2	*Adjusted* R^2
Pooled	-0.004	-0.040	0.179	0.004
	(-1.13)	(-1.16)	(2.63)***	
F-statistic for test $\delta_1=\delta_2$:				6.62**
Fama-MacBeth	-0.004	-0.035	0.145	
(4 years)	(-0.48)	(-0.43)	(1.28)	
T-statistic from annual coefficient estimates for test $\delta_1=\delta_2$:				1.58

Other firms

Model	β_0	β_1	β_2	*Adjusted* R^2
Pooled	0.013	0.144	0.168	0.039
	(2.77)***	(2.28)**	(4.76)***	
F-statistic for test $\delta_1=\delta_2$:				0.09
Fama-MacBeth	0.012	0.169	0.243	
(4 years)	(1.35)	(2.48)	(1.20)	
T-statistic from annual coefficient estimates for test $\delta_1=\delta_2$:				3.20**

I_{NEW} is the difference between I_{TOTAL} and $I_{MANINTENANCE}$.
I^*_{NEW} is the fitted value from regression model IV in table 2. It is an estimate of the expected level of investment.
I^{ε}_{NEW} is the residual from regression model IV in table 2. It is an estimate of over-investment.
CF_{AIP} is cash flow from operating activities after maintenance investment expenditure. It is calculated as cash from operations less $I_{MAINTENANCE}$ plus research and development expenditure.
FCF is CF_{AIP} less I^*_{NEW}. *FCF* is cash flow beyond that necessary to maintain assets in place (including servicing existing debt obligations) and finance expected new investments (i.e., free cash flow).

FCF<0 (*FCF>0*) is equal to *FCF* for values of *FCF* less than (or greater than) zero and zero otherwise.
All investment and cash flow variables are scaled by average total assets.
t-values are reported in parentheses underneath coefficient estimates. *, **, *** indicates significance at the 10%, 5%, 1% level respectively.
For the pooled regressions, t-values are reported on the basis of Huber-White robust standard errors.
For the industry and industry-year group regressions the parameter estimates and are the weighted average (using the square root of the number of observations in each group as the weight) of individual group regression parameters. Test statistics are based on the across group variation in these parameters.

Table 4: Uses of free cash flow

This table presents an analysis of how free cash flow is used. Panel A shows the descriptive statistics of the uses of free cash flow for firms with different ownerships. Panel B shows how free cash flow is used for firms with different ownerships. The sample includes 3,460 firm-year observations with available data in *CSMAR* from 2001 to 2004.

Panel A: Descriptive statistics for how free cash flow is used

Sample	Mean	Std Dev	Median	Minimum	Maximum
Full sample					
FCF	-0.052	0.105	-0.044	-0.837	0.740
I^{ε}_{NEW}	0	0.095	-0.016	-0.746	1.049
ΔEquity	-0.0002	0.007	0	-0.092	0.164
ΔDebt	-0.030	0.111	-0.016	-0.859	0.657
ΔFinancial Assets	-0.012	0.094	-0.004	-0.750	0.550
Other Inv.	0.009	0.054	0	-0.402	0.523
Other	-0.018	0.207	-0.006	-1.562	1.436
State firms					
FCF	-0.043	0.088	-0.038	-0.686	0.427
I^{ε}_{NEW}	-0.002	0.082	-0.016	-0.424	0.634
ΔEquity	-0.0001	0.007	0	-0.080	0.143
ΔDebt	-0.023	0.113	-0.010	-0.859	0.657
ΔFinancial Assets	-0.009	0.080	-0.004	-0.750	0.338
Other Inv.	0.006	0.045	0	-0.239	0.399
Other	-0.014	0.173	-0.005	-0.941	0.912
State-Owned Legal Person firms					
FCF	-0.055	0.105	-0.049	-0.837	0.566
I^{ε}_{NEW}	0.001	0.103	-0.017	-0.746	1.049
ΔEquity	0.00004	0.008	0	-0.077	0.164
ΔDebt	-0.030	0.101	-0.016	-0.544	0.442
ΔFinancial Assets	-0.012	0.091	-0.005	-0.543	0.480
Other Inv.	0.009	0.059	0.00001	-0.402	0.451
Other	-0.024	0.219	-0.008	-1.562	1.436
Other firms					
FCF	-0.059	0.124	-0.048	-0.830	0.740
I^{ε}_{NEW}	0.002	0.098	-0.013	-0.304	0.674
ΔEquity	-0.0006	0.005	0	-0.092	0.014
ΔDebt	-0.041	0.1223	-0.026	-0.695	0.584
ΔFinancial Assets	-0.015	0.117	-0.006	-0.570	0.550

Other Inv.	0.012	0.056	0	-0.280	0.523
Other	-0.015	0.233	-0.004	-1.180	0.905

Panel B: How free cash flow is used

Sample	FCF>0 Firm-years		FCF<0 Firm-years	
	Average	Percent	Average	Percent
Full sample				
Sources	(n=895)		(n=2558)	
FCF	0.059	100%	-0.091	100%
Users				
I^{ε}_{NEW}	0.017	29%	-0.006	7%
ΔEquity	0.00016	0%	0.00018	0%
ΔDebt	0.006	10%	-0.043	47%
ΔFinancial Assets	0.048	81%	-0.0004	0%
Other Inv.	0.010	17%	0.0008	-1%
Other	-0.024	-41%	-0.048	53%
State firms				
Sources	(n=328)		(n=928)	
FCF	0.051	100%	-0.078	100%
Uses				
I^{ε}_{NEW}	0.014	27%	-0.009	12%
ΔEquity	0.0002	0%	0.00003	0%
ΔDebt	0.006	12%	-0.033	42%
ΔFinancial Assets	0.039	76%	-0.0005	1%
Other Inv.	0.005	10%	0.007	-9%
Other	-0.013	-25%	-0.039	50%
State-Owned Legal Person firms				
Sources	(n=342)		(n=1010)	
FCF	0.059	100%	-0.095	100%
Uses				
I^{ε}_{NEW}	0.011	19%	-0.002	2%
ΔEquity	-0.0004	-1%	0.0001	0%
ΔDebt	0.012	20%	-0.044	46%
ΔFinancial Assets	0.051	86%	-0.0008	1%
Other Inv.	0.013	22%	0.007	-7%
Other	-0.028	-47%	-0.055	58%
Other firms				

Sources	(n=225)		(n=2558)	
FCF	0.070	100%	-0.106	100%
Uses				
I^{ϵ}_{NEW}	0.032	46%	-0.008	8%
ΔEquity	0.0009	1%	0.0005	0%
ΔDebt	-0.0003	0%	-0.056	53%
ΔFinancial Assets	0.057	81%	0.0002	0%
Other Inv.	0.014	20%	0.011	-10%
Other	-0.035	-50%	-0.051	48%

Δ*Equity* is the net cash returned to shareholders for the period. It is calculated as the sum of repurchases, and dividends less cash raised from stock issuance.
Δ*Debt* is the net cash returned to debt holders for the period. It is calculated as long term debt reduction less long term debt issuance less changes in current debt.
Δ*Financial Assets* is the change in cash holdings. It is calculated as change in cash less change in short-term investments.
Other Investments is other investments made. It is calculated as increase in investments less sale of investments.
Other includes all other categories on the statement of cash flows not included in Δ*Equity*, Δ*Debt*, Δ*Financial Assets*, I^{ϵ}_{NEW} and *Other Investments*. It is calculated as the negative of the sum of exchange rate effects, other investing activities and other financing activities.
FCF is CF_{AIP} less I^{*}_{NEW}. *FCF* is cash flow beyond that necessary to maintain assets in place (including servicing existing debt obligations) and finance expected new investments.
CF_{AIP} is cash flow from operating activities after maintenance investment expenditure. It is calculated as cash from operations less $I_{MAINTENANCE}$ plus research and development expenditure.
I_{NEW} is the difference between I_{TOTAL} and $I_{MANINTENANCE}$. I_{NEW} represents investment expenditure after maintenance of existing assets in place. I_{TOTAL} is total investment expenditure. It is calculated as research and development expenditure, *RD* plus capital expenditure, *CAPEX* plus acquisition expenditure, *Acquisitions* less cash receipts from sale of property, plant and equipment, *SalePPE* (item 107). $I_{MAINTENANCE}$ is the investment expenditure necessary to maintain assets in place. This construct is estimated by reported depreciation and amortization.
I^{*}_{NEW} is the fitted value from the regression model IV in table 2. It is an estimate of the expected level of investment.
I^{ϵ}_{NEW} is the residual from the regression model IV in table 2. It is an estimate of over-investment.
All cash flows and investment variables are scaled by average total assets.

Table 5: Relation between governance structures, free cash flow and over-investment for full sample

This table shows the impact of governance factors on over-investment for full sample. The sample includes 3,460 firm-year observations with available data in *CSMAR* from 2001 to 2004.

$$I^{\varepsilon}{}_{NEW,t} = \beta_0 + \beta_1 FCF_t + \sum \phi_i Governance\_Factors_t + \sum \varphi_j Governance\_Factors_t * FCF_t + \varepsilon$$

Variable	Predicted sign	Model		
		I	II	III
Intercept		0.005	0.017	0.002
		(0.12)	(0.38)	(0.05)
FCF	+	0.288	0.282	0.323
		(2.67)***	(2.63)***	(2.68)***
Largest Shareholdings D1	+	0.010		
		(2.14)**		
Largest Shareholdings D2	-		-0.011	
			(-2.33)**	
Herfi3	-			-0.030
				(-2.03)**
State	+	-0.002	-0.002	-0.003
		(-0.54)	(-0.54)	(-0.76)
B share	-	-0.010	-0.010	-0.009
		(-1.49)	(-1.49)	(-1.40)
Tradable Share	+	0.005	0.005	-0.005
		(0.34)	(0.34)	(-0.32)
CEO Duality	+	-0.004	-0.004	-0.003
		(-0.65)	(-0.65)	(-0.62)
Board Size	-	-0.0005	-0.0005	-0.0005
		(-0.65)	(-0.65)	(-0.66)
Supervisor Size	-	-0.001	-0.001	-0.001
		(-0.76)	(-0.76)	(-0.88)
Executives Size	-	-0.0009	-0.0009	-0.0008
		(-1.12)	(-1.12)	(-1.04)
Outside Directors	+	0.004	0.004	0.005
		(0.21)	(0.21)	(0.23)
Non-paid Directors	-	-0.003	-0.003	-0.004
		(-0.36)	(-0.36)	(-0.51)
Non-paid Supervisors	-	-0.0006	-0.0006	-0.0009
		(-0.09)	(-0.09)	(-0.12)
Largest Shareholdings D1 FCF*	+	0.030		
		(0.78)		

Largest Shareholdings D2 FCF*	-		-0.030 (-0.78)	
Herfi3 FCF*	-			-0.152 (-1.24)
State FCF*	+	0.055 (1.48)	0.055 (1.48)	0.053 (1.44)
B share FCF*	-	0.111 (1.31)	0.111 (1.31)	0.118 (1.40)
Tradable Share FCF*	+	0.029 (0.22)	0.029 (0.22)	-0.046 (-0.31)
CEO Duality FCF*	+	0.020 (0.43)	0.020 (0.43)	0.017 (0.37)
Board Size FCF*	-	-0.010 (-1.50)	-0.010 (-1.50)	-0.010 (-1.39)
Supervisor Size FCF*	-	-0.016 (-1.91)**	-0.016 (-1.91)**	-0.017 (-2.01)**
Executives Size FCF*	-	0.00002 (0.00)	0.00002 (0.00)	0.001 (0.13)
Outside Directors FCF*	+	0.035 (0.31)	0.035 (0.31)	0.014 (0.12)
Non-paid Directors FCF*	-	-0.045 (-0.59)	-0.045 (-0.59)	-0.060 (-0.77)
Non-paid Supervisors FCF*	-	-0.024 (-0.36)	-0.024 (-0.36)	-0.024 (-0.36)
Size		0.0005 (0.24)	0.0005 (0.24)	0.001 (0.65)
Leverage		-0.007 (-0.74)	-0.007 (-0.74)	-0.008 (-0.80)
Fixed Effects		included	included	included
Adjusted R-square		0.010	0.010	0.010
Observations		3260	3260	3260

See earlier tables for definitions of I^{ε}_{NEW} and FCF.

The governance factors are collected or calculated based on an analysis of principal components in CSMAR 2005. All the important factors representing the underlying dimensions of corporate governance are included. The factors are standardized combinations of the following variables (Debt is excluded as leverage is included in the investment expectation model):

Largest Shareholdings D1 is a dummy variable which equals one if the largest shareholdings is less than 25%, and zero otherwise.

Largest Shareholdings D2 is a dummy variable which equals one if the largest shareholdings is greater than 25%, and zero otherwise.

Herfi3 is the ownership concentration variable, which is defined by the average of the square of the 3 largest shareholders ownership.

State is a dummy variable which equals one if the largest shareholder is a state shareholder, and zero otherwise.

B share is a dummy variable which equals one if the listed firm is also listed as B shares, and zero otherwise.
Tradable Share is the proportion of the number of tradable shares to the number of total shares.
CEO Duality is a dummy variable which equals one if the CEO and the chairman of the board of directors is the same person, and zero otherwise.
Board Size is the total number of directors on the board of directors.
Supervisor Size is the total number of directors on the board of supervisors.
Executives Size is the total number of executives on the board of directors.
Outside Directors is the proportion of the number of outside directors on the board to the total number of directors on the board.
Non-paid Directors is the proportion of the number of directors who do not receive compensation from the firm to the total number of directors on the board of directors.
Non-paid Supervisors is the proportion of the number of supervisors who does not receive compensation from the firm to the total number of supervisors on the board of supervisors.
Size is the natural logarithm of total assets.
Leverage is defined as the ratio of total debts to total assets.
Fixed Effects include dummy variables controlling for fixed effects of calendar years and industry.
t-values are reported in parentheses below coefficient estimates. We use OLS models to estimate the coefficients, and at the same time we take into account the heteroskedasticity of the samples and the multicollinearity of the variables. *, **, *** indicates significance at the 10%, 5%, 1% level respectively.

Table 6: Relation between governance structures, free cash flow and over-investment for subsamples

The sample includes 3,460 firm-year observations with available data in *CSMAR* from 2001 to 2004. Panel A presents the descriptive statistics between over-investment firms and under-investment firms; Panel B examines whether agency costs have an important impact on over-investment; Panel C examines whether information asymmetries have an important impact on under-investment.

$$\left|I^{\varepsilon}{}_{NEW,t}\right| = \beta_0 + \beta_1 FCF_t + \sum \phi_i Governance\_Factors_t + \sum \varphi_j Governance\_Factors_t * FCF_t + \varepsilon$$

Panel A: Descriptive statistics between over-investment firms and under-investment firms

Variable	Mean			Median		
	Over-inv.	Under-inv.	t	Over-inv.	Under-inv.	Wilcoxon Z
FCF	-0.039	-0.060	-5.58***	-0.033	-0.049	-6.09**
Largest Shareholdings	0.384	0.387	0.48	0.380	0.386	0.47
Herfi3	0.206	0.210	0.69	0.168	0.172	0.77
State	0.354	0.368	0.81	0	0	0.80
State Share	0.275	0.284	0.98	0.261	0.285	0.80
B share	0.070	0.090	2.13**	0	0	2.07**
Tradable Share	0.406	0.401	-1.30	0.392	0.380	-1.84*
CEO Duality	0.112	0.107	-0.41	0	0	-0.40
Board Size	9.641	9.712	0.84	9	9	0.69
Supervisor Size	4.339	4.311	-0.56	5	5	-0.91
Executives Size	5.857	5.958	1.28	6	6	1.20
Outside Directors	0.158	0.156	-0.43	0.181	0.166	-0.30
Non-paid Directors	0.419	0.421	0.19	0.444	0.444	0.08
Non-paid Supervisors	0.412	0.400	-1.15	0.400	0.400	-1.11
Dividends	0.293	0.269	-1.55	0	0	-1.55
Size	21.074	21.025	-1.60*	21.031	20.973	-1.74*
Leverage	0.471	0.465	-0.97	0.473	0.463	-0.87
Observations	1327	2133	-	1327	2133	-

Panel B: Relation between over-investment (I^{ε}_{NEW} >0) and free cash flow (FCF)

Variable	Predicted sign	Model		
		I	II	III
Intercept		0.248	0.262	0.250

		(3.48)***	(3.66)***	(3.46)***
FCF	+	0.534	0.603	0.583
		(3.11)***	(3.24)***	(2.95)***
Largest Shareholdings D1	+	0.013		
		(1.82)*		
Largest Shareholdings D2	-		-0.013	
			(-1.82)*	
Herfi3	-			-0.014
				(-0.62)
State	+	-0.006	-0.006	-0.008
		(-1.08)	(-1.08)	(-1.33)
B share	-	-0.006	-0.006	-0.005
		(-0.58)	(-0.58)	(-0.48)
Tradable Share	-	-0.035	-0.034	-0.034
		(-1.44)	(-1.44)	(-1.23)
CEO Duality	-	-0.008	-0.008	-0.006
		(-0.88)	(-0.88)	(-0.73)
Board Size	-	-0.001	-0.001	-0.001
		(-1.20)	(-1.20)	(-1.14)
Supervisor Size	-	-0.003	-0.003	-0.003
		(-1.58)	(-1.58)	(-1.63)
Executives Size	-	-0.0006	-0.0006	-0.0006
		(-0.53)	(-0.53)	(-0.52)
Outside Directors	+	0.027	0.027	0.029
		(0.82)	(0.82)	(0.88)
Non-paid Directors	-	0.021	0.021	0.020
		(1.53)	(1.53)	(1.47)
Non-paid Supervisors	-	-0.013	-0.013	-0.014
		(-1.11)	(-1.11)	(-1.19)
Largest Shareholdings D1 FCF*	+	0.069		
		(1.15)		
Largest Shareholdings D2 FCF*	-		-0.069	
			(-1.15)	
Herfi3 FCF*	-			-0.116
				(-0.58)
State FCF*	+	0.156	0.156	0.146
		(2.46)**	(2.46)**	(2.32)**

B share FCF*	-	0.181	0.181	0.201
		(1.36)	(1.36)	(1.51)
Tradable Share FCF*	-	-0.368	-0.368	-0.375
		(-1.61)*	(-1.61)*	(-1.49)
CEO Duality FCF*	-	-0.081	-0.081	-0.076
		(-1.03)	(-1.03)	(-0.96)
Board Size FCF*	-	-0.007	-0.007	-0.007
		(-0.60)	(-0.60)	(-0.62)
Supervisor Size FCF*	-	-0.095	-0.095	-0.095
		(-4.82)***	(-4.82)***	(-4.79)***
Executives Size FCF*	-	-0.007	-0.007	-0.007
		(-0.60)	(-0.60)	(-0.58)
Outside Directors FCF*	+	0.229	0.229	0.221
		(1.25)	(1.25)	(1.18)
Non-paid Directors FCF*	-	-0.066	-0.066	-0.077
		(-0.52)	(-0.52)	(-0.59)
Non-paid Supervisors FCF*	-	0.086	0.086	0.083
		(0.79)	(0.79)	(0.76)
Size		-0.003	-0.003	-0.003
		(-1.14)	(-1.14)	(-1.00)
Leverage		-0.098	-0.098	-0.096
		(-6.01)***	(-6.01)***	(-5.86)***
Fixed Effects		included	included	included
Adjusted R-Square		0.082	0.082	0.080
Observations		1275	1275	1275

Panel C: Relation between under-investment (I^{ε}_{NEW} <0) and free cash flow (FCF)

Variable	Predicted sign	Model		
		I	II	III
Intercept		0.090	0.085	0.094
		(3.56)***	(3.37)***	(3.68)***
FCF	-	-0.099	-0.139	-0.127
		(-1.62)*	(-2.09)**	(-1.83)*
Largest Shareholdings D1	-	-0.005		
		(-1.67)*		
Largest Shareholdings D2	+		0.005	
			(1.67)*	

Herfi3	+			0.018
				(2.06)**
State	+	-0.0006	-0.0006	-0.0002
		(-0.24)	(-0.24)	(-0.09)
B share	-	0.001	0.001	0.001
		(0.40)	(0.40)	(0.40)
Tradable Share	-	-0.013	-0.013	-0.005
		(-1.40)	(-1.40)	(-0.52)
CEO Duality	+	0.007	0.007	0.007
		(1.94)**	(1.95)**	(1.96)**
Board Size	+	-0.0007	-0.0007	-0.0006
		(-1.43)	(-1.43)	(-1.34)
Supervisor Size	-	-0.0004	-0.0004	-0.0004
		(-0.55)	(-0.55)	(-0.48)
Executives Size	-	-0.0001	-0.0001	-0.0001
		(-0.31)	(-0.31)	(-0.37)
Outside Directors	+	0.023	0.023	0.022
		(1.73)*	(1.73)*	(1.64)*
Non-paid Directors	+	0.009	0.009	0.010
		(1.64)*	(1.64)*	(1.77)*
Non-paid Supervisors	+	0.007	0.007	0.007
		(1.45)	(1.45)	(1.55)
Largest Shareholdings D1 FCF*	-	-0.039		
		(-1.69)*		
Largest Shareholdings D2 FCF*	+		0.039	
			(1.69)*	
Herfi3 FCF*	+			0.056
				(0.81)
State FCF*	+	0.041	0.041	0.043
		(1.94)**	(1.94)**	(2.06)**
B share FCF*	-	0.069	0.069	0.067
		(1.38)	(1.38)	(1.33)
Tradable Share FCF*	-	-0.242	-0.242	-0.237
		(-3.07)***	(-3.07)***	(-2.74)***
CEO Duality FCF*	+	0.030	0.030	0.030
		(1.06)	(1.06)	(1.05)
Board Size FCF*	+	0.008	0.008	0.008

		(2.02)**	(2.02)**	(2.00)**
Supervisor Size FCF*	-	-0.006	-0.006	-0.007
		(-1.51)	(-1.51)	(-1.52)
Executives Size FCF*	-	-0.003	-0.003	-0.003
		(-0.75)	(-0.75)	(-0.80)
Outside Directors FCF*	+	0.304	0.304	0.299
		(4.46)***	(4.46)***	(4.36)***
Non-paid Directors FCF*	+	0.003	0.003	0.007
		(0.09)	(0.09)	(0.16)
Non-paid Supervisors FCF*	+	0.010	0.010	0.021
		(0.25)	(0.25)	(0.54)
Size		-0.001	-0.001	-0.001
		(-0.86)	(-0.86)	(-1.31)
Leverage		-0.043	-0.043	-0.041
		(-7.30)***	(-7.30)***	(-6.96)***
Fixed Effects		included	included	included
Adjusted R-Square		0.148	0.148	0.149
Observations		1986	1986	1986

See earlier tables for definitions of the variables.
t-values are reported in parentheses below coefficient estimates. We use OLS models to estimate the coefficients, and at the same time we take into account the heteroskedasticity of the samples and the multicollinearity of the variables. *, **, *** indicates significance at the 10%, 5%, 1% level respectively.

Table 7: Robustness check on the relation between governance structures, free cash flow and over-investment with *different ownership thresholds*

This table shows the impact of governance factors on the relationship between free cash flow and over-investment or under-investment, with different ownership thresholds, 20% and 30%. The sample includes 3,460 firm-year observations with available data in *CSMAR* from 2001 to 2004.

$$I^{\varepsilon}{}_{NEW,t} = \beta_0 + \beta_1 FCF_t + \sum \phi_i Governance\_Factors_t + \sum \varphi_j Governance\_Factors_t * FCF_t + \varepsilon$$

Variable	Predicted sign	Sample					
		Full sample		$I^{\varepsilon}_{NEW}>0$		$I^{\varepsilon}_{NEW}<0$	
		Threshold=20%	Threshold=30%	Threshold=20%	Threshold=30%	Threshold=20%	Threshold=30%
Intercept		0.008	0.005	0.247	0.243	0.088	0.088
		（0.20）	（0.10）	(3.46)***	(3.36)***	(3.47)***	(3.40)***
FCF	+	0.260	0.252	0.565	0.529	-0.114	-0.112
		(2.45)**	(2.37)**	(3.28)***	(3.09)***	(-1.84)*	(-1.79)*
Largest Shareholdings D1	+	0.009	0.004	0.018	0.004	-0.002	-0.001
		(1.66)*	(0.90)	(2.10)**	(0.68)	(-0.56)	(-0.25)
State	+	-0.003	-0.003	-0.007	-0.008	-0.0003	-0.0003
		(-0.66)	(-0.70)	(-1.16)	(-1.27)	(-0.14)	(-0.14)
B share	-	-0.010	-0.010	-0.005	-0.005	0.001	0.001
		(-1.39)	(-1.44)	(-0.44)	(-0.53)	(0.35)	(0.33)
Tradable Share	+	0.009	0.010	-0.035	-0.030	-0.016	-0.016
		(0.54)	(0.64)	(-1.45)	(-1.23)	(-1.70)*	(-1.73)*
CEO Duality	+	-0.003	-0.003	-0.008	-0.006	0.007	0.007
		(-0.56)	(-0.45)	(-1.90)*	(-0.67)*	(1.79)*	(1.78)*
Board Size	-	-0.0006	-0.0006	-0.001	-0.001	-0.0007	-0.0007
		(-0.66)	(-0.67)	(-1.19)	(-1.22)	(-1.45)	(-1.46)

Supervisor Size	-	-0.001	-0.001	-0.004	-0.003	-0.0004	-0.0004
		(-0.79)	(-0.80)	(-1.64)*	(-1.59)	(-0.51)	(-0.51)
Executives Size	-	-0.0009	-0.0009	-0.0006	-0.0007	-0.0001	-0.0001
		(-1.09)	(-1.14)	(-0.45)	(-0.51)	(-0.27)	(-0.29)
Outside Directors	+	0.004	0.006	0.028	0.029	0.023	0.023
		(0.20)	(0.29)	(0.85)	(0.88)	(1.69)*	(1.69)*
Non-paid Directors	-	-0.003	-0.003	0.021	0.021	0.009	0.009
		(-0.30)	(-0.34)	(1.50)	(1.51)	(1.58)	(1.59)
Non-paid Supervisors	-	-0.0009	-0.001	-0.013	-0.014	0.007	0.007
		(-0.12)	(-0.14)	(-1.13)	(-1.20)	(1.49)	(1.51)
Largest Shareholdings D1 FCF*	+	0.085	0.019	0.157	0.039	-0.019	-0.012
		(1.88)*	(0.53)	(2.09)**	(0.71)	(-0.74)	(-0.57)
State FCF*	+	0.056	0.046	0.151	0.136	0.042	0.041
		(1.52)	(1.24)	(2.42)**	(2.13)**	(2.00)**	(1.92)*
B share FCF*	-	0.117	0.113	0.205	0.194	0.068	0.068
		(1.38)	(1.34)	(1.54)	(1.46)	(1.35)	(1.35)
Tradable Share FCF*	+	−0.010	0.080	-0.412	-0.259	-0.263	-0.264
		(−0.08)	(0.59)	(-1.83)*	(-1.13)*	(-3.34)***	(-3.31)***
CEO Duality FCF*	+	0.024	0.029	-0.082	-0.073	0.027	0.029
		(0.50)	(0.60)	(-1.03)	(-0.91)	(0.92)	(1.02)
Board Size FCF*	-	-0.010	-0.011	-0.008	-0.008	0.008	0.008
		(-1.46)	(-1.53)	(-0.70)	(-0.63)	(1.99)**	(1.97)**
Supervisor Size FCF*	-	-0.017	-0.016	-0.097	-0.096	-0.007	-0.007
		(-2.02)**	(-1.87)*	(-4.87)***	(-4.78)***	(-1.73)*	(-1.55)
Executives Size FCF*	-	0.0005	-0.0007	-0.007	-0.008	-0.003	-0.003
		(0.06)	(-0.09)	(-0.53)	(-0.66)	(-0.68)	(-0.72)
Outside Directors FCF*	+	0.003	0.053	0.162	0.260	0.297	0.296
		(0.02)	(0.46)	(0.87)	(1.42)	(4.34)***	(4.32)***

Non-paid Directors FCF*	-	-0.048	-0.040	-0.073	-0.041	0.001	0.003
		(-0.62)	(-0.51)	(-0.57)	(-0.31)	(0.04)	(0.07)
Non-paid Supervisors FCF*	-	-0.014	-0.031	0.092	0.062	0.015	0.018
		(-0.20)	(-0.47)	(0.84)	(0.56)	(0.38)	(0.44)
Size		0.0004	0.0007	-0.004	-0.003	-0.001	-0.001
		(0.18)	(0.35)	(-1.15)	(-1.01)	(-0.80)	(-0.79)
Leverage		-0.006	-0.007	-0.098	-0.098	-0.043	-0.043
		(-0.60)	(-0.75)	(-6.00)***	(-5.97)***	(-7.30)***	(-7.24)***
Fixed Effects		included	included	included	included	included	included
Adjusted R-Square		0.011	0.010	0.084	0.081	0.147	0.147
F value		2.43***	2.31***	3.45***	3.33***	8.15***	8.15***
Observations		3260	3260	1275	1275	1986	1986

See earlier tables for definitions of the variables.
t-values are reported in parentheses below coefficient estimates. We use OLS models to estimate the coefficients, and at the same time we take into account the heteroskedasticity of the samples and the multicollinearity of the variables. *, **, *** indicates significance at the 10%, 5%, 1% level respectively.

Table 8: Robustness check on the relation between governance structures, free cash flow and over-investment *without constant term*

This table shows the impact of governance factors on the relationship between free cash flow and over-investment or under-investment, without constant term. The sample includes 3,460 firm-year observations with available data in *CSMAR* from 2001 to 2004.

$$I^{\varepsilon}_{NEW,t} = \beta_0 FCF_t + \sum \varphi_i Governance\_Factors_t + \sum \phi_j Governance\_Factors_t * FCF_t + \varepsilon$$

Variable	Predicted sign	Sample					
		Full sample		$I^{\varepsilon}_{NEW}>0$		$I^{\varepsilon}_{NEW}<0$	
		D1=Dummy	D1=Continuous	D1=Dummy	D1=Continuous	D1=Dummy	D1=Continuous
FCF	+	0.249	0.351	0.458	0.574	-0.114	-0.187
		(2.37)**	(2.81)***	(2.68)***	(2.78)***	(-1.84)*	(-2.51)**
Largest Shareholdings D1	+	0.011	0.0002	0.015	0.0008	-0.002	0.0002
		(2.34)**	(2.06)**	(1.97)**	(3.68)***	(-0.56)	(2.16)**
Largest Shareholdings D2	-		-0.0001		-0.003		0.0001
			(-1.24)		(-1.28)		(0.96)
State	+	-0.002	-0.002	-0.007	-0.006	-0.0003	0.0002
		(-0.54)	(-0.68)	(-1.12)	(-1.00)	(-0.14)	(0.07)
B share	-	-0.010	-0.010	-0.012	-0.010	0.001	-0.002
		(-1.53)	(-1.46)	(-1.13)	(-0.92)	(0.35)	(-0.44)
Tradable Share	+	0.005	0.0002	-0.032	-0.033	-0.016	-0.015
		(0.35)	(0.01)	(-1.31)	(-1.22)	(-1.70)*	(-1.47)
CEO Duality	+	-0.004	-0.004	-0.008	-0.002	0.007	0.007
		(-0.65)	(-0.46)	(-0.83)	(-0.27)	(1.79)*	(1.93)*
Board Size	-	-0.0005	-0.0006	-0.002	-0.001	-0.0007	-0.0006
		(-0.66)	(-0.70)	(-1.37)	(-1.07)	(-1.45)	(-1.27)

Supervisor Size	-	-0.001	-0.001	-0.003	-0.003	-0.0004	-0.0003
		(-0.76)	(-0.83)	(-1.46)	(-1.61)	(-0.51)	(-0.42)
Executives Size	-	-0.0009	-0.0009	-0.0006	-0.0007	-0.0001	-0.0003
		(-1.12)	(-1.06)	(-0.49)	(-0.55)	(-0.27)	(-0.56)
Outside Directors	+	0.005	0.004	0.036	-0.015	0.023	0.008
		(0.22)	(0.19)	(1.10)	(-0.75)	(1.69)*	(1.00)
Non-paid Directors	-	-0.003	-0.004	0.026	0.027	0.009	0.010
		(-0.35)	(-0.40)	(1.85)*	(1.91)*	(1.58)	(1.84)*
Non-paid Supervisors	-	-0.0006	-0.0007	-0.011	-0.010	0.007	0.010
		(-0.08)	(-0.10)	(-0.88)	(-0.87)	(1.49)	(2.12)**
Largest Shareholdings D1 FCF*	+	0.031	0.003	0.071	0.006	-0.019	0.001
		(0.78)	(1.31)	(1.17)	(1.45)	(-0.74)	(0.56)
Largest Shareholdings D2 FCF*	+		-0.0007		-0.0002	-0.019	0.0003
			(-1.62)		(-0.10)	(-0.74)	(0.42)
State FCF*	+	0.055	0.055	0.160	0.143	0.042	0.041
		(1.48)	(1.47)	(2.52)**	(2.28)**	(2.00)**	(1.92)*
B share FCF*	-	0.111	0.114	0.151	0.182	0.068	0.051
		(1.31)	(1.35)	(1.13)	(1.38)	(1.35)	(1.01)
Tradable Share FCF*	+	0.031	-0.030	-0.325	-0.284	-0.263	-0.206
		(0.23)	(-0.21)	(-1.42)	(-1.17)*	(-3.34)***	(-2.44)**
CEO Duality FCF*	+	0.021	0.019	-0.072	-0.043	0.027	0.027
		(0.43)	(0.40)	(-0.90)	(-0.55)	(0.92)	(0.95)
Board Size FCF*	-	-0.011	-0.010	-0.007	-0.006	0.008	0.009
		(-1.49)	(-1.41)	(-0.60)	(-0.51)	(1.99)**	(2.23)**
Supervisor Size FCF*	-	-0.016	-0.018	-0.096	-0.099	-0.007	-0.006
		(-1.96)**	(-2.11)**	(-4.79)***	(-4.98)***	(-1.73)*	(-1.34)
Executives Size FCF*	-	0.0007	0.0009	-0.004	-0.003	-0.003	-0.003
		(0.01)	(0.11)	(-0.30)	(-0.22)	(-0.68)	(-0.59)

Outside Directors FCF*	+	0.036	-0.010	0.280	0.300	0.297	0.315
		(0.31)	(-0.08)	(1.53)	(1.59)	(4.34)***	(4.51)***
Non-paid Directors FCF*	-	-0.045	-0.052	-0.027	-0.023	0.001	-0.002
		(-0.58)	(-0.66)	(-0.21)	(-0.17)	(0.04)	(-0.04)
Non-paid Supervisors FCF*	-	-0.023	-0.018	0.095	0.101	0.015	0.046
		(-0.35)	(-0.28)	(0.86)	(0.93)	(0.38)	(1.15)
Size		0.0007	0.001	0.007	0.008	-0.001	0.003
		(0.96)	(1.84)*	(6.29)***	(7.51)***	(-0.80)	(6.81)***
Leverage		-0.007	-0.007	-0.096	-0.097	-0.043	-0.046
		(-0.73)	(-0.76)	(-5.83)***	(-6.13)***	(-7.30)***	(-8.03)***
Fixed Effects		included	included	included	included	included	included
Adjusted R-Square		0.010	0.010	0.456	0.452	0.147	0.603
F-value		2.43***	2.26***	23.29***	40.07***	8.15***	113.01***
Observations		3260	3260	1275	1275	1986	1986

See earlier tables for definitions of the variables.
t-values are reported in parentheses below coefficient estimates. We use OLS models to estimate the coefficients, and at the same time we take into account the heteroskedasticity of the samples and the multicollinearity of the variables. *, **, *** indicates significance at the 10%, 5%, 1% level respectively.

Table 9: Robustness check on the endogeneity of governance factors *with panel data approach*

This table shows the results examining the endogeneity of governance factors with panel data approach. The firm and year features are added to the model to run the regression. The sample includes 683 firms with available data in *CSMAR* from 2001 to 2004.

$$I^{\varepsilon}_{NEW,it} = \beta_0 FCF_{it} + \sum \varphi_i Governance\_Factors_{it} + \sum \phi_j Governance\_Factors_{it} * FCF_{it} + Firm_i + Year_t + \varepsilon$$

Variable	Predicted sign	Model		
		I	II	III
FCF	+	0.187 (8.97)***	0.184 (8.56)***	0.184 (8.55)***
Largest Shareholdings D1	+	0.0001 (1.24)		
Largest Shareholdings D2	-		-0.0002 (-0.55)	
Herfi3	-			-0.016 (-0.61)
State	+	0.007 (0.50)	0.008 (0.54)	0.007 (0.52)
B share	-	0.061 (0.81)	0.059 (0.79)	0.059 (0.78)
Tradable Share	+	-0.107 (-1.51)	-0.105 (-1.48)	-0.107 (-1.51)
CEO Duality	+	-0.004 (-0.35)	-0.003 (-0.27)	-0.003 (-0.28)
Board Size	-	0.0002 (0.12)	0.0002 (0.12)	0.0002 (0.13)
Supervisor Size	-	-0.005 (-1.66)*	-0.005 (-1.65)*	-0.005 (-1.66)*
Executives Size	-	0.0006 (0.42)	0.0008 (0.51)	0.0008 (0.52)
Outside Directors	+	0.001 (0.04)	0.008 (0.27)	0.007 (0.25)
Non-paid Directors	-	-0.011 (-0.77)	-0.013 (-0.85)	-0.013 (-0.85)
Non-paid Supervisors	-	-0.001 (-0.10)	-0.002 (-0.12)	-0.002 (-0.12)
Largest Shareholdings D1 FCF*	+	0.005 (1.98)**		
Largest Shareholdings D2 FCF*	-		-0.0001 (-0.78)	

Herfi3 FCF*	-			-0.047
				(-0.31)
State FCF*	+	0.137	0.136	0.137
		(2.73)***	(2.71)***	(2.74)***
B share FCF*	-	0.205	0.209	0.210
		(1.78)*	(1.82)*	(1.82)*
Tradable Share FCF*	+	0.297	0.364	0.340
		(1.77)*	(2.00)**	(1.83)*
CEO Duality FCF*	+	0.004	0.004	0.002
		(0.07)	(0.07)	(0.03)
Board Size FCF*	-	-0.002	-0.003	-0.002
		(-0.17)	(-0.28)	(-0.26)
Supervisor Size FCF*	-	-0.019	-0.016	-0.016
		(-1.72)*	(-1.66)*	(-1.67)*
Executives Size FCF*	-	0.014	0.014	0.014
		(1.33)	(1.38)	(1.38)
Outside Directors FCF*	+	-0.062	0.019	0.010
		(-0.42)	(0.13)	(0.07)
Non-paid Directors FCF*	-	0.055	0.062	0.058
		(0.55)	(0.61)	(0.57)
Non-paid Supervisors FCF*	-	-0.010	-0.026	-0.025
		(-0.13)	(-0.32)	(-0.30)
Size		-0.038	-0.039	-0.039
		(-3.43)***	(-3.48)***	(-3.48)***
Leverage		-0.057	-0.058	-0.058
		(-2.05)**	(-2.07)**	(-2.07)**
R-Square		0.325	0.324	0.324
F-value		1.34***	1.34***	1.34***
Number of firms		687	687	687

See earlier tables for definitions of the variables.
t-values are reported in parentheses below coefficient estimates. We use OLS models to estimate the coefficients, and at the same time we take into account the heteroskedasticity of the samples and the multicollinearity of the variables. *, **, *** indicates significance at the 10%, 5%, 1% level respectively.

Table 10: Robustness check on the endogeneity between free cash flow and abnormal investments (I^{ε}_{NEW}) *with 2SLS approach*

This table shows the results examining the endogeneity between free cash flow and abnormal investments (I^{ε}_{NEW}) with 2SLS approach based on two instrumental variables: *Tradable Share* and *Outside Directors*. The sample includes 683 firms with available data in *CSMAR* from 2001 to 2004.

$$I^{\varepsilon}_{NEW,it} = \beta_0 FCF_{it} + \sum \varphi_i Governance\_Factors_{it} + \sum \phi_j Governance\_Factors_{it} * FCF_{it} + Firm_i + Year_t + \varepsilon$$

Variable	Model			
	(1) *FCF*	(2) I^{ε}_{NEW}	(1) *FCF*	(2) I^{ε}_{NEW}
FCF		0.243		0.240
		(2.53)**		(2.49)**
Largest Shareholdings D1	-0.006	0.010		
	(-1.40)	(2.24)**		
Herfi3			0.042	-0.022
			(3.06)***	(-1.98)**
State	0.007	-0.002	0.007	-0.003
	(1.77)*	(-0.53)	(1.82)*	(-0.72)
B share	0.025	-0.010	0.025	-0.010
	(3.79)***	(-1.53)	(3.78)***	(-1.52)
Tradable Share	-0.060	-	-0.037	-
	(-3.95)***	-	(-2.15)**	-
CEO Duality	-0.011	-0.003	-0.010	-0.003
	(-1.87)*	(-0.55)	(-1.73)*	(-0.49)
Board Size	0.001	-0.001	0.001	-0.001
	(1.08)	(-0.91)	(1.23)	(-0.84)
Supervisor Size	-0.001	-0.001	-0.001	-0.001
	(-0.96)	(-0.78)	(-0.84)	(-0.75)
Executives Size	-0.0008	-0.001	-0.0008	-0.001
	(-0.98)	(-1.24)	(-1.03)	(-1.04)
Outside Directors	0.050	-	0.054	-
	(3.75)***	-	(4.12)***	-
Non-paid Directors	0.007	-0.001	0.010	-0.002
	(0.86)	(-0.13)	(1.14)	(-0.23)
Non-paid Supervisors	-0.015	-0.002	-0.016	-0.002
	(-2.05)**	(-0.24)	(-2.10)**	(-0.22)
Largest Shareholdings D1 FCF*		0.032		
		(0.89)		
Herfi3 FCF*				-0.145
				(-0.95)
State FCF*		0.054		0.053

		(1.46)		(1.40)
B share FCF*		0.109		0.114
		(1.30)		(1.34)
CEO Duality FCF*		0.022		0.020
		(0.47)		(0.40)
Board Size FCF*		-0.014		-0.010
		(-1.24)		(-1.05)
Supervisor Size FCF*		-0.017		-0.016
		(-1.68)*		(-1.69)*
Executives Size FCF*		-0.003		0.001
		(-0.26)		(0.08)
Non-paid Directors FCF*		-0.060		-0.059
		(-0.78)		(-0.77)
Non-paid Supervisors FCF*		-0.033		-0.019
		(-0.45)		(-0.27)
Size	-0.004	0.001	-0.005	0.002
	(-6.58)***	(2.03)**	(-7.05)***	(2.54)**
Leverage	0.106	-0.008	0.109	-0.007
	(10.20)***	(-0.81)	(10.49)***	(-0.79)
Adjusted R-Square	0.047	0.018	0.049	0.018
Observations	3260	3260	3260	3260

See earlier tables for definitions of the variables.
t-values are reported in parentheses below coefficient estimates. We use OLS models to estimate the coefficients, and at the same time we take into account the heteroskedasticity of the samples and the multicollinearity of the variables. *, **, *** indicates significance at the 10%, 5%, 1% level respectively.

Free Cash Flow, Over-Investment and Corporate Governance in China

Highlights:

- How free cash flows affect over-investment for Chinese firms.
- How corporate governance affects over-investment or under-investment.
- Chinese firms' over-investment is excessively sensitive to current free cash flow.
- Chinese firms' corporate governance characteristics are associated with over-investment or under-investment.