Excess Cash Holdings and Investment: The Moderating Roles of Financial Constraints and Managerial Entrenchment

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Abstract

Our study investigates the relationship between excess cash holdings and investment behavior, under both financial constraints and managerial entrenchment, based upon a sample of Taiwanese firms, which are in the environment characterized by poor legal protection for investors, with the data covering the years 2000 to 2006. We find that excess cash is significantly sensitive to both total investment and capital expenditure, particularly for firms with financially constrained and severe managerial entrenchment. However, the evidence shows that the problems of both underinvestment and overinvestment are found to have less distorting effect on the use of excess cash for R&D expenditure.

1 Introduction

How the determinants complement each other to influence a firm's investment decisions is important in the study of corporate finance. There are a variety of distortionary forces preventing a firm from pursuing optimal investment level when the presumption of perfect market is violated. Information asymmetries and agency problems are the most important factors influencing investment efficiency (Stein, 2003). In addition, cash holdings are strongly related to a firm's investment when facing these frictions. On the one hand, adverse selection problem arises because managers are reluctant to issue undervalued securities due to information asymmetries, which leads to underinvestment. Also, cash holdings can prevent firms with high external financing cost (i.e., financially constrained firms) from giving up positive NPV projects. Such phenomenon therefore makes investment sensitive to cash holdings. On the other hand, empire-building preferences would lead to overinvestment, causing entrenched managers to spend all available funds on investment (Jensen 1986). This also leads to the investment increasing in cash holdings.

Prior literatures have shown how cash holdings are associated with investment when either financial constraints or corporate governance is considered. Almeida et al. (2004) indicate that financially constrained firms tend to save cash, whereas unconstrained firms do not. Consistent with the costly external finance view of Faulkender and Wang (2006) and Pinkowitz and Williamson (2004) that the cash holdings are more valuable for constrained

than for unconstrained firms, Denis and Sibilkov (2010) explain that higher cash holdings allow financially constrained firms to undertake value-increasing projects that might be bypassed. Another strand of research addresses the agency cost hypotheses. Recent studies document that poor corporate governance is detrimental to the value of corporate cash holdings (see e.g. Dittmar et al. 2003; Pincowitz et al. 2006; Dittmar and Mahr-Smith 2007). Dittmar and Mahrt-Smith (2007) investigates that US firms with poor corporate governance dissipate excess cash quickly. Harford et al. (2008) propose their findings are consistent with spending hypotheses that self-interested managers of US firms use excess cash to increase capital expenditures and acquisitions.

Based upon these two lines of research, we tend to explore the moderating effect of financial constraints and managerial entrenchment on the association between excess cash holdings and investment. Using a study sample of 4,428 firm-year observations covering the years from 2000 to 2006, we focus on the effects of excess cash on three types of investment expenditure, namely: (i) capital expenditure; (ii) R&D expenditure; and (iii) total investment. We apply five constraints criteria which are on behalf of the emerging market and develop a managerial entrenchment index to capture the governance mechanism of Taiwan.

Splitting our sample for testing the costly external finance hypotheses in accordance with the financial constraint criteria, our results show that capital expenditure and total investment have statistically significant sensitivity to excess cash, and that this is stronger for constrained

firms, which provide support for the underinvestment argument. However, although excess cash is found to be significantly and positively correlated with R&D expenditure for both constrained and unconstrained firms, we are unable to provide any consistent results to suggest that the effect is any stronger for constrained firms.

Splitting our sample for testing the agency problem hypotheses in accordance with the managerial entrenchment index, our results show that the sensitivity of investment to excess cash is found to have a positive sign under higher entrenchment, thereby indicating a tendency towards overinvestment; however, when we apply the blockholdings of institutional investors to reexamine the empire-building assumption, in cases where there is less monitoring by institutional investors, both total investment and capital expenditure are found to have statistically significant sensitivity to excess cash, which thereby confirms overinvestment.

Our empirical evidence contributes to the extant literature on the use of excess cash on investment behavior by simultaneously accounting for both underinvestment arising from financing constraints, and overinvestment arising from managerial entrenchment. The evidence in the present study reveals that both of these dimensions have potential effects on total investment and capital expenditure when firms hold excess cash. If a firm suffers from financing constraints, excess cash can finance investment projects which the firm may have previously given up as a result of a shortage of internal resources. Furthermore, if the firm is characterized by managerial entrenchment, then excess cash may induce such managers to

invest in projects which could prove detrimental to shareholder wealth. Additionally, when the ownership share held by institutional investors is used as a proxy for the quality of a firm's corporate governance structure, the two dimensions become even more significant, thereby indicating the problems of both underinvestment and overinvestment actually have influence on total investment and capital expenditure of those firms with excess cash.

In addition, we attempt to determine whether the use of excess cash varies in different degrees with two types of investment expenditure examined in the present study. Our results indicate that in contrast to capital expenditure, R&D expenditure is insensitive to excess cash under the two dimensions. Our findings suggest that financially constrained firms do not invest in large R&D expenditure when holding excess cash, whilst entrenched managers are less likely to overinvest in R&D, essentially as a result of their risk aversion[1].

The rest of this paper proceeds as follows. Section 2 describes theoretical background, develops hypothesis and related literature. Section 3 describes data and variables that are used in the study. Section 4 details the research methodology. Section 5 presents our empirical findings. Section 6 concludes the paper.

2. Theoretical background, hypothesis, and related literature

2.1 Theory background and hypotheses

Modigliani and Miller (1958) suggest that in the frictionless market, real firm decisions (such

[1] It should be noted that as compared to capital expenditure on property, plant and equipment, R&D expenditures is typically viewed as high-risk investment (Kothari, Laguerre and Leone, 2002).

as fixed investment) were independent of financial status (such as internal liquidity, debt leverage). However, in the imperfect market, information asymmetry between corporate insiders and outsiders invariably results in costly external financing, which causes adverse selection problem. Managers may be forced to give up positive NPV projects because they are not willing to raise external capital by issuing underpriced securities (Myers and Majluf, 1984). Cash holdings can benefit the firms facing external financing constraints to fund necessary expenditures, which makes investment sensitive to the availability of internal funds (Stein, 2003; Franzoni, 2009). This reasoning results in our first hypotheses:

Hypotheses 1: *After controlling for investment opportunities and cash flow, the sensitivity of corporate investment expenditure to excess cash will be stronger for financially-constrained firms than for unconstrained firms.*

Managers with empire-building preferences will use all of available resources on investment projects beyond a level that would maximize shareholder value (Jensen, 1986). As noted by Myers and Rajan (1998), when managers have power over corporate decisions, and are not constrained by legal provisions or effective external monitoring, it is much easier for cash reserves to be expropriated. Indeed, even when insiders cannot expropriate directly, they may use cash to finance negative NPV projects for their personal benefit; that is, they have a tendency for overinvestment based upon empire-building.[2]

[2] Fresard and Salva (2010) explain that this occurs when insiders do not have sufficient power to expropriate outsiders, or when legal protections effectively constrain such expropriation.

Corporate governance practices in Taiwan remain severely underdeveloped; thus, events involving managerial expropriation of small shareholders have become quite commonplace. This situation therefore provides us with a strong motivation to investigate whether the firms which demonstrate weaker corporate governance structures (higher entrenchment) waste their excess cash. This reasoning results in our second hypotheses:

Hypotheses 2: *After controlling for investment opportunities and cash flow, the sensitivity of corporate investment expenditure to excess cash will be stronger* (*weaker*) *for higher* (*lower*) *entrenchment firms.*

Stein (2003) argues that financial slack is important to investment, it is far from clear as to whether this relationship is attributable to financing constraints or empire-building. Although, with regard to the sensitivity of investment to cash flows, the costly external financing and agency conflict theories are essentially equivalent, their policy implications differ markedly; therefore, the two hypotheses may well coexist in a unified model which considers both underinvestment and overinvestment (Stein 2003, Franzoni, 2009).

Acknowledging that underinvestment and overinvestment may coexist within the same firm (Stein, 2003; Franzoni 2009), we take the financing constraints variable and the managerial entrenchment variable into account in our examination of the relationship between excess cash and investment expenditure. Furthermore, of particular interest to us is the identification of which distortion is considered to be more prominent.

2.2 Related literature

This section reviews research outcomes that are related to our hypotheses. One strand of the literature documents the effects of financial constraints on corporate liquidity (related to hypotheses 1). Fazzari et al. (1988) argue that cash flow is the primary capital for financially-constrained firms and the sensitivity of cash flow to investment is stronger for constrained than for unconstrained firms. As opposed to using the sensitivity of investment to cash flow as the means of determining the effect of costly external financing on corporate policies, Almeida et al. (2004) divide their sample into constrained/unconstrained firms using several criteria.[3] They find that constrained firms display a significantly positive cash flow sensitivity of cash, while unconstrained firms do not.

Faulkender and Wang (2006) argue that liquidity provides a benefit for constrained firms, thereby demonstrating that the marginal value of cash holdings is more valuable for financially-constrained than for unconstrained firms. Denis and Sibilkov (2010) interpret prior findings to mean that constrained firms with higher cash holdings are more likely to use cash to increase investment in positive NPV projects, and that marginal investment is more valuable for constrained than for unconstrained firms. Brown and Petersen (2010) provide evidence that firms faced with financing frictions tend to be heavily reliant upon cash holdings in order to smooth their R&D spending, essentially because cash provides a buffer

[3] They adopt 'asset size', 'payout ratio', 'bond ratings', 'commercial paper ratings' and the KZ index (Kaplan and Zingales, 1997) as financing constraints criteria.

for R&D from financial shocks and avoids the high adjustment costs of R&D.

Another strand of the literature focuses on the effects of corporate governance on corporate liquidity (related to hypotheses 2). Cross-border studies provide evidence to show that weak shareholder rights are associated with higher cash holdings (Dittmar et al. 2003; Pinkowitz et al. 2004). In addition, the value of cash holdings is lower in those countries (Pincowitz et al. 2006; Kalcheva and Lins 2007). Harford (1999) argues that cash-rich firms with a greater likelihood of agency problems engage in value-decreasing acquisitions. Mikkelson and Partch (2003) find that persistently high cash holdings of US firms do not lead to poor performance, nor do they indicate any agency problems. Lee and Powell (2010) show that the marginal value of cash declines with persistently excess cash holdings of Australian firms, which is consistent with agency cost associated with excess cash.

Dittmar and Mahrt-Smith (2007) and Harford et al. (2008) provide evidence to show that how corporate governance influences the decision on the ways in which the cash should be spent. Dittmar and Mahrt-Smith (2007) note that firms with poor governance structures and higher excess cash experience lower operating performance (ROA) through the rapid dissipation of cash, which implies that, under conditions of serious agency problems, excess cash reduces the pressure on managers to operate efficiently. Harford et al. (2008) show that, relative to their industry peers, poorly governed firms with higher levels of excess cash tend to increase their capital and acquisition expenditure, whilst reducing R&D investment.

Finally, on the purpose to find the sensitivity of investment to financial slack depends on either under- or overinvestment, Franzoni (2009) nests both the financial constraints and empire-building models into one specification. Franzoni (2009) demonstrates that the reduction in liquidity leads those financially-constrained firms to underinvestment, which has a negative effect on shareholder value. Conversely, when managers pursue their personal interests, the reduction in internal resources, which is less costly for outside investors, has a positive effect on firm value. The evidence shows that underinvestment is more relevant for the entire sample. Analogous to Franzoni (2009), Xu, Xu and Yuan (2010) demonstrate that listed family firms in China are prone to underinvestment, as opposed to overinvestment. Furthermore, political connectedness could reduce the level of investment-cash flow sensitivity for those firms with financial constraints, as opposed to those with poor governance, thereby providing further support for the underinvestment argument.

3. Data and variable construction

3.1 Data

Our sample includes all non-financial listed firms in Taiwan, covering the years from 2000 to 2006. After discarding all observations with incomplete data, we were left with a total sample of 4,428 firm-year observations for subsequent analysis. Corporate governance data and other company information were collected from the *Taiwan Economic Journal* (TEJ) database.

We follow the Opler et al. (1999) approach to measure the normal level of cash holdings.

Excess cash is the difference between the actual and predicted normal cash holdings.[4] Those firms whose excess cash is greater than zero are adopted as our sample to test our hypotheses.

3.2 Managerial entrenchment measures

3.2.1 Construction of the managerial entrenchment index

Managerial entrenchment has gained considerable attention as a result of its implications for corporate governance. Managers entrench themselves through the pursuit of self-interest policies that do not maximize shareholder value (Shleifer and Vishny, 1989). We adopt the following proxies, each of which has predicted associations with managerial entrenchment.

a. *Affiliated board seats* (*Aff_Bd*): Board seats are classified as being affiliated when they are held by the firm's largest shareholder, by the identifiable relatives of the largest shareholder, or by legal representatives from other companies controlled by the largest shareholder (Yeh and Woidtke, 2005). *Aff_Bd* is defined as the number of affiliated directors divided by the total number of directors.

b. *Independent directors* (*Ind_Dir*): Independent directors have expertise in management

[4] We use *natural log of cash to net assets* as the dependent variable (*Ln (Cash/NA)*), the independent variables include: natural log of assets (*Size*), *cash flow to net assets*(*CF/NA*), net working capital to net assets (*NWC/NA*), the mean industry standard deviation in cash flow over assets over the previous five-year period (*IndustrySigma*), market value to net assets (*MV/NA*), R&D to sales (*RD/Sales*), total debt to net assets (*Leverage/NA*), capital expenditure to net assets (*Capex/NA*), *and* a dummy indicating whether the firm paid dividends in that year (*Dividend*) and includes industry and year indicators to estimate normal level of cash holdings. To avoid the problem of endogeneity, we follow the procedure of Dittmar and Mahrt-Smith (2007) to employ three-year lagged sales growth (*SalesG)* as an instrument variable for *MV* and find that *SalesG* is a good proxy for investment opportunity. Our regression results shows: *Ln (Cash/NA)=-0.251+0.549CF/NA-0.284Size-0.365 NWC/NA+1.245IndustrySigma+1.746RD/Sales+0.465MV/NA+0.105Capex/NA+0.912Leverage/NA+0.143 Dividend*. We find that smaller firms, firms with larger cash flows, growth opportunities, R&D expenditure and leverage tend to hold more cash, as do dividend paying firms and firms with lower net working capital.

and decision making and are less subject to agency conflicts (Fama and Jensen, 1983). *Ind_Dir* is measured as the number of independent board seats divided by the total number of board seats.

c. Separation of ownership and control (*Sep_OC*): La Porta et al. (1999) suggest the separation of ownership and control can benefit the controlling shareholders to control a firm's operations with a small direct stake in cash-flow right. *Sep_OC* is equal to 1 if the voting rights of the controlling shareholders are higher than cash-flow rights; otherwise 0.[5]

d. Cash compensation ratio (*CCR*): Berger et al. (1997) argue that CEOs with higher levels of cash compensation are more likely to be entrenched, and will therefore seek to avoid risk. Listed firms in Taiwan pay stock bonuses as incentives for employees; therefore, we define *CCR* as the proportion of cash salary to total compensation paid to CEOs.[6]

e. CEO_duality: Based upon the agency cost hypothesis, Jensen (1993) point out that CEO duality may hinder board effectiveness, whilst also increasing agency costs. Nevertheless, 'stewardship theory' suggests that CEO duality may be beneficial to firm value because it provides a unity of leadership structure (Donaldson, 1990). The *CEO_duality* dummy variable is equal to 1 if the CEO is also the chairman of the board; otherwise 0.

[5] Claessens et al. (2000) find that almost 80% of firms in Taiwan have managers and directors who belong to the controlling shareholders. Moreover, Yeh and Woidtke (2005) indicate that Taiwan is characterized by having a high level of ownership concentrated in the largest controlling shareholders, and significant divergence in control and ownership, it is pervasive for the controlling shareholders of Taiwan firms to utilize dominant control power to exploit minority shareholders.

[6] Total compensation comprises of cash salary plus the value of stock bonuses.

We use principal component analysis (PCA) to construct a managerial entrenchment index.[7] As reported by Florackis and Ozkan (2009), PCA helps to control for problems of multicollinearity that may arise when several governance and control variables are incorporated within the empirical models. PCA automatically produces the weights so that the measure will capture the largest proportion of the variance in the underlying data.[8]

3.2.2 Institutional blockholdings

We follow prior studies to use the blockholdings of institutional investors as an additional measure of the quality of corporate governance (see e.g. Dittmar and Mahrt-Smith 2007; Franzoni 2009).[9] We define *Block* is equal to 1 if the institutional blockholdings is below the medium of our sample, which implies weaker corporate governance structure; otherwise 0.

3.3 Financial constraints criteria

We select five approaches associated with firm-level financial status as proxies for financial constraints.[10]

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[7] Callahan et al. (2003) construct an index of management involvement in director nominations using PCA and ten governance variables, whilst Florackis and Ozkan (2009) also utilize the approach, combining governance variables to construct a corporate governance measure in UK firms.

[8] Taking a combination of the above five governance variables based upon PCA, with the selection of the first principal component, the *managerial entrenchment index*=0.613**Aff_Bd-0.626*Ind_Dir+0.208*Sep_OC+0.398*CCR-0.177*CEO_duality*. The negative weight of *CEO_duality* provides support for stewardship theory (Donaldson, 1990), which argues that leadership unity which effectively reduces entrenchment is beneficial to firm performance.

[9] Institutional blockholdings is defined as equity ownership by an institutional shareholder with ownership greater than 5%.

[10] There are a number of methods for measuring financial constraints. Although the various applications of these measures remain controversial, this is hardly surprising, since each method is reliant upon certain empirical and/or theoretical assumptions (Hadlock and Pierce, 2010); nevertheless, it is still questionable as to whether the application of these indices to an emerging market such as Taiwan is appropriate. Xu, Xu and Yuan (2010) argue

a. *Firm size* (*Size*): Almeida et al. (2004) state that small firms have difficulties in raising capital within the market because they are less well known. We classify financially constrained firms if their book value of total assets is below the median level in the year.

b. *Dividend payouts* (*Payout*): Compared to constrained firms, unconstrained firms are more likely to have higher payout ratios (Fazzari et al. 1998; Almeida et al. 2004). We classify financially constrained firms if they did not pay cash dividends in the year.[11]

c. *Cash flow* (*CF*): Firms with larger internal cash flows may find it easier to obtain external financing, since such firms will invariably be perceived by lenders as being less risky (Leland and Pyle, 1977). We classify financially constrained firms if their cash flow is below the sample median level (Babenko et al. 2010) in the year.

d. *Firm age* (*Age*): As suggested by Hadlock and Pierce (2010), firm age and firm size are the two variables with the greatest relevance to financial constraints.[12] We estimate the ages of the firms since listing on the TSE or OTC market, classifying financially constrained firms if the ages of the firms are below the sample median level in the year.

e. *Bank loans* (*Loan*): Shen and Wang (2005) investigate the firms in Taiwan are less

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that the requirement of the parameter stability across firms, and over time, of the indices such as the KZ index is very easily violated. To avoid these problems, they pick several variables associated with financial status to proxy for financial constraints in China.

[11] We find the empirical results are unchanged if we use average payout ratio as constraint criteria.

[12] Hadlock and Pierce (2010) use qualitative information on firms to develop an SA index of financial constraints. After evaluating several common sorting variables, they conclude that firm size and age appear to be closely related to financial constraints.

financially constrained when they have a strong bank relationship.[13] We use bank loans as a proxy for bank relationships, and categorizing financially constrained firms if their total bank loans are below the sample mean for each year.

Table 1 provides descriptive statistics. Panel A of Table 1 shows summery statistics of the variables used to predict the normal level of cash holdings and the firm-specific variables to proxy for financial constraints. All ratios are winsorized at the 1% and the 99% to reduce the impact of outliers. Panel B reports summery statistics of the variables we use to construct the managerial entrenchment index and the institutional blockholdings.

<Table 1 is inserted about here>

The Pearson correlation coefficients for the proxies of financial constraints and managerial entrenchment are reported in Table 2, which shows that the correlation coefficients on the financial constraints proxy range from –0.125 to 0.587, each with statistical significance. Although the high correlations imply that the measures are picking up similar information, it appears that each measure picks up certain unique information (Denis and Sibilkov 2010). Finally, blockholdings is uncorrelated to the managerial entrenchment index.

<Table 2 is inserted about here>

4. Methodology

[13] Shen and Wang (2005) evaluate the bank relationship using three proxies, the number of banks that a firm engaged for its borrowing, the loan amounts and the loan duration. The results remained robust regardless of which of these was used as the proxy for bank relationship.

We consider three measures of firm investment: (i) capital expenditure; (ii) R&D expenditure[14]; and (iii) total investment (measured as the sum of capital expenditure and R&D expenditure), and also note that R&D has a number of characteristics which differ from ordinary investment, as detailed below.

Firstly, R&D investment is particularly subject to financing constraints because it is firm-specific and difficult to evaluate (Himmelberg and Petersen, 1994). Secondly, R&D involves substantial adjustment costs, essentially because most of the costs of R&D are related to wage payments to highly skilled workers. Firms facing financial friction should therefore manage their liquidity to maintain smooth R&D (Brown and Petersen, 2010). Thirdly, since R&D is found to account for approximately 24 percent of total investment in our sample, it represents an important component of total expenditure.

Our first hypotheses begins with an examination of the dependence on excess cash for financially-constrained/unconstrained firms, with the equations being separately estimated in accordance with our five financial constraints criteria for the two types of firms. Our second hypotheses examines the dependence on excess cash for higher and lower entrenchment firms, with the division of our sample into higher entrenchment and lower entrenchment firms being undertaken according to our managerial entrenchment index and institutional blockholdings. The equation is as follows:

[14] When there are missing values on R&D, it is set as being equal to zero.

$$I_{it} = \beta_0 + \beta_1 XCash_{i,t-1} + \beta_2 Q_{i,t-1} + x_{i,t} * \gamma + YearDummies + IndustryFixedEffects + \varepsilon_{i,t}$$

(1)

where I_{it} represents the investment expenditure by firm *i* in year *t*; and $XCash_{i,t-1}$ is the start-of-year excess cash, scaled by the start-of-year book assets. *XCash* is measured by lagging the data by a year, which reduces the extent of the potential problem of endogeneity arising from simultaneous determination of these variables; $Q_{i,t-1}$ is the start-of-year market-to-book ratio to control for investment opportunity, which is the market value of equity plus the book value of assets minus the book value of equity divided by book value of total assets.; and $x_{i,t}$ is a set of control variables representing the financial status of the firm.

To test the costly external finance hypotheses, we expect that, ceteris paribus, the coefficient on *XCash* would be stronger for financially constrained than for unconstrained firms. To test the empire-building hypotheses, we expect that, ceteris paribus, the coefficient on *XCash* would be stronger for higher entrenchment than for lower entrenchment firms.

In addition, according to Stein (2003), we demonstrate the logic behind taking into account both the costly external finance model and the empire-building model. Our financial constraints and managerial entrenchment proxies are included in Equation (2), along with their interactions with excess cash. The equation is as follows:

$$I_{it} = \beta_0 + \beta_1 XCash_{i,t-1} + \beta_2 FC_{i,t-1} + \beta_3 XCash_{i,t-1} * FC_{i,t-1} + \beta_4 M_{i,t-1} + \beta_5 XCash_{i,t-1} * M_{i,t-1} + \beta_6 Q_{i,t-1} + x_{i,t}\gamma + YearDummies + IndustryFixedEffects + \varepsilon_{i,t}$$

(2)

where $FC_{i,t-1}$ is the start-of-year financial constraint proxy; and $M_{i,t-1}$ is the start-of-year managerial entrenchment proxy. All other variables are the same as defined in equation (1).

Our empirical work attempts to determine which distortion is more prominent by examining the interaction between *XCash*FC* or *XCash*M* in our model. If the coefficient on *XCash*FC* is significantly less than zero, it reflects the problem of underinvestment. If the coefficient on *XCash*M* is significantly less than zero, it reflects the problem of overinvestment.

Numerous empirical studies focus on the ways in which financial status affects investment;[15] we rely upon these studies on investment decision-making for the control variables representing financial status; these include: operating cash flow (*Cash Flow*), growth in sales (*SalesG*), firm size (*Size*) and total leverage (*Leverage*).

The investment regression includes both industry and year fixed effects. The industry fixed effects may help to minimize the likelihood of excess cash affecting different types of investment friction across different industries, whilst the year fixed effects are used to control for the macroeconomic effects that could conceivably affect investment decision making.

5. Empirical results

Table 3 reports the fixed effects regressions of investment on excess cash under financial constraints criteria. Panel A of Table 3 reports the sensitivity of total investment to excess cash.

[15] See e.g., Fazzari et al. (1988), Kaplan and Zingales (1997) and Denis and Sibilkov (2010).

After controlling for cash flow, investment opportunities and other firm-specific variables, we find that for all kinds of financially-constrained firms, total investment has a significantly positive correlation with excess cash. The estimated coefficients on *XCash* for constrained firms are found to be between 0.059 and 0.108, whilst those for unconstrained firms range between –0.039 and 0.026. These results are consistent with our first hypotheses that those firms faced with higher external financing costs have stronger incentives to use excess cash to finance their total investment.

<Table 3 is inserted about here>

Panel B of Table 3 reports the sensitivity of capital expenditure to excess cash. As compared to unconstrained firms, under four of the five financial constraints, excess cash is found to have a significantly positive correlation with the capital expenditure for constrained firms, with the coefficients on *XCash* for constrained firms ranging between 0.036 and 0.062. In contrast, the coefficients on *XCash* are found to be either negative or insignificant for unconstrained firms. These results are largely in agreement with the first hypotheses, that the dependence of excess cash on capital expenditure is stronger for constrained than for unconstrained firms.

Panel C of Table 3 presents the sensitivity of R&D expenditure to excess cash, from which we find that for both constrained and unconstrained firms, excess cash has a positive and significant correlation with R&D expenditure. The estimated coefficients on *XCash* for

constrained firms range between 0.033 and 0.054, whilst the coefficients on *XCash* for unconstrained firms range between 0.020 and 0.049. However, for two of the five constraints criteria, the coefficients are found to be significantly higher for constrained than for unconstrained firms. The results in Panel C provide mixed evidence on the hypothesis that excess cash enable constrained firms to increase their R&D investment.[16]

Table 4 reports the fixed effects regressions of investment on excess cash under managerial entrenchment. The first column provides that for higher entrenchment firms, excess cash has a significantly positive correlation with total investment. The difference in the coefficient on *XCash* is found to be significantly stronger for higher entrenchment than for lower entrenchment firms, which is consistent with our second hypothesis, that managers of those firms with weaker corporate governance structures have a tendency for empire-building.

As we can see from the second column, there is no evidence to suggest that the dependence of excess cash on capital expenditure is significantly higher for higher entrenchment than for lower entrenchment firms. Furthermore, although the third column reveals that excess cash is positively correlated with R&D expenditure for both high and low entrenchment firms, we are still unable to find any evidence to suggest that the estimated coefficient on *XCash* is statistically higher for higher entrenchment than that for lower entrenchment firms.

[16] We also restrict the sample to the firms with R&D expenditure greater than zero to test all of our empirical settings, and find the results are unchanged.

<Table 4 is inserted about here>

Table 5 reports the regression results of investment on excess cash under financial constraints and managerial entrenchment. Panel A of Table 5 reports the sensitivity of total investment to excess cash under the two dimensions. The coefficients on the interactions between *XCash* and our five financial constraints variables are significant, ranging from 0.049 to 0.128, and thereby providing support for the underinvestment argument. Conversely, the coefficients on the interactions between *XCash* and our managerial entrenchment proxy are all found to be positively correlated with total investment, ranging from 0.033 to 0.119, although two of the five constraints criteria are found to have no statistical significance. We therefore conclude that firms of small size, with lower cash flow levels, and bank loans below the mean level, will tend to use excess cash to increase their total investment, and that when their managers are more highly entrenched, the firms will also have a tendency for overinvestment.

<Table 5 is inserted about here>

Panel B of Table 5 reports the sensitivity of capital expenditure to excess cash under the two dimensions. The findings mirror those of Panel A, that firms of small size, with lower cash flow levels, and bank loans below the mean level, will tend to find themselves faced with problems of both underinvestment and overinvestment.

Panel C of Table 5 reports the sensitivity of R&D expenditure to excess cash under the two dimensions. The coefficients on the interactions with financial constraints proxy are

significant for two of the five criteria. However, the coefficients on the interactions with our managerial entrenchment proxy are all found to be positive, although only the size and loan criteria have statistical significance. Overall, there is no clear evidence to show which distortion is more prominent with regard to dependence on excess cash for R&D expenditure.

In addition, we use institutional blockholdings to examine the effect of managerial entrenchment on the relationship between excess cash and investment. The results in Table 6 show that sensitivity of total investment (capital expenditure) to excess cash is significantly higher when there is less monitoring by institutional investors, which agrees with overinvestment. However, we also find the sensitivity of R&D to excess cash is not significantly higher when there is less monitoring.

<Table 6 is inserted about here>

When considering both dimensions of financial constraints and institutional blockholdings, the results on the sensitivity of total investment (capital expenditure) to excess cash are shown in Panel A (Panel B) of Table 7. The coefficients on the interaction between *XCash* and *Block* dummy are found to have a significantly positive correlation with total investment (capital expenditure) for all of the financial constraints criteria, which indicate that when there is less monitoring, excess cash could be used for empire-building. This evidence further confirms that overinvestment exists when two dimensions are considered. The coefficients on the interaction between *XCash* and the financial constraints proxy are

positively significant for four (three) of the five criteria, which suggest that for most constrained firms, excess cash increases both total investment and capital expenditure.

<Table 7 is inserted about here>

Panel C of Table 7 shows the results of the sensitivity of R&D expenditure to excess cash. The coefficients on the interactions between *XCash* and the financial constraints variable are found to be significantly positive for only two of the five criteria, whereas, with the exception of the size constraint criteria, none of the other coefficients on the interactions with the *Block* dummy are found to have any statistical significance. We still can not find the primary distortion effect on the relationship between excess cash and R&D expenditure.

6. Conclusions

In the present study, we aim to determine the ways in which excess cash, which is not required for operations, affects firm investment under the frictions of information asymmetry and agency problem. We develop two hypotheses to examine if the problem of underinvestment arising from information asymmetry exists in financially constrained firms (Myers and Majluf, 1984) and if the problem of overinvestment arising from agency problems exists in poor governance firms (Jensen 1986). Furthermore, considering both the costly-external-finance and empire-building dimensions (Stein, 2003), we attempt to determine which investment distortion prevails.

Using our five financial constraints approaches, we find that the dependence of excess cash for total investment and capital expenditure are stronger for constrained than for

unconstrained firms, which are largely consistent with the argument of underinvestment. Nevertheless, we can find no evidence to suggest that constrained firms use more excess cash than unconstrained firms for R&D purposes.

We develop a managerial entrenchment index to estimate the exposure to empire-building and find that under a condition of higher managerial entrenchment, managers have incentives to over-invest. We also use institutional blockholdings as another way of measuring the quality of internal governance, with our findings showing that overinvestment in total investment and capital expenditure actually exists when there is less monitoring by institutional investors; nevertheless; R&D expenditure is unrelated to the problem of overinvestment.

Our paper complements recent literature by considering both costly-external-finance and empire-building dimensions on the relationship between excess cash and investment behavior. We find that excess cash is significantly correlated to total investment and capital expenditure, particularly for firms with financially constrained and severe managerial entrenchment, which agrees with the argument of under- and overinvestment. However, we can find no significant effects of excess cash distorting R&D investment.

In summery, our results have implications for corporate liquidity management in the emerging market, like Taiwan. Although excess cash is beneficial for the financially constrained firms, however, it could expropriate the interests of the shareholders by facilitating empire-building overinvestment when the firms have severe managerial

entrenchment. Therefore, it might be questionable to accumulate cash for poorly governed firms though they are facing costly external funds. Further research could find out in which state excess cash can be used to value-increasing or value-decreasing investment when both financial constraints and agency problems are considered.

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Table 1 Descriptive statistics

Panel A reports summery statistics of the variables used to predict the normal level of cash holdings and the firm-specific variables to proxy for financial constraints based on a sample of 4,428 firm-year observations covering the 2000-2006 period. *Size* is natural log of assets; *CF/Assets* is the ratio of earnings before interest and tax minus common dividends to assets; *NWC/Assets* is the ratio of current assets excluding cash minus current liabilities to assets; *IndustrySigma* is the mean industry standard deviation in cash flow over assets over the previous five-year period; *RD/Sales* is the ratio of R&D to sales; *MV/Assets* is the ratio of the market value of equity plus the book value of assets minus the book value of equity divided by book value of total assets; *SalesG* is the growth in sales over the previous three-year period; *Capex/Assets* is the ratio of capital expenditure to assets; and *Leverage* is the ratio of the sum of long-term debt and current liabilities to assets . *Dividend* is a dummy variable which is equal to 1 if the firm paid a common dividend in that year; otherwise 0. *Age* is number of years since the firm is listed on the TSE or OTC market; *Loan* is the total amount of bank loans; All ratios are winsorized at the 1% and 99% levels. Panel B reports summery statistics of the variables we use to construct the *managerial entrenchment index*: *Aff_Bd* is the number of affiliated directors divided by the total number of directors; *Ind_Dir* is the ratio of the number of independent board seats divided by the total number of board seats; *Sep_OC* is a dummy which takes the value of 1 if the voting rights of the controlling shareholders exceeds cash-flow rights; otherwise 0.; *CCR* is cash compensation ratio; *CEO_duality* is a dummy which is equal to 1 if the CEO is also the chairman of the board; otherwise 0. The managerial entrenchment index is calculated as the weighted sum of the above five components. *Blockholdings* is equity ownership of institutional blockholders.

Panel A

Variables	N	Mean	Median	S.D.	25th Percentile	75th Percentile
Size	4428	15.161	15.027	1.151	14.284	15.860
CF/Assets	4428	0.069	0.067	0.080	0.028	0.112
NWC/Assets	4428	0.132	0.122	0.176	0.007	0.254
IndustrySigma	4428	0.072	0.063	0.031	0.049	0.086
RD/Sales	4428	0.019	0.008	0.028	0.000	0.026
MV/Assets	4428	1.261	1.101	0.537	0.904	1.448
SalesG	4428	0.219	0.143	0.389	-0.002	0.350
Capex/Assets	4428	0.059	0.041	0.059	0.016	0.084
Leverage	4428	0.460	0.464	0.168	0.342	0.581
Dividend	4428	0.614	1.000	0.487	0.000	1.000
Age	4428	23.009	22.000	11.012	14.000	30.000
Loan (millions)	3107	1,152.437	445.555	2,631.944	150.000	1,079.532
Panel B						
Aff_Bd	4428	0.683	0.667	0.207	0.571	0.833
Ind_Dir	4428	0.092	0.000	0.146	0.000	0.200
Sep_OC	4428	0.772	1.000	0.420	1.000	1.000
CCR	3885	0.719	0.899	0.326	0.417	1.000
CEO_duality	4428	0.324	0.000	0.468	0.000	1.000
Managerial entrenchment index	3885	-0.123	0.076	1.305	-1.045	0.926
Blockholdings	4095	0.334	0.303	0.214	0.160	0.475

Table 2 Correlation matrix of financial constraints and managerial entrenchment

This table reports the correlations between the variables in our analysis of the financial constraints and managerial entrenchment, with the data covering the 2000-2006 period having been obtained from the TEJ. Following the exclusion of companies within the financial industries, we are left with a total of 4,428 firm-year observations (refer to sub-section 3.3 of the text for full definitions of the financial constraints criteria: *Size*; *Payout*; *CF*; *Age and Loan*). *M-index* refers to the managerial entrenchment index; and *Blockholdings* is equity ownership of institutional blockholders. The *p*-value (reported in parentheses) are based on robust standard errors.

Variables	*Size*	*Payout*	*CF*	*Age*	*Loan*	*M-index*	*Blockholdings*
Size	1						
Payout	–0.054 (0.000)	1					
CF	0.587 (<0.000)	–0.057 (<0.000)	1				
Age	0.261 (<0.000)	–0.014 (0.036)	0.036 (0.017)	1			
Loan	0.440 (<0.000)	0.058 (0.001)	0.158 (<0.000)	0.165 (<0.000)	1		
M-index	0.253 (<0.000)	0.244 (<0.000)	0.099 (<0.000)	0.286 (<0.000)	0.148 (0.000)	1	
Blockholdings	0.291 (<0.000)	–0.125 (<0.000)	0.204 (<0.000)	–0.055 (0.000)	0.109 (<0.000)	0.062 (0.001)	1

Table 3 Fixed effects regressions of investment on excess cash under financial constraints criteria

This table reports the coefficients on the fixed effects of investment on excess cash under the financial constraints criteria, presenting the models separately for the groups of financial constrained (FC) and unconstrained (UN) firms. The dependent variable in Panel A is the sum of capital expenditure and R&D*(Total Investment)*, whilst the dependent variable in Panel B is capital expenditure (*Capex*), and the dependent variable in Panel C is R&D expenditure (*R&D*); each of the dependent variables is normalized by the start-of-year book assets. *XCash* refers to the beginning-of-year excess cash holdings of a firm normalized by the start-of-year book assets. The control variables are as follows: *Cash Flow* is cash flow normalized by the start-of-year book assets; Q is the beginning-of-year market-to-book ratio; *Size* is natural log of assets; *SalesG* is the growth in sales over the previous three-year period, and *Leverage* is the sum of long-term debt and current liabilities normalized by the start-of-year book assets. The *p*-values based on robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5, 10% levels, respectively. All estimations include industry and year indicators as well as intercept term.

Variables	*Size*		*Payout*		*CF*		*Age*		*Loan*	
	FC	UN	FC	UN	FC	UN	FC	UN	FC	UN
Panel A: Total Investment										
XCash	0.078***	–0.006	0.099***	0.019	0.086***	–0.039	0.059***	0.026	0.108***	–0.025
	(0.000)	(0.759)	(0.001)	(0.263)	(0.000)	(0.229)	(0.007)	(0.178)	(0.000)	(0.612)
Cash Flow	0.202***	0.295***	0.164***	0.306***	0.109***	0.408***	0.253***	0.292***	0.278***	0.307***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Q	0.033***	0.024***	0.045***	0.018***	0.036***	0.016***	0.027***	0.022***	0.021***	0.034***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SalesG	–0.000	0.000	0.000	–0.000	–0.000*	0.000	0.000	–0.000*	–0.000	0.000
	(0.658)	(0.662)	(0.688)	(0.819)	(0.084)	(0.935)	(0.492)	(0.083)	(0.150)	(0.302)
Size	–0.008**	0.003	–0.004**	–0.003*	–0.011***	0.003	–0.004*	–0.003	–0.006***	0.004
	(0.052)	(0.189)	(0.050)	(0.060)	(0.000)	(0.236)	(0.068)	(0.149)	(0.008)	(0.258)
Leverage	0.075***	0.117***	0.073***	0.095***	0.063***	0.107***	0.093***	0.081***	0.105***	0.057***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
No. of Obs.	1,193	1,403	824	1,772	1,178	1,417	1,219	1,302	1,353	442
Adj. R^2	0.294	0.375	0.329	0.341	0.277	0.379	0.327	0.313	0.338	0.424
p-value difference in coefficients on *XCash*	0.002***		0.041**		0.000***		0.080*		0.044**	
Panel B: Capex										
XCash	0.036*	–0.047**	0.062**	–0.020	0.053***	–0.078***	0.007	0.006	0.054**	–0.075
	(0.064)	(0.017)	(0.021)	(0.209)	(0.001)	(0.000)	(0.718)	(0.744)	(0.013)	(0.102)
Cash Flow	0.194***	0.329***	0.187***	0.287***	0.119***	0.390***	0.248***	0.274***	0.273***	0.303***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Q	0.018**	0.009**	0.033***	0.007*	0.021***	0.008*	0.012***	0.016***	0.009**	0.021**
	(0.000)	(0.026)	(0.000)	(0.061)	(0.000)	(0.054)	(0.005)	(0.000)	(0.045)	(0.013)
SalesG	–0.000	–0.000	–0.000	–0.000	–0.001***	–0.000	0.000	–0.000**	–0.002**	0.000
	(0.147)	(0.615)	(0.239)	(0.578)	(0.003)	(0.854)	(0.995)	(0.030)	(0.011)	(0.355)
Size	–0.001	0.004*	–0.001	–0.000	–0.005**	0.005**	0.001	–0.002	–0.001	0.005
	(0.804)	(0.094)	(0.761)	(0.813)	(0.028)	(0.033)	(0.549)	(0.356)	(0.665)	(0.141)
Leverage	0.077***	0.098***	0.067***	0.101***	0.070***	0.105***	0.091***	0.087***	0.111***	0.062***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
No. of Obs.	1,193	1,403	824	1,772	1,178	1,417	1,219	1,302	1,253	442
Adj. R^2	0.213	0.347	0.260	0.280	0.198	0.309	0.277	0.283	0.272	0.377
p-value difference in coefficients on *XCash*	0.021**		0.008***		0.000***		0.724		0.027**	
Panel C: R&D										
XCash	0.042***	0.031***	0.037***	0.039***	0.033***	0.038***	0.052***	0.020***	0.054***	0.049***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Cash Flow	0.007	0.016**	–0.023**	0.019**	–0.009	0.021*	0.005	0.018**	0.005	0.005
	(0.436)	(0.042)	(0.034)	(0.016)	(0.352)	(0.057)	(0.603)	(0.013)	(0.587)	(0.741)
Q	0.014***	0.007***	0.012***	0.011***	0.015***	0.008***	0.015***	0.006***	0.011***	0.013***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SalesG	0.000**	0.000	0.000***	0.000	0.000**	0.000	0.000*	0.000	0.000***	0.000
	(0.019)	(0.657)	(0.000)	(0.382)	(0.013)	(0.489)	(0.073)	(0.206)	(0.003)	(0.556)
Size	–0.007***	0.001	–0.004***	–0.003***	–0.006***	–0.002**	–0.005***	–0.001**	–0.005***	–0.001
	(0.000)	(0.425)	(0.000)	(0.000)	(0.000)	(0.013)	(0.000)	(0.024)	(0.000)	(0.439)
Leverage	–0.002	0.001	0.006	–0.006**	–0.007*	0.002	0.003	–0.006**	–0.005	–0.004
	(0.578)	(0.684)	(0.136)	(0.043)	(0.068)	(0.428)	(0.504)	(0.013)	(0.134)	(0.354)
No. of Obs.	1,193	1,403	824	1,772	1,178	1,417	1,219	1,302	1,353	442
Adj. R^2	0.377	0.395	0.371	0.378	0.375	0.375	0.377	0.323	0.357	0.413
p-value difference in coefficients on *XCash*	0.006***		0.162		0.979		0.000***		0.774	

Table 4 Fixed effects regressions of investment on excess cash under managerial entrenchment

This table reports the coefficients on the fixed effects of investment on excess cash under managerial entrenchment, presenting the models separately for groups of higher/lower entrenchment firms, where higher (lower) entrenchment firms are defined as those with managerial entrenchment index above (below) the quartile. The dependent variables are the sum of capital expenditure and R&D expenditure, normalized by the start-of-year book assets (*Total Investment*); capital expenditure normalized by the start-of-year book assets (*Capex*); R&D expenditure normalized by the start-of-year book assets *(R&D*). *XCash* refers to the beginning-of-year excess cash holdings of a firm normalized by the start-of-year book assets. The control variables are as follows: *Cash Flow* is cash flow normalized by the start-of-year book assets; Q is the beginning-of-year market-to-book ratio; *Size* is natural log of assets; *SalesG* is the growth in sales over the previous three-year period, and *Leverage* is the sum of long-term debt and current liabilities normalized by the start-of-year book assets. The *p*-values based on robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5, 10% levels, respectively. All estimations include industry and year indicators.

Variables	Total Investment		Capex		R&D	
	Higher entrenchment	Lower entrenchment	Higher entrenchment	Lower entrenchment	Higher entrenchment	Lower entrenchment
Intercept	0.010 (0.643)	0.105** (0.013)	–0.020 (0.375)	0.323 (0.438)	0.035*** (0.000)	0.065*** (0.000)
XCash	0.097*** (0.000)	0.033 (0.170)	0.022 (0.223)	–0.023 (0.302)	0.044*** (0.000)	0.031*** (0.000)
Cash Flow	0.315*** (0.000)	0.325*** (0.000)	0.262*** (0..000)	0.254*** (0.000)	0.009 (0.211)	0.014 (0.243)
Q	0.026*** (0.000)	0.030*** (0.000)	0.011*** (0.002)	0.015*** (0.008)	0.011*** (0.000)	0.010*** (0.000)
SalesG	0.000 (0.551)	–0.000 (0.114)	–0.000 (0.894)	–0.001 (0.205)	0.000 (0.203)	0.000 (0.127)
Size	–0.002 (0.184)	–0.007*** (0.010)	0.001*** (0.000)	–0.004 (0.188)	–0.003*** (0.000)	–0.004*** (0.000)
Leverage	0.073*** (0.000)	0.085*** (0.000)	0.083 (0.494)	0.107*** (0.000)	0.001 (0.868)	–0.003 (0.433)
No. of Obs.	1,724	872	1,724	872	1,724	872
Adj. R^2	0.294	0.247	0.298	0.245	0.390	0.359
p-value difference in coefficients on *XCash*	0.080*		0.227		0.317	

Table 5 Fixed effects regressions of investment on excess cash under financial constraints and managerial entrenchment

This table reports the coefficients on the fixed effects of investment on excess cash under both financial constraints and managerial entrenchment. The dependent variable in Panel A is the sum of capital expenditure and R&D expenditure (*Total Investment*), whilst the dependent variable in Panel B is capital expenditure (*Capex*), and the dependent variable in Panel C is R&D expenditure (*R&D*); all of the dependent variables are normalized by the start-of-year book assets. *XCash* refers to the beginning-of-year excess cash holdings of a firm normalized by the start-of-year book assets. *FC* is a dummy variable for financial constraints which is equal to 1 (0) if the firm is financially constrained (unconstrained); *M* is a dummy variable which is equal to 1 (0) if the managerial entrenchment index is above (below) the sample quartile. The control variables are as follows: *Cash Flow* is cash flow normalized by the start-of-year book assets.; Q is the beginning-of-year market-to-book ratio; *Size* is natural log of assets; *SalesG* is the growth in sales over the previous three-year period, and *Leverage* is the sum of long-term debt and current liabilities normalized by the start-of-year book assets. The *p*-values based on robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5, 10% levels, respectively. All estimations include industry and year indicators as well as intercept term.

Variables	*Size*		*Payout*		*CF*		*Age*		*Loan*	
	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value
Panel A: Total Investment										
XCash	–0.044*	0.097	0.008	0.689	–0.049*	0.060	–0.005	0.831	–0.083	0.142
FC	0.000	0.972	–0.012***	0.004	–0.012**	0.013	0.004	0.383	0.002	0.682
*FC*XCash*	0.102***	0.000	0.063*	0.068	0.115***	0.000	0.049*	0.079	0.128**	0.015
M	–0.007	0.113	–0.005	0.328	0.007	0.122	–0.005	0.257	–0.014**	0.017
*M*XCash*	0.067**	0.017	0.033	0.222	0.061**	0.028	0.043	0.126	0.119***	0.002
Cash Flow	0.266***	0.000	0.257***	0.000	0.268***	0.000	0.267***	0.000	0.263***	0.000
Q	0.025***	0.000	0.023***	0.000	0.025***	0.000	0.023***	0.000	0.021***	0.000
SalesG	–0.000	0.847	0.000	0.989	–0.000	0.907	0.000	0.983	0.000	0.647
Size	0.000	0.834	–0.004***	0.006	–0.003*	0.051	–0.003**	0.027	–0.003*	0.078
Leverage	0.089***	0.000	0.089***	0.000	0.088***	0.000	0.087***	0.000	0.088***	0.000
No. of Obs.	2,596		2,596		2,595		2,521		1,795	
Adj. R^2	0.348		0.346		0.349		0.349		0.363	
Panel B: Capex										
XCash	–0.058**	0.019	–0.027	0.166	–0.081***	0.001	–0.006	0.804	–0.107**	0.045
FC	–0.001	0.810	–0.014***	0.001	–0.009**	0.032	0.005	0.221	0.005	0.335

*FC*XCash*	0.072***	0.007	0.081**	0.013	0.114***	0.000	–0.090	0.727	0.124**	0.014
M	–0.005	0.289	–0.002	0.613	–0.005	0.254	–0.003	0.479	–0.009*	0.091
*M*XCash*	0.049*	0.063	0.022	0.404	0.051*	0.054	0.031	0.236	0.073**	0.046
Cash Flow	0.254***	0.000	0.247***	0.000	0.263***	0.000	0.258***	0.000	0.251***	0.000
Q	0.014***	0.000	0.012***	0.000	0.014***	0.000	0.013***	0.000	0.009**	0.012
SalesG	0.000	0.408	0.000	0.489	–0.000	0.414	–0.000	0.485	–0.000	0.902
Size	0.002	0.306	0.001	0.647	0.000	0.832	–0.000	0.855	0.001	0.733
Leverage	0.089***	0.000	0.090***	0.000	0.089***	0.000	0.089***	0.000	0.092***	0.000
No. of Obs.	2,596		2,596		2,595		2,521		1,795	
Adj. R^2	0.281		0.282		0.284		0.282		0.295	
Panel C: R&D										
XCash	0.015	0.109	0.035***	0.000	0.032***	0.000	0.001	0.950	0.025	0.172
FC	0.001	0.448	0.001	0.350	–0.002	0.193	–0.001	0.396	–0.003	0.119
*FC*XCash*	0.029***	0.003	–0.018	0.123	0.001	0.899	0.058***	0.000	0.004	0.814
M	–0.003*	0.095	–0.002	0.150	–0.002	0.183	–0.002	0.178	–0.004**	0.019
*M*XCash*	0.017*	0.075	0.012	0.214	0.010	0.297	0.011	0.238	0.046***	0.000
Cash Flow	0.012*	0.063	0.009	0.116	0.005	0.508	0.008	0.165	0.012*	0.094
Q	0.011***	0.000	0.011***	0.000	0.011***	0.000	0.011***	0.000	0.011***	0.000
SalesG	0.000*	0.087	0.000*	0.054	0.000*	0.058	0.000**	0.046	0.000*	0.079
Size	–0.001**	0.028	–0.003***	0.000	–0.004***	0.000	–0.003***	0.000	–0.004***	0.000
Leverage	–0.000	0.843	–0.001	0.593	–0.001	0.732	–0.002***	0.000	–0.003	0.213
No. of Obs.	2,596		2,596		2,595		2,521		1,795	
Adj. R^2	0.374		0.371		0.371		0.387		0.376	

Table 6 Fixed effects regressions of investment on excess cash under institutional blockholdings

This table reports the coefficients on the fixed effects of investment on excess cash under institutional blockholdings, presenting the models separately for groups of high/low block firms, where high (low) block firms are defined as those with institutional blockholdings above (below) the medium. The dependent variables are the sum of capital expenditure and R&D expenditure, normalized by the start-of-year book assets (*Total Investment*); capital expenditure normalized by the start-of-year book assets (C*apex*); R&D expenditure normalized by the start-of-year book assets *(R&D*). *XCash* refers to the beginning-of-year excess cash holdings of a firm normalized by the start-of-year book assets. The control variables are as follows: *Cash Flow* is cash flow normalized by the start-of-year book assets; Q is the beginning-of-year market-to-book ratio; *Size* is natural log of assets; *SalesG* is the growth in sales over the previous three-year period, and *Leverage* is the sum of long-term debt and current liabilities normalized by the start-of-year book assets. The coefficients on the other variables are not reported for brevity. The *p*-values based on robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5, 10% levels, respectively. All estimations include industry and year fixed effects.

Variables	Total Investment		Capex		R&D	
	Low Block	High Block	Low Block	High Block	Low Block	High Block
Intercept	0.022 (0.477)	0.059* (0.069)	-0.033 (0.251)	0.024 (0.443)	0.055*** (0.000)	0.035*** (0.002)
XCash	0.077*** (0.000)	-0.025 (0.170)	0.037** (0.031)	-0.061*** (0.006)	0.040*** (0.000)	0.036*** (0.000)
No. of Obs.	1,390	1205	1,390	1205	1,390	1205
Adj. R^2	0.332	0.380	0.268	0.317	0.383	0.371
p-value difference in coefficients	0.002***		0.002***		0.469	

Table 7 Fixed effects regressions of investment on excess cash under financial constraints and institutional blockholdings

This table reports the coefficients on the fixed effects of investment on excess cash under both financial constraints and institutional blockholdings. The dependent variable in Panel A is the sum of capital expenditure and R&D expenditure (*Total Investment*), whilst the dependent variable in Panel B is capital expenditure (*Capex*), and the dependent variable in Panel C is R&D expenditure (*R&D*); all of the dependent variables are normalized by the start-of-year book assets. *XCash* refers to the beginning-of-year excess cash holdings of a firm normalized by the start-of-year book assets. *FC* is a dummy variable for financial constraints which is equal to 1 (0) if the firm is financially constrained (unconstrained); *Block* is a dummy variable which is equal to 1 (0) if the institutional blockholdings of the firm are below (above) the median for the sample. The control variables include: *Cash Flow* is cash flow normalized by the start-of-year book assets; Q is the beginning-of-year market-to-book ratio; *Size* is is natural log of assets; *SalesG* is the growth in sales over the previous three-year period, and *Leverage* is the sum of long-term debt and current liabilities normalized by the start-of-year book assets. The coefficients on the other variables are not reported for brevity. The *p*-values based on robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5, 10% levels, respectively. All estimations include industry and year indicators as well as intercept term.

Variables	*Size*		*Payout*		*CF*		*Age*		*Loan*	
	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value
Panel A: Total Investment										
FC	0.003	0.612	-0.012***	0.006	-0.009**	0.044	0.003	0.385	-0.000	0.944
*FC*XCash*	0.069**	0.014	0.062*	0.067	0.094***	0.001	0.047*	0.087	0.093	0.194
Block	-0.008**	0.042	-0.008**	0.031	-0.008**	0.039	-0.009**	0.022	-0.008*	0.064
*Block*XCash*	0.068**	0.015	0.080***	0.004	0.072***	0.009	0.083***	0.003	0.069*	0.077
No. of Obs.	2,595		2,595		2,594		2,520		1,798	
Adj. R^2	0.348		0.348		0.349		0.351		0.358	
Panel B: Capex										
FC	0.001	0.832	-0.013***	0.002	-0.007*	0.090	0.005	0.236	0.002	0.788
*FC*XCash*	0.044*	0.099	0.078**	0.014	0.095***	0.000	-0.009	0.711	0.096	0.159
Block	-0.010***	0.006	-0.010***	0.006	-0.009***	0.007	-0.011***	0.004	-0.012***	0.008
*Block*XCash*	0.068**	0.011	0.072***	0.005	0.065**	0.012	0.080***	0.002	0.072*	0.052
No. of Obs.	2,595		2,595		2,594		2,520		1,798	
Adj. R^2	0.283		0.285		0.286		0.285		0.292	
Panel C: R&D										
FC	0.002	0.378	0.001	0.479	-0.002	0.234	-0.001	0.453	-0.002	0.318

*FC*XCash*	0.025***	0.009	-0.017	0.158	-0.001	0.898	0.057***	0.000	-0.003	0.903
Block	0.002*	0.094	0.002	0.219	0.002	0.177	0.002	0.168	0.003	0.045
*Block*XCash*	0.001*	0.060	0.007	0.419	0.006	0.488	0.003	0.760	-0.003	0.805
No. of Obs.	2,595		2,595		2,594		2,520		1,798	
Adj. R^2	0.374		0.372		0.372		0.388		0.374	