Lingnan University
Digital Commons @ Lingnan University

Theses & Dissertations | Department of Finance and Insurance

8-21-2013

How does asymmetric information relate to investment efficiency? Evidence from analysts' earnings forecasts and daily stock trading

Lingmin XIE

Follow this and additional works at: https://commons.ln.edu.hk/fin_etd

Part of the Finance and Financial Management Commons

Recommended Citation
Xie, L. (2013). How does asymmetric information relate to investment efficiency? Evidence from analysts' earnings forecasts and daily stock trading (Master's thesis, Lingnan University, Hong Kong). Retrieved from http://dx.doi.org/10.14793/fin_etd.6

This Thesis is brought to you for free and open access by the Department of Finance and Insurance at Digital Commons @ Lingnan University. It has been accepted for inclusion in Theses & Dissertations by an authorized administrator of Digital Commons @ Lingnan University.

Terms of Use

The copyright of this thesis is owned by its author. Any reproduction, adaptation, distribution or dissemination of this thesis without express authorization is strictly prohibited.

All rights reserved.

HOW DOES ASYMMETRIC INFORMATION RELATE TO INVESTMENT EFFICIENCY?

EVIDENCE FROM ANALYSTS' EARNINGS FORECASTS AND DAILY STOCK TRADING

XIE LINGMIN

MPHIL

LINGNAN UNIVERSITY

2013

HOW DOES ASYMMETRIC INFORMATION RELATE TO INVESTMENT EFFICIENCY?

EVIDENCE FROM ANALYSTS' EARNINGS FORECASTS AND DAILY STOCK TRADING

by

XIE Lingmin

A thesis

submitted in partial fulfillment

of the requirements for the Degree of

Master of Philosophy in Business
(Finance & Insurance)

Lingnan University

2013

ABSTRACT

How Does Asymmetric Information Relate to Investment Efficiency?
Evidence from Analysts' Earnings Forecasts and Daily Stock Trading

by

XIE Lingmin

Master of Philosophy

The adverse selection and agency cost theories suggest that the informational transparency of a firm can help to reduce over- or under-investment. This thesis examines how information asymmetry influences firm-level investment efficiency for companies listed in the U.S. market from 1993 to 2009. Information asymmetry is measured by the dispersion and error of the earnings forecasts made by financial analysts. I investigate how information asymmetry affects firms' proneness to over- or under-invest and the firms' deviations from the investment levels predicted by investment opportunities. To be consistent with the prior literature, I also use the volatility of daily stock returns and yearly high-low price spreads derived from daily stock trading as alternative proxies of information asymmetry.
The results show that lower information asymmetry is associated with more efficient investment. Specifically, a good information environment reduces capital investment for firms that are more prone to over-invest and increases capital investment for those that are more prone to under-invest. In addition, lower information asymmetry is also negatively associated with firm investment when the firm is over-investing and is positively associated with firm investment when the firm is under-investing The results are robust across different regression methodologies and to different estimates of the variables. My findings are consistent with the agency theories of adverse selection and principal-agent conflict.

DECLARATION

I declare that this is an original work based primarily on my own research, and I warrant that all citations of previous research, published or unpublished, have been duly acknowledged.

(XIE Lingmin)
July 29, 2013

CERTIFICATE OF APPROVAL OF THESIS

HOW DOES ASYMMETRIC INFORMATION RELATE TO INVESTMENT EFFICIENCY? EVIDENCE FROM ANALSTS' EARNINGS FORCASTS AND DAILY STOCK TRADING

by

XIE Lingmin

Master of Philosophy

Panel of Examiners :

SIGNED _(Chairman)

(Dr Sonia WONG)

SIGNED (External Member)

(Prof Wayne W YU)

SIGNED (Internal Member)

(Dr Karen ZHANG)

SIGNED (Internal Member)

(Dr GAO Jin)

Chief Supervisor :
Name Prof Michael FIRTH

Co-supervisor :
Name Dr Karen ZHANG

Approved for the Senate :

SIGNED

Prof SEADE Jesús
Chairman, Postgraduate Studies Committee

21-August-2013.

Date

TABLE OF CONTENTS

ACKNOWLEDGEMENT

I am especially grateful to my chief-supervisor, Prof. Michael Firth, who provides valuable advices and thorough guidance with extraordinary patience on my thesis. I also sincerely acknowledge my co-supervisor, Dr. Yuanyuan Zhang, whose encouragement and concerned supervision are indispensable to my MPhil studies. Without the strong support of my supervisors, I cannot have completed my thesis and my studies. I would like to also express my gratitude to Dr. Sonia Wong, Dr. Jin Gao, Dr. Winnie Poon, Dr. Jingyuan Li and Dr. Martin Yick for helpful comments on the thesis and for their support during the last two years. I wish to acknowledge the insightful comments of my external examiner, Professor Wayne Yu, which have helped me understand the issues more clearly. Furthermore, I wish to extend my appreciation to Clara Hui, Vanessa Chan and Christy Au for their kind help during my studies. Finally, I want to thank my family and all my dear friends for their support and encouragement during the last two years.

How Does Asymmetric Information Relate to Investment Efficiency? Evidence from Analysts' Earnings Forecasts and Daily Stock Trading

Chapter 1. Introduction

This thesis examines firms' investment decisions in the presence of asymmetric information. In theory, without any frictions, firms invest efficiently by undertaking projects with positive net present values (Modigliani and Miller, 1958). However, prior literature suggests that the existence of asymmetric information can reduce investment efficiency for at least two reasons. First, the deviation from efficient investment is a result of the principal-agent conflict, where managers work for their own interests through making non-optimal investment decisions when their interests are misaligned with those of shareholders (Jensen and Meckling, 1976). The asymmetric information available to the agent and the managers limits the shareholders' abilities to monitor the managers and thus increases the possibility of over- and under-investment. Second, the investment inefficiency is a consequence of the imperfection of capital markets where firm insiders and external suppliers of capital possess asymmetric sets of information. When raising capital is difficult and costly, firms have to give up profitable projects and suffer under-investment (Myers, 1984). Alternatively, the "lemons problem" of selling overpriced securities gives rise to over-investment (Baker et al., 2003).

This thesis focuses on whether a better information environment (or lower information asymmetry) is associated with a reduction of firm-level over-investment and a reduction of under-investment. To the best of my knowledge, this thesis is the first to examine the influence of information asymmetry on investment efficiency directly. Prior research such as Biddle et al. (2009) and Verdi (2006) documents that higher quality financial reporting improves investment efficiency by reducing over- and under-investment through mitigating information asymmetry between firms and external suppliers of capital. In a related study, García Lara et al. (2010) further document that firms which are more conservative in preparing accounting reports are able to ameliorate information asymmetry problems, and are thus less likely to over- or under-invest. Focusing only on the over-investment behaviors of firms, Richardson (2006) finds that firms with the highest levels of free cash flow tend to over-invest. He argues that information asymmetry makes it costly for investors to monitor management. Under this situation, managers engage in additional investment on self-serving projects rather than distribute the cash to shareholders. My thesis extends these findings by showing, in a more direct manner, how information asymmetry influences firm-level investments.

A major strand of the investment literature has examined how various factors, including asymmetric information, affect investment-cash flow sensitivities, where the sensitivities of investment to cash flows indicate the reliance of investment on internal funds and/or the reluctance of managers to return excess cash to shareholders (Jensen, 1986). It has been shown that higher financial reporting quality reduces investment-cash flow sensitivities (Biddle and Hilary, 2006) and that information asymmetry in the form of higher bid-ask spreads (lower market liquidity) and the probability of informed trading exacerbates investment-cash flow sensitivities (Ascioglu et al., 2008). However, as the internally generated cash flow could be invested in profitable projects, high investment-cash flow sensitivity may not always indicate investment inefficiency (over- or under-investment). Therefore, the conclusions from the prior literature about the factors influencing investment-cash flow sensitivity cannot be automatically extended to investigations of investment efficiency.

Following Biddle et al. (2009), my empirical analysis proceeds in two stages. First, I examine whether lower information asymmetry reduces investments for firms that are more prone to over-invest and increases investments for those that are more prone to under-invest. The firms' proneness to over- and under-invest is measured through ranking the firms according to their leverage and cash, as suggested by Myers (1977) and Jensen (1986). Second, I classify firms as over-investing or under-investing based on their deviations from the optimal investment levels predicted by investment opportunities and explore the effects of lower information asymmetry on investments for over- and under-investing firms, separately.

My study captures asymmetric information by using the error and dispersion of the earnings forecasts made by financial analysts. These measures convey the accuracy of earnings forecasts and the disagreements among financial analysts, and are expected to be higher if the firm being analyzed has greater insider information and is less transparent. In addition, the information asymmetry estimated in this way is not limited to the information conveyed by historical accounting statements. I also consider two alternative proxies of information asymmetry constructed from the daily stock trading process, namely the volatility of daily stock returns and the yearly high-low stock price spread, which capture the information asymmetry among investors who trade in the stock market (Dierkens, 1991; Linck et al., 2008; Corwin and Schultz, 2012).

I test my hypotheses using a panel data set of U.S. publicly listed non-financial and non-regulated firms from 1993 to 2009 and find results consistent with the adverse selection explanation and principal-agent conflict argument. First, lower information asymmetry is shown to be negatively associated with investment if the firms have the potential to over- invest (i.e., firms with relatively more cash and lower leverage) and is positively associated with investment if the firms are inclined to under-invest (i.e., firms with relatively less cash and higher leverage). This finding suggests that among the firms that are more likely to over- or under-invest, lower asymmetric information, as measured by analysts' forecast error and dispersion and the volatility of daily stock returns and the yearly high-low stock price spread, suppresses firms' incentives to make non-optimal investment decisions and improves firm-level investment efficiency. Second, my results show that a better information environment or lower information asymmetry improves firms' investment efficiency by reducing the deviations from the optimal investment levels as predicted by investment opportunities. More specifically, a better information environment is able to reduce investments when the firm is already over-investing and to increase investments when the firm is already under-investing.

A plausible explanation for my results is that both the asymmetric information and investment efficiency of a firm are endogenously determined by some unobservable firm-specific factors. To address this concern, I use fixed firm and year effects regressions. To be consistent with the prior literature, I control for financial reporting quality throughout my analysis, which will also rule out the possibility that analysts' forecast accuracy and uncertainty are solely proxies of financial reporting quality or the possibility that analysts depend only on information conveyed in financial statements when they make earnings forecasts. The robustness tests, including the two-stage instrumental variables regressions, all generate consistent results.

My thesis contributes to several strands of the existing literature. The first contribution is that I directly show how information asymmetry affects the firm-level investment efficiency of U.S. publicly listed non-financial and non-regulated firms. To the best of my knowledge, this is the first study to show direct evidence on this relation. Prior studies show that some factors such as financial reporting quality increase firms' investment efficiency by reducing the firms' information asymmetry or that information asymmetry increases firms' investment-cash flow sensitivities. However, no previous study has directly investigated the association between information asymmetry and investment efficiency. My study also indicates that when analysts make earnings forecasts and when investors participate in the market, they take not only the information conveyed in financial statements but also other information into consideration, because my proxies of information asymmetry still have a significant effect on investment efficiency after controlling for accounting quality.

The remainder of the thesis proceeds as follows. Chapter 2 provides a brief literature review as well as developing my hypotheses. Chapter 3 describes the sample and variables. Chapter 4 introduces the research design and model specifications. Chapter 5 presents empirical results and Chapter 6 concludes.

Chapter 2. Literature review and hypothesis development

2.1 Literature review

In a complete market without frictions, firms invest efficiently by undertaking projects with positive net present values (Modigliani and Miller, 1958). In the real world, information asymmetry between firm insiders and outside capital providers and between managers and shareholders creates conditions whereby managers can make investment decisions that deviate from the optimal levels, and thus lead to over-investment or under-investment. Insiders possess superior information about the true economic values of their firms when compared to "outsiders" and they have incentives to sell overpriced securities, which brings in excess capital that enables over-investment. However, rational investors and lenders may detect or suspect such behavior and respond by rationing capital, which will increase the cost of external finance and reduce the ability of the firm to finance feasible investments.

Akerlof (1970) pioneered the adverse selection literature (also referred to as the "lemons problem"), showing the impact of information asymmetry on investment decisions through influencing equity financing. In a perfect capital market, there is no cost differential between internal and external funds. When firms and potential investors or lenders have different information (i.e., information asymmetry) about the firms' prospects, market imperfections arise. Firms' internal and external finance are not perfect substitutes anymore under these circumstances, and external financing becomes more costly or even completely unavailable when information asymmetry is very high. The model developed by Myers and Majluf (1984) suggests that the impact of information asymmetry will be to increase the cost of capital of firms forced to raise external finance, which in turn will lead to a higher reliance of investment on internally generated funds and/or induce under-investment.

Recent empirical studies have shown that higher information asymmetry is associated with higher costs of equity capital (e.g., Easley and O'Hara, 2004; Francis et al., 2005). Managers, who have superior information and represent the interests of existing shareholders, will prefer to forego projects with positive net present values rather than sell under-valued securities to finance the investment. Similar arguments also apply to debt financing where lenders with less information than borrowers tend to maximize their profits by charging higher interest rates on loans, which will drive away "good borrowers" (Stiglitz and Weiss, 1981; Fazzari et al., 1988). As stated in Fazzari et al. (1988), borrowers have private information about the riskiness of their project returns, while lenders cannot easily distinguish "good borrowers" from "bad borrowers". Under these circumstances, the higher loan interest rates imposed by banks and bondholders will drive away borrowers with good projects.

Besides adverse selection problems, the principal-agent conflict or moral hazard (Jensen and Meckling, 1976) attributes distortions in investment to the misalignment of managerial incentives and shareholder interests and argues that managers over-invest to reap private benefits from, for example, empire building (Jensen, 1986) and managerial entrenchment (Shleifer and Vishny, 1989). Moreover, managers have other private objectives that might lead them to inefficiently invest shareholders' capital. For example, managers might pursue perquisite consumptions (Jensen, 1986), and retain cash windfalls inside the firm and invest them in unattractive projects for the purposes of self-gratification or maintaining the long-run survival and the independence of their firms with themselves at the helm (Blanchard et al., 1994). Managers might also have career concerns caused by the incongruity in risk preferences between the managers and the firms' shareholders (Holmstrom, 1999), a preference for a "quiet life" (Bertrand and Mullainathan, 2003), and hubris, where managers overestimate their abilities to identify good investments (Heaton, 2002). These behavioral traits can induce over- or under-investment. Agency problems can also affect investment efficiency through increasing the cost of capital. If investors are not convinced that managers can credibly commit to foregoing expropriation, they will put a low valuation on the firm and its cost of capital will be high (Grossman and Hart, 1982; Young et al., 2008). However, a timely and transparent information environment helps shareholders to monitor managements and prevents managers from making investment decisions that deviate from the optimal levels.

Prior literature has investigated how information asymmetry influences investment-cash flow sensitivities. Fazzari et al. (1988) first document that imperfect information can create "financing hierarchies" over the use of internal and external funds, and make firms' investment expenditures more sensitive to internal cash flows and stock liquidity. Using a set of firms in the Standard and Poor's 1500 (S&P 1500) index in year 2000 and 2003, Ascioglu et al. (2008) use market microstructure measures of liquidity from stock market high-frequency trading and find that higher informational frictions are associated with lower average firm-level investments and higher investment-cash flow sensitivities. Using data from 34 countries, Biddle and Hilary (2006) show that the quality of accounting reports is negatively related with investment-cash flow sensitivity and higher accounting quality reduces investment-cash flow sensitivity more in economies dominated by stock markets than in those dominated by creditors. The investment-cash flow sensitivity measures the degree of the reliance of firms' investments on internally generated cash, which as pointed by Kaplan and Zingales (1997, 2000) and Fazzari et al. (2000) can reflect external financing constraints and/or an excess of cash, but cannot capture investment (in)efficiency, i.e., over-investment and under-investment.[1] Thus, the results and conclusions from previous studies that examine the factors influencing investment-cash flow sensitivity cannot be automatically imputed to investigations of investment efficiency.

Previous literature about investment efficiency is limited. Motivated by the principal-agent conflict or agency cost explanations, Richardson (2006) documents that over-investment is concentrated in firms with the highest level of free cash flow. He argues that the monitoring difficulty resulting from information asymmetry creates the potential for managers in firms with free cash flow to engage in projects that are beneficial to management but costly from a shareholder perspective. Biddle et al. (2009) study the effects of financial reporting quality on their measures of over- and under-investment, separately, based on a large sample of firms in the U.S. from 1993 to 2005. They find evidence that there is a negative (positive) association between financial reporting quality and investment for firms operating in settings more prone to over-investment (under-investment) and firms with higher financial reporting quality deviate less from their predicted investment levels and show less sensitivity to macro-economic conditions. They argue that one possible mechanism linking reporting quality and investment efficiency is that financial reporting quality serves a role in mitigating information frictions that ultimately hamper investment efficiency.

[1] Alti (2003) shows that investment-cash flow sensitivity is substantially higher for young and small firms with high growth rates and low dividend payout ratios.

Similarly, using a large U.S. sample from the period 1990-2007 and following the method of Biddle et al. (2009), García Lara et al. (2010) analyze the association between investment efficiency and a proxy of firm-level conservative reporting. They find a strong negative relation between a firm specific measure of conservatism and measures of over- and under-investment and attribute this to the informational benefits of conservatism, which is predicted to reduce information asymmetry and thus ameliorate both moral hazard and principal-agent conflict. The evidence from these studies suggests that accounting quality and accounting conservatism have an effect on information asymmetry which in turn influences firm-level investment efficiency. In my study, I directly investigate how information asymmetry influences firms' investment efficiency, or how a better information environment helps reduce over- or under-investment.

2.2 Hypothesis development

Since asymmetric information distorts firm-level investment efficiency, a better information environment is expected to restrain managers from inflating firm performance in the market and from making over- and under-investment decisions. Here, the argument is that if more information is disclosed to the public, especially when potential projects with positive net present values are more visible, it will ease the capital-raising process of firms and reduce related costs and, in turn, the set of projects with positive net present values available for investment will be enlarged. Meanwhile, lower asymmetric information or higher transparency can limit managerial control rights and enhance the shareholders' ability to monitor managerial investment decisions. Alternatively, managers may be aware of the monitoring and constraints they face and build up and maintain self-discipline. Consequently, managers refrain from attempting to expropriate firm cash flows from shareholders through engaging in value-destroying investments.

Based on the above discussions, I hypothesize that lower information asymmetry will improve firm-level investment efficiency by reducing firms' over-investment, under-investment or both. More specifically, I form the following two hypotheses:

H1a: lower information asymmetry is associated with higher investment for under-investing firms and the firms that are more likely to under-invest.

H1b: lower information asymmetry is associated with lower investment for over-investing firms and the firms that are more likely to over-invest.

Chapter 3. Data description

3.1 Sample construction

I obtain earnings forecasts and actual earnings from the Unadjusted Detail History file and Unadjusted Detail Actuals file of the Institutional Brokers Estimate Systems (I/B/E/S), respectively[2]. Annual financial data on firms and historical stock trading data are respectively obtained from Compustat and Center for Research in Security Prices (CRSP).

As the number of analysts following any given firm in the U.S. market tends to increase as the fiscal year end approaches and decrease after the eleventh month, I follow O'Brien and Bhushan (1990) and Mansi et al. (2011) and use the forecasts made in the one month prior to the fiscal year-end to calculate forecast dispersion and error. For example, I use the forecasts released by financial analysts during November if a company's fiscal year-end is December 31. Including the forecasts made near the end of the fiscal year can reduce the effects of optimism bias that appears to exist in the forecasts released at the beginning of the fiscal year (e.g., Fried and Givoly, 1982; O'Brien, 1988; Easterwood and Nutt, 1999). Moreover, limiting the selection period to one month to shorten the length of the window is advantageous because the past literature has shown that when all forecasts are not equally recent, analysts who make forecasts later have an information advantage over the earlier predictions released by other analysts (e.g., O'Brien, 1990; Loh and Mian, 2006). For the above reasons,

[2] I/B/E/S adjusts forecasts and actual data for stock splits and rounds them to two decimals in the summary file and four decimals in the detail file. This rounding artificially reduces forecast dispersion and error, introducing measurement error (e.g., Payne and Thomas, 2003). To avoid this problem, I conduct my analyses on the basis of raw forecast data unadjusted for stock splits and re-adjust them following the instruction provided by Wharton Research Data Services (WRDS).

forecasts released near to the end of the forecasting period are more appropriate for constructing proxies of information asymmetry for individual firms.

To be included in the sample, firm-year observations need to have at least two analysts providing earnings forecasts. Firms in the financial industry (SIC codes 6000-6999) are excluded because their financial ratios are not comparable to those of the firms in other industry sectors. Firms in the utilities industry (SIC codes 4900-4999) are also excluded because they tend to have different objectives from other firms when making investment decisions due to heavy regulations, and are subject to various investment constraints. In order to mitigate the influence of outliers in each year, I remove the top and bottom 1% of all continuous variables by year. My final sample contains 12,871 firm-year observations from 1993 to 2009.

3.2 Variable definitions

In my study, information asymmetry is first measured by the dispersion and error of the earnings forecasts made by financial analysts. Forecast dispersion (*Disp*) is defined as the standard deviation of analysts' earnings forecasts scaled by the stock price at fiscal year-end and then multiplied by minus one. Forecast error (*Error*) is defined as the absolute earnings forecast error: |actual-median forecast|, scaled by the stock price at the fiscal year-end and then multiplied by minus one. I use negative dispersion and error so that *Disp* and *Error* are increasing with information quality and decreasing with the information asymmetry of firms.

Analysts are prominent information intermediaries in capital markets. They engage in information search from public and private sources. The forecast dispersion and error are considered to be straightforward, forward-looking and comprehensive [3] as measures of information asymmetry, and have been widely used in the prior literature (e.g., Lang and Lundholm, 1996; Krishnaswami and Subramaniam, 1999; Thomas, 2002). Forecast dispersion represents the disagreements among analysts about the future performance of firms. High dispersion implies low consensus among analysts' forecasts, and is a sign of low transparency of a firm. The error in analysts' earnings forecasts is a particularly appropriate proxy of the level of information asymmetry about a firm given the evidence shown in Elton et al. (1984). Firms with higher levels of information asymmetry between insiders and outsiders and between managers and shareholders are expected to have higher forecast dispersion and error.

In addition to forecast dispersion and error, I also use two alternative proxies of information asymmetry measured by the volatility of daily stock returns and yearly high-low stock price spread. The first measure is the volatility of daily stock returns or market-adjusted residual volatility of the daily stock returns, which I denote as *Std*[4]. The second is the yearly high-low price spreads based on daily high-low stock price data from CRSP following the methodology in Corwin and Schultz (2012), which I denote as *Spread*. Higher volatility in stock returns and stock price spread indicates more uncertainties in the market and higher information asymmetry among investors. These variables have been used in prior studies to measure information asymmetry (Dierkens, 1991; Linck et al., 2008; Maskara and Mullineaux, 2011; Cho et al., 2013).

[3] Ohlson (2001) and Bryan and Tiras (2007) both document that analysts' earnings forecasts not only reflect the information conveyed by accounting fundamentals but also capture other information about future earnings.

[4] Each year, I regress a firm's daily stock returns on market daily returns and obtain its residuals. *Std* is measured as the standard deviation of the residuals.

Both measures are multiplied by minus one so that they are increasing with information quality and decreasing with information asymmetry.

Following Biddle et al. (2009), a firm's investment, denoted by *Invest*, is measured as the sum of research and development expenditure, capital expenditure, and acquisition expenditure less cash receipts from the sale of property, plant, and equipment and scaled by lagged total assets. In robustness tests, I also use capital investment, *Capex*, as the dependent variable and the results are consistent with those from the more comprehensive measure of investment described above (*Invest*).

Consistent with prior literature, I control for cash balance (Jensen, 1986) denoted by *Cash* and financial leverage (Myers, 1977) denoted by *Leverage*, which are important indicators of a firm's financial condition. I also control for other firm-specific characteristics including firm age (*Age*), the difference between the date when a firm first appeared in CRSP and fiscal year end date, firm size (*Size*), calculated as the logarithm of total assets, and market-to-book ratio (*MB*), which is the ratio of the market value of equity to the book value of common stock. I also include *Sdcfo*, *Sdsales*, and *Sdinvest*, which are, respectively, the standard deviation of cash flow from operations deflated by average total assets, the standard deviation of sales deflated by average total assets, and the standard deviation of investment (*Invest*) measured over the years *t-5* to *t-1*. *Loss* is an indicator variable that is coded one if net income before extraordinary items is negative and zero otherwise. *Dividend* is an indicator variable that is coded one if the firm paid a dividend and zero otherwise. *Zscore* measures the degree of a firm's financial health; the higher the probability of corporate default, the lower the score. *Tangible* is the ratio of tangible assets to total assets. Operating cycle (*OC*) is defined as the average time between purchasing or acquiring inventory and receiving the cash proceeds from sales.

Following Biddle et al. (2009), I also control for financial reporting quality (*AQ*), which measures the precision of the information conveyed in financial reports about the firm's operation, in particular its expected cash flow. Financial reporting quality is calculated as the standard deviation of the firm-level residuals from a regression model developed by Dechow and Dichev (2002) and extended by Francis et al. (2005) to include change in revenues and plant, property and equipment (PPE) from years *t-5* to *t-1* and multiplied by negative one so that *AQ* is increasing in financial reporting quality. The extended model regresses working capital accruals on lagged, current and future cash flows plus the change in revenue (scaled by average total assets) and PPE[5]. The model is estimated cross-sectionally for each industry with at least 20 observations in a given year based on the Fama and French (1997) 48-industry classifications. The measure is based on the idea that accruals are estimates of future cash flows and will be more predictive of future cash flows when there is lower estimation error embedded in the accruals process. The residuals from the model represent the estimation errors in the current accruals that are not associated with operating cash flows and that cannot be explained by the change in revenue and the level of PPE. So the unexplained portion of the variation in working capital accruals

[5] The extended model is $TCA_{i,t} = \alpha_0 + \alpha_1 CFO_{i,t-1} + \alpha_2 CFO_{i,t} + \alpha_3 CFO_{i,t+1} + \alpha_4 \Delta Rev_{i,t} + \alpha_5 PPE_{i,t} + \varepsilon_{i,t}$, where $TCA_{j,t}$ = total current accruals in year $t = \Delta CA_{j,t} - \Delta CL_{j,t} - \Delta Cash_{j,t} + STDEBT_{j,t}$, $CFO_{j,t} = NIBE_{j,t} - TA_{j,t}$ = firm *i*'s cash flow from operations in year *t*, *NIBEj,t* = firm *i*'s net income before extraordinary items (item18) in year *t*, $TA_{j,t}$ = firm *i*'s total accruals in year $t = (\Delta CA_{j,t} - \Delta CL_{j,t} - \Delta Cash_{j,t} + \Delta STDEBT_{j,t} - DEPN_{j,t})$, $\Delta CA_{j,t}$ = firm *i*'s change in current assets (item 4) between year *t-1* and year *t*, $\Delta CL_{j,t}$ = firm *i*'s change in current liabilities (item 5) between year *t-1* and year *t*, $\Delta Cash_{j,t}$ = firm *i*'s change in cash (item 1) between year *t-1* and year *t*, $\Delta STDEBT_{j,t}$ = firm *i*'s change in debt in current liabilities (item 34) between year *t-1* and year *t*, $DEPN_{j,t}$ = firm *i*'s depreciation and amortization expense (item 14) in year *t*, $\Delta Rev_{i,t}$= firm *i*'s change in revenue (item 12) between year t-1 and year t and $PPE_{i,t}$= firm *i*'s gross value of PPE (item 7).

is an inverse measure of accruals quality, or the reporting quality (Biddle et al., 2009; Chen et al., 2011). The detailed descriptions and definitions of variables are given in Table 1.

[Insert Table 1 here]

3.3 Descriptive statistics

Table 2 provides the descriptive statistics for the full sample including mean, standard deviation (STD), 25% percentile, median, and 75% percentile. The mean (median) of investments across all firm-years is 16.1% (11.0%) of the prior years' total assets. The mean (median) value of reporting quality (*AQ*) is -0.105 (-0.059), which is consistent with those reported in Biddle et al. (2009) and Garcia Lara et al. (2010). The forecast dispersion (*Disp*) has a mean of -0.006 and a median of -0.002 and the forecast error (*Error*) has a mean of -0.011 and a median of -0.002 (note that the dispersion and error have been multiplied by minus one). The mean (median) of the volatility of daily stock returns (*Std*) is -0.028 (-0.025) and the mean (median) of yearly high-low price spreads (*Spread*) is -0.004 (-0.002) (note that *Std* and *Spread* have been multiplied by minus one and increase with information quality).

[Insert Table 2 here]

Table 3 presents the Pearson correlation matrix of the variables used in my analysis. Forecast dispersion and error are positively and significantly correlated with investments at time *t+1*, with coefficients of 0.04 and 0.04, respectively. However, as I will show later, the relation between information asymmetry and investment is conditional on the firm's proneness to over- or under-invest or on whether the firm positively or negatively deviates from the predicted investment level. Consistent with the prior literature, the quality of financial reporting is significantly and positively related to each of the proxies of information asymmetry and the four proxies of information asymmetry are also significantly and positively correlated with each other. In addition, cash and leverage are significantly correlated with investments with their predicted positive and negative signs, respectively. Firms with more cash in hand are more likely to over-invest and those with higher leverage are more likely to have financial constraints and tend to under-invest. The correlation coefficients between the other control variables and investments are broadly consistent with those in Biddle et al. (2009).

[Insert Table 3 here]

Chapter 4. Research methodology and model specifications

4.1 Measuring over- and under-investment

As discussed earlier, the relation between lower asymmetric information and investment is expected to be either negative for over-investing firms or positive for under-investing firms. So my estimation starts from measuring over- and under-investment. Following Biddle et al. (2009), I use two approaches, which are the firms' proneness to over- and under-invest and the firms' actual deviations from the investment levels predicted from their investment opportunities and industry affiliations.

To measure the firms' proneness to over- and under-invest, in each year and industry, firms are ranked into deciles based on each of the two firm-specific variables, cash balance and leverage (I multiply leverage by minus one before ranking so that it is increasing with the likelihood of over-investment). The two groups of ranked numbers are rescaled to range between zero and one, respectively. Firms with more cash in hand are subject to higher agency costs and have a greater potential to over-invest (Jensen, 1986). In contrast, the lack of cash and/or high leverage may lead to financial constraints and thus result in under-investment. Therefore, the likelihood of over-investment increases with cash and decreases with leverage, while that of under-investment decreases with cash and increases with leverage. My rankings according to cash and minus leverage give the highest rank to the firms that are most likely to over-invest and the lowest rank to the firms that are most likely to under-invest. I then construct a variable, *OverInvest*, as the average of the two rescaled ranks. If *OverInvest* is one or close to one then I describe the firm as being prone to overinvest while if *OverInvest* is zero or close to zero, I describe the firm as being prone to under-invest. *OverInvest* increases with the firm's likelihood of over-investment. As shown in Table 2, the mean and standard deviation of *OverInvest* are, respectively, 0.495 and 0.232.

My first approach considers over- and under-investment conditional on the firms' cash and leverage. The second approach directly measures the deviations from the predicted level of investments, based on a regression model of investment as a function of investment opportunities, measured by Tobin's Q[6], specified as follows:

$$Invest_{i,t+1} = \alpha + \beta Q_{i,t+1} + \varepsilon_{i,t+1} \qquad \text{eq. (1)},$$

where $Invest_{i,t+1}$ refers to the total investment of firm *i* at year *t+1*, and $Q_{i,t}$ refers to the Tobin's Q in year *t*. The regression model of eq. (1) is estimated cross-sectionally for each industry with at least 20 observations in a given year based on the Fama and French (1997) 48-industry classifications. The resulting regression residuals are used as the firm-specific proxies of the deviations from expected investment levels. Firms with negative residuals are classified as under-investing and those with positive residuals are classified as over-investing. I define a dummy variable, *neg*, which is coded 1 if a firm is classified as under-investing (with a negative residual) and otherwise coded zero, and a dummy variable, *pos*, which is coded 1 if a firm is classified as over-investing (with a positive residual) and otherwise coded zero[7].

[6] In untabulated analysis, I find that results are similar if I estimate the model using sales growth, which is the change in sales from year *t-1* to *t*, as a proxy of investment opportunities.

[7] As a further test, I drop the observations if the residual is lower than the median of the positive residuals and is higher than the median of the negative residuals. For the remaining observations, if the residual is positive, the dummy variable, *pos*, is coded one and otherwise coded zero. Similarly, the dummy variable, *neg*, is coded one for the observations with negative residuals and otherwise coded zero. The results for this test are reported later in Table 8.

4.2 Regression models

In order to test whether lower information asymmetry is positively (negatively) associated with investment among the firms that are more prone to under-invest (over-invest), I include the ranked variable, *OverInvest*, discussed in the previous section and the fixed firm and year effect regression model is specified as follows:

$$Invest_{i,t+1} = \alpha_0 + \alpha_1 Disp_{i,t} + \alpha_2 Disp_{i,t} \times OverInvest_{i,t} + \alpha_3 OverInvest_{i,t} + \alpha_4 AQ_{i,t} + \alpha_5 AQ_{i,t} \times OverInvest_{i,t} + \gamma Control_{i,t} + \lambda_i + \varepsilon_{i,t+1} \quad \text{eq.(2)},$$

where $Invest_{i,t+1}$ refers to the investment of firm i in year $t+1$, $Disp_{i,t}$ refers to the dispersion of analysts' forecasts of firm i in year t multiplied by minus one and $AQ_{i,t}$ represents the accounting quality. The proneness to over- and under-invest for firm i in year t is captured by the ranked variable, $OverInvest_{i,t}$, which ranges from zero to one and takes the value of zero (one) or close to zero (one) for firms that are more prone to under-invest (over-invest).

In eq. (2), when *OverInvest* equals zero, the coefficient on $Disp_{i,t}$, α_1, measures the effect of asymmetric information on investment among the firms with the highest level of leverage and lowest amount of cash (i.e., firms in the bottom decile). According to H1a, lower information asymmetry increases the investments for the firms that are most likely to under-invest. So, I expect that $\alpha_1>0$. The effect of information asymmetry on investments among the firms that are more prone to over-invest (i.e., firms with the highest amount of cash and lowest level of leverage) is captured by the sum of the coefficients on $Disp_{i,t}$ and the interaction term of $Disp_{i,t} \times OverInvest_{i,t}$, which is $\alpha_1+\alpha_2$. According to H1b, I expect that the effect is negative and $\alpha_1+\alpha_2 <0$. The coefficient on the interaction term, α_2, measures the incremental relation between information asymmetry and investment among the firms that are most likely to over-invest, and according to H1a and H1b, I expect that α_2 <0.

Based on the deviation from the predicted investment level, I further test the effects of information asymmetry on firm-level under- and over-investment using a regression model as follows:

$$Invest_{i,t+1} = \beta_0 + \beta_1 Disp_{i,t} \times neg_{i,t+1} + \beta_2 Disp_{i,t} \times pos_{i,t+1} + \eta Control_{i,t} + \lambda_i + \varepsilon_{i,t+1} \quad \text{eq.(3)},$$

where the investment of firm i in year $t+1$, $Invest_{i,t+1}$, is explained by the interaction term of dispersion in analysts' forecasts at year t and the under-investment dummy at year $t+1$, $Disp_{i,t} \times neg_{i,t+1}$, the interaction term of dispersion of analysts' forecasts at year t and the over-investment dummy at year $t+1$, $Disp_{i,t} \times pos_{i,t+1}$, and control variables. The dummy variables *neg* and *pos* are defined based on the regression model of eq. (1) and discussed in the previous section.

According to my hypothesis H1a, if the firm appears to under-invest, lower asymmetric information is expected to increase investment. Hence, I expect that the coefficient on $Disp_{i,t} \times neg_{i,t+1}$ in eq.(3), β_1, to be positive. In contrast, if the firm is over-investing compared with the predicted level, lower asymmetric information is expected to reduce investment and thus the coefficient on $Disp_{i,t} \times pos_{i,t+1}$ in eq.(3), β_2, is expected to be negative.

For both the regression models specified in eq.(2) and eq.(3), alternative proxies of asymmetric information are used by replacing $Disp_{i,t}$ by $Error_{i,t}$, $Std_{i,t}$ and $Spread_{i,t}$. To control for the potential endogeneity problem due to omitted firm-specific variables that influence both asymmetric information and investment efficiency, I use the fixed firm and year effect regression model for both eq.(2) and eq.(3) to eliminate the time-invariant firm effect.[8] Control variables following the prior literature are also included. Following Biddle et al. (2009), I also use a regression model with fixed-industry effect and with standard errors clustered in the two dimensions of firm and year for eq.(2) (proposed by Petersen, 2009). The results are overall consistent with those in Table 4.

[8] Results from the Hausman Test suggest that it is more appropriate to use fixed-effect models in my tests than random effect models.

Chapter 5. Empirical results

5.1 Firms that are more prone to over- or under-invest

In this section, I test how asymmetric information affects investments among the firms that are more prone to over- or under-invest, where the proneness is captured by the ranked variable, *OverInvest*, which is described in Section 4.1. Table 4 reports the fixed-effect regression results of eq. (2). In column (1), when *Disp* is used as a proxy of asymmetric information, the estimated coefficient on *Disp* is positive (1.684) and significant (p=0.000). Therefore, among the firms that are more prone to under-invest, lower asymmetric information increases investments. In terms of the economic significance, when *Disp* increases by one standard deviation, investment of the under-investing firms will increase by 0.032[9]. Given that the mean investment of the whole sample is 0.161, the effect represents an increase in investment of 19.9%[10].

The estimated coefficient on the interaction term of *Disp*× *OverInvest* is significantly negative (-2.935, p=0.000). The overall effect of lower asymmetric information on investments among the firms that are more prone to over-invest is captured by the sum of coefficient estimates on *Disp* and *Disp*× *OverInvest*, i.e., $\alpha_1+\alpha_2$ in eq.(2), which is significantly negative according to the joint test (–1.250, p=0.000). In terms of the economic significance, increasing *Disp* by one standard deviation decreases investment by 0.024[11] among the firms that are most likely to over-invest and it represents a decrease in investment of about 14.9%[12] (The mean investment of the whole sample is 0.161).

[9] This figure is calculated as 1.684×0.019.
[10] This figure is calculated as 0.032/0.161.
[11] This figure is calculated as 1.250×0.019.
[12] This figure is calculated as 0.024/0.161.

My regression analysis controls for accounting quality, *AQ*, estimated following the method of Biddle et al. (2009) and Dechow and Dichev (2002). Consistent with the prior literature, the accounting quality increases investments for firms that are more likely to under-invest (0.336, p=0.000) and decreases investments for firms that are more likely to over-invest (-0.425, p=0.000). The results for the other control variables are also consistent with those reported in previous studies (e.g., Biddle et al., 2009).

In column (2), when replacing the measure of asymmetric information by *Error*, the estimated coefficients on the experimental variables, *Error*, *Error*× *OverInvest*, and *OverInvest*, also have the predicted signs and are statistically significant. Specifically, the estimated coefficient on *Error* is positive (0.254) and significant (p=0.000) and the estimated coefficient on the interaction term of *Error*× *OverInvest* is significantly negative (-0.465, p=0.009). The overall effect of lower asymmetric information on investments among the firms that are more prone to over-invest is captured by the sum of coefficient estimates on *Error* and *Error*× *OverInvest*, i.e., $\alpha_1+\alpha_2$ in eq.(2), which is significantly negative according to the joint test (-0.211, p=0.075). In terms of the economic significance, when *Error* increases by one standard deviation, investment of the under-investing firms will increase by 0.013[13]. Given that the mean investment of the whole sample is 0.161, the effect represents an increase in investment of 8.1%. In addition, increasing *Error* by one standard deviation decreases investment by 0.011[14] among the firms that are most likely to over-invest and it represents a decrease in investment of about 6.8%. The effects of information

[13] This figure is calculated as 0.254×0.053.
[14] This figure is calculated as 0.211×0.053.

asymmetry on investment efficiency are economically and statistically significant when forecast dispersion and error are used as the proxies of information asymmetry.

I also use two alternative measures as the proxies of asymmetric information that have appeared in the literature. They are the volatility of daily stock returns (*Std*) and yearly high-low price spreads (*Spread*) derived from daily stock trading. As mentioned previously, both variables are multiplied by minus one so that *Std* and *Spread* are increasing with information quality. The regression results are presented in columns (3) and (4) in Table 4. The results are consistent with those in columns (1) and (2). In particular, the coefficients on the information asymmetry variables, *OverInvest*, interactions, and the joint tests have their expected signs and are statistically significant.

[Insert Table 4 here]

Following Biddle et al. (2009), I also estimate eq. (2) with fixed-industry effect and with standard errors clustered in the two dimensions of firm and year (Petersen, 2009) and the results are reported in Table 5. The results for the main experimental variables are generally consistent with those in Table 4 and support my hypotheses. Most of the coefficient estimates on information asymmetry variables, interactions, and the joint tests are significant with the predicted signs. Although the joint test is not significant at conventional levels when *Error* is used as the proxy of information asymmetry, the sign is consistent with my prediction. The results for the control variables are also consistent with those reported in previous studies (e.g., Biddle et al., 2009).

[Insert Table 5 here]

In summary, the results in Table 4 and Table 5 provide strong evidence supporting my hypothesis of H1a, that when firms are more prone to under-invest, lower information asymmetry increases investments, and of H1b, that when firms are more prone to over-invest, lower information asymmetry decreases investments.

5.2 Firms that deviate from the predicted investment levels

In this section, I use an alternative way to identify whether a firm is over- investing or under-investing. Regression eq. (1) is run and a firm is defined as over-investing if the residual is positive and under-investing if the residual is negative. As described in section 4.1, the dummy variables *Pos* is coded one for over-investing firms and zero for other firms and the dummy variable *Neg* is coded one for under-investing firms and zero for other firms. Then the effects of lower asymmetric information on investments are tested separately for over- and under-investing firms using regression eq. (3). The results are reported in Table 6, with *Disp* and *Error* as proxies of asymmetric information.

Columns (1) and (2) present the univariate regression results. As predicted, the coefficients on *Disp*× *Neg* and *Error*× *Neg* are significantly positive, while those on *Disp*× *Pos* and *Error*× *Pos* are significantly negative. I include all the control variables used earlier except for accounting quality in columns (3) and (4) and the results are still consistent with my hypotheses that lower information asymmetry is negatively associated with under-investment and over-investment, i.e., lower information asymmetry is positively associated with investment for under-investing firms and negatively associated with investment for over-investing firms[15].

Columns (5) and (6) show the regression results of how asymmetric information influences firms' over- and under-investment, after controlling for *AQ* and other firm-specific variables. The estimated coefficients on the main experimental variables, the interaction term of information asymmetry and over-investment and under-investment, remain significant with their predicted signs. In terms of the economic significance, for column (5) (or column (6)), a one-standard-deviation increase in *Disp* (or *Error*) on average increases investment by approximately 0.007 (or 0.005)[16] for under-investing firms and decreases investment by approximately 0.008 (or 0.01)[17] for over-investing firms. Given that the mean investment is 0.161 (See Table 2), such effects imply that investments increase by 4.3% (or 3.1%)[18] for under-investing firms and decrease by 5.0% (or 6.2%)[19] for over-investing firms. Hence, the effects of information asymmetry on investment efficiency are economically as well as statistically significant. Therefore, consistent with my hypotheses, the under-investing firms with lower asymmetric information tend to increase investments while the over-investing firms with lower asymmetric information tend to reduce investments.

[Insert Table 6 here]

Table 7 shows the regression results of the models specified in eq. (3) when forecast

[15] In untabulated analysis, I test the relation between reporting quality, *AQ*, and investment efficiency (Biddle et al., 2009) without information asymmetry included. The results show that, consistent with the prior literature, *AQ* is negatively associated with investment for over-investing firms and positively associated with investment for under-investing firms.

[16] These figures are calculated as 0.394×0.019 (or 0.091×0.053).

[17] These figures are calculated as 0.413×0.019 (or 0.190×0.053).

[18] These figures are calculated as 0.007/0.161 (or 0.005/0.161).

[19] These figures are calculated as 0.008/0.161 (or 0.010/0.161).

dispersion and error are replaced by a stock return volatility measure, *Std*, and a yearly high-low price spread, *Spread*. The estimated coefficients on *Std*× *Neg* and *Spread*× *Neg* are positive and significant while those on *Std*× *Pos* and *Spread*× *Pos* are negative and significant. The results are consistent with those reported when using *Disp* and *Error* as the measures of information asymmetry (See Table 6). For example, the coefficient on the interaction term of *Std* and under-investment dummy is significantly positive (2.338, p=0.000) and the coefficient on the interaction term of *Std* and over-investment dummy is significantly negative (-1.479, p=0.000) in column (5). Similarly, the coefficient on the interaction term of *Spread* and under-investment dummy is significantly positive (4.375, p=0.000) and the coefficient on the interaction term of *Spread* and over-investment dummy is significantly negative (-3.262, p=0.000) in column (6). In terms of the economic significance, for column (5) (or column (6)), a one-standard-deviation increase in *Std* (or *Spread*) on average increases investment by approximately 0.033 (or 0.026)[20] for under-investing firms and decreases investment by approximately 0.021 (or 0.020) for over-investing firms. Given that the mean investment is 0.161, as shown in Table 2, such effects imply that investments increase by 20.5% (or 16.1%)[21] for under-investing firms and decrease by 13% (or 12.4%) for over-investing firms.

[Insert Table 7 here]

As a further test, I drop the observations with the residuals estimated from eq. (1) that are lower than the median of the positive residuals and are higher than the median of the negative residuals. For the remaining observations, the dummy variable, *pos*, is coded one if the residual is positive and otherwise coded zero. Similarly, the dummy

[20] These figures are calculated as 2.338×0.014 (or 4.375×0.006).
[21] These figures are calculated as 0.033/0.161 (or 0.026/0.161).

variable, *neg*, is coded one if the residual is negative and otherwise coded zero. This procedure gives me a sample of firms with more severe over- or under-investment; the number of observations is thus reduced by 50%. Table 8 presents the results of the regression eq. (3) using the reduced sample. When I use *Disp*, *Error*, *Std* and *Spread* as proxies of information asymmetry, the coefficients on *Disp*× *Neg*, *Error*× *Neg*, *Std*× *Neg* and *Spread*× *Neg* are always significantly positive and the coefficients on *Disp*× *Pos*, *Error*× *Pos*, *Std*× *Pos* and *Spread*× *Pos* are always significantly negative. As I only include the observations in the upper half of the positive residuals and lower half of the negative residuals, the magnitudes of the estimated coefficients on the interaction terms are consistently higher than their counterparts in Table 6 and Table 7. The Table 8 results provide corroborative support for my hypotheses that lower information asymmetry is positively associated with investment for under-investing firms and is negatively associated with investment for over-investing firms.

[Insert Table 8 here]

5.3 Robustness tests

5.3.*1 Instrumental variables estimation*

As the level of information asymmetry of a firm and the firm's investment decisions can be endogenously determined by firms rather than exogenously given, the above analysis is subject to endogeneity problems. If a firm's information asymmetry and investment decisions are driven by the same underlying forces or common omitted factors simultaneously, my models and analyses may create a spurious relation between information asymmetry and investment efficiency. For example, the managers of under-investing firms in anticipation of future investment opportunities might want to improve the current information environment, and thereby reduce information asymmetry. This will lower the cost of external finance and help fund incremental investments. Under this situation, the underlying driving force of the association between information asymmetry and investment decisions is the managers' perceptions of future investment and financing needs. To address the potential endogeneity of information asymmetry and investment efficiency, I use instrumental variables estimation and use the industry average information asymmetry for each firm as instrument for the firm's information asymmetry. For example, I use the industry average analyst forecast dispersion and error as instruments for each firm's forecast dispersion and error, respectively. Information asymmetry at the firm level is influenced by that of its industry peers since firms in the same industry tend to share commonalities in the factors that affect information asymmetry. However, the industry average dispersion and error are unlikely to be closely related with the investment behaviors of a particular firm. Hence, the industry average forecast dispersion (error) can make a good instrumental variable for the forecast dispersion (error) of a specific firm.

The firm-level information asymmetry is estimated as a function of the instrumental variable as well as all of the control variables and the predicted value of information asymmetry is then included in the main models to replace the original information asymmetry variable. The fixed-effect regressions of eq. (3) are re-estimated in the second stage of the model and the results are shown in Table 9. The untabulated results from the first-stage instrumental model show that the industry average *Disp*, *Error*, *Std* and *Spread* are positively and significantly associated with the firms' *Disp*, *Error*, *Std* and *Spread*, respectively. The F-tests in the first-stage regressions indicate that the coefficient estimates on the instruments are significantly different from zero at the 1% level. Using firms' proneness to over- or under-invest as the measure of investment efficiency, Table 9 shows consistent results with those presented in Table 4. The estimated coefficients on the main experimental variables are all highly significant with p-values close to zero and with predicted signs, except for the joint test with *Error* in column (2). The restraints of lower information asymmetry on firms' proneness to over- or under-invest still survive when using instrumental variables estimation.

[Insert Table 9 here]

Table 10 shows the instrumental variables estimation results when investment efficiency is based on deviations from the predicted investment levels. The coefficient estimates on the interaction terms of information asymmetry and under-investment dummy are always positive and significant at the 1% level and those on the interaction terms of information asymmetry and over-investment dummy are negative and significant at the 1% level except when forecast error is used as the proxy of information asymmetry. Therefore, my findings on the impact of information asymmetry on over- and under-investment appear to be robust to the instrumental variables estimation.

[Insert Table 10 here]

5.3.2 Alternative measures of investments

As a robustness check, I replace the investment dependent variable (*Invest*) for each firm in eq. (3) by alternative measures of investment and re-estimate my main models. The alternatives are the capital investment, *Capex*, and the residual of the regression model specified by eq. (1), which measures the deviation from the predicted investment. The regression results of eq.(2) with *Capex* as the dependent variable are shown in Table 11 and those of eq.(3) with *Capex* and the residual as dependent variables are shown, respectively, in Panel A and Panel B of Table 12. Overall, my conclusions are not affected by the decision to use capital investment or the investment model residual instead of investment as the dependent variable.

[Insert Table 11 and Table 12 here]

Chapter 6. Conclusion

Theoretical models have suggested that lower information asymmetry can improve firms' investment efficiency by mitigating the adverse selection problem and moral hazard or principal-agent conflict. Extending previous research, I use the dispersion and error of analysts' earnings forecasts and the volatilities of daily stock returns and yearly high-low price spreads as the proxies of information asymmetry and test the relations between information asymmetry and investment efficiency. My study is the first to directly investigate this relation with a variety of proxies of information asymmetry and two different approaches to measure investment efficiency.

I find that lower information asymmetry is positively associated with investment for firms classified as under-investing and the firms that are more likely to under-invest, and is negatively associated with investment for firms classified as over-investing and the firms that are more likely to over-invest. The results are robust across different regression methodologies and to different estimates of the variables. Overall, the findings are consistent with my hypotheses that lower information asymmetry restrains firms' incentives to under-invest and over-invest and firms with lower information asymmetry deviate less from the optimal investment levels predicted by investment opportunities and industry affiliations.

Tables

Table 1 Definitions of variables

This table provides detailed definitions of variables. The item numbers of the variables from Compustat are provided.

Name	Definition
Invest	The sum of research and development expenditure (item 46), capital expenditure (item 128), and acquisition expenditure (item 129) less cash receipts from sale of property, plant, and equipment (item 107) and scaled by lagged total assets (item 6).
Capex	The ratio of capital expenditure (item 128) to lagged property, plant and equipment (item 8).
Disp	The standard deviation of analysts' earnings forecasts scaled by fiscal year end price and then multiplied by minus one.
Error	The absolute earnings forecast error: |actual EPS-median forecast EPS| scaled by fiscal year end price and then multiplied by minus one.
Std	The standard deviation of the residuals of the market model regression, where the daily stock returns of a firm is regressed against the value-weighted market returns from CRSP and then multiplied by minus one. The estimation period is one year.
Spread	The yearly high-low price spreads based on daily high-low price data from CRSP following the methodology in Corwin and Schultz (2012) and then multiplied by minus one.
Q	The ratio of Market value of total assets to Book value of total assets= [book value of assets (item 6) + market value of common stock (item 25×item 199) - book value of common stock (item 60) - balance sheet deferred taxes (item 74)]/book value of assets (item 6).
AQ	Financial reporting quality is calculated as the standard deviation of the firm-level residuals from the model developed by Dechow and Dichev (2002) and extended by Francis et al. (2005) to include change in revenues and plant, property and equipment (PPE) during the years *t-5* to *t-1* and multiplied by negative one so that AQ is increasing in financial reporting quality. The extended Dechow and Dichev model is a regression of working capital accruals on lagged, current, and future cash flows plus the change in revenue and PPE and is estimated cross-sectionally for each industry with at least 20 observations in a given year based on the Fama and French (1997) 48-industry classification.
OverInvest	In each year and industry, firms are ranked into deciles based on each of the two firm-specific variables, cash balance and leverage (leverage is multiplied by minus one before ranking). The two groups of ranked numbers are rescaled to range between zero and one, respectively. *OverInvest* is the average of the two rescaled ranks.

Age	The difference between the first date when a firm appeared in CRSP and the fiscal year end date.
Size	The logarithm of total assets (item 6).
MB	The ratio of the market value of equity (item 25×item 199) to the book value of common stock (item 60).
Cash	The ratio of cash (item 1) to total assets (item 6).
Leverage	The ratio of debt to total assets= [long-term debt (item 9) + debt in current liabilities (item 34)]/ total assets (item 6).
Sdcfo	The standard deviation of the cash flow from operations deflated by the average total assets from years *t-5* to *t-1*.
Sdsales	The standard deviation of the sales (item 12) deflated by the average total assets from years *t-5* to *t-1*.
Sdinvest	The standard deviation of investment (*Invest*) from years *t-5* to *t-1*.
Loss	An indicator variable that takes the value of one if net income before extraordinary items (item 18) is negative, and zero otherwise.
Dividend	An indicator variable that takes the value of one if the firm paid a dividend (i.e., if item 21>0 or item 127>0), and zero otherwise.
Zscore	A measure of a firm's financial health= [3.3×pretax income + sales + 0.25×retained earnings + 0.5× (current assets-current liabilities)]/total assets = [3.3× item 170 + item 12 + 0.25× item 36 + 0.5× (items 4-item 5)]/item 6.
Tangible	The ratio of tangible assets (item 8) to total assets (item 6).
OC	The average time between purchasing or acquiring inventory and receiving the cash proceeds from its sale = Log [(item 2/item 12+item 3/item 41)×360].

Table 2 Descriptive statistics

This table presents the descriptive statistics of the variables in the analysis, including the mean, standard deviation (STD), 25% percentile, median and 75% percentile. The sample includes 12,871 firm-year observations during the period from 1993 to 2009. $Invest_{t+1}$ is investment at time $t+1$. The dispersion of analysts' forecasts (*Disp*), forecast error (*Error*), the volatility of daily stock returns (*Std*) and yearly high-low price spreads (*Spread*) have been multiplied by minus one. Detailed definitions of variables are reported in Table 1.

Variables	Mean	STD	25%	Median	75%
$Invest_{t+1}$	0.161	0.211	0.058	0.110	0.199
$Disp_t$	–0.006	0.019	–0.004	–0.002	–0.001
$Error_t$	–0.011	0.053	–0.007	–0.002	–0.001
$OverInvest_t$	0.495	0.232	0.333	0.500	0.667
Age_t	18.480	17.286	6.471	12.249	24.888
$Size_t$	6.913	1.694	5.648	6.768	8.036
MB_t	3.089	3.187	1.497	2.333	3.683
$Cash_t$	0.161	0.181	0.026	0.088	0.237
$Leverage_t$	0.216	0.182	0.047	0.200	0.333
$Sdcfo_t$	0.081	0.075	0.035	0.058	0.099
$Sdsales_t$	0.167	0.147	0.070	0.123	0.214
$Sdinvest_t$	0.128	0.179	0.033	0.069	0.149
$Loss_t$	0.230	0.421	0	0	0
$Dividend_t$	0.456	0.498	0	0	1
$Zscore_t$	1.359	1.007	0.788	1.357	1.942
$Tangible_t$	0.316	0.237	0.121	0.250	0.474
OC_t	4.619	0.700	4.252	4.693	5.086
Std_t	–0.028	0.014	–0.035	–0.025	–0.018
$Spread_t$	–0.004	0.006	–0.005	–0.002	0.000
AQ_t	–0.105	0.122	–0.122	–0.059	–0.032
Q_t	2.048	1.546	1.196	1.596	2.327

Table 3 Correlation matrices of variables

This table presents Pearson correlations of the variables in the analysis. *Invest$_{t+1}$* is investment at time *t+1*. Detailed definitions of variables are reported in Table 1. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Invest$_{t+1}$	Disp	Error	Std	Spread	Size	Age	MB	Cash	Leverage	Sdcfo	Sdsales	Sdinvest	Loss	Dividend	Zscore	Tangible	OC	AQ
Disp$_t$	0.04***																		
Error$_t$	0.04***	0.28***																	
Std$_t$	-0.03***	0.26***	0.22***																
Spread$_t$	0.01	0.13***	0.15***	0.35***															
Size$_t$	-0.16***	0.03***	0.06***	0.44***	0.42***														
Age$_t$	-0.10***	0.05**	0.04***	0.32***	0.20***	0.44***													
MB$_t$	0.17***	0.11***	0.09***	0.05***	0.13***	0.01***	–0.02*												
Cash$_t$	0.18***	-0.01	0.02**	-0.25***	-0.09***	-0.32***	-0.21***	0.22***											
Leverage$_t$	-0.13***	-0.12***	-0.09***	0.00	0.03***	0.28***	0.06***	-0.12***	-0.41***										
Sdcfo$_t$	0.11***	-0.06***	-0.05***	-0.31***	-0.13***	-0.32***	-0.23***	0.07***	0.33***	-0.13***									
Sdsales$_t$	-0.01	-0.01	-0.02***	-0.23***	-0.08***	-0.24***	-0.16***	-0.00	0.14***	-0.11***	0.33***								
Sdinvest$_t$	0.08***	-0.05***	-0.04***	-0.23***	-0.07***	-0.13***	-0.19***	0.02***	0.06***	0.14***	0.25***	0.19***							
Loss$_t$	-0.01	-0.26***	-0.20***	-0.38***	-0.19***	-0.18***	-0.13***	-0.08***	0.17***	0.13***	0.21***	0.07***	0.16***						
Dividend$_t$	-0.10***	0.06***	0.05***	0.39***	0.16***	0.44***	0.42***	0.01*	-0.31***	0.11***	-0.29***	-0.20***	-0.18***	-0.20***					
Zscore$_t$	-0.08***	0.18***	0.12***	0.24***	0.09***	0.02*	0.12***	0.07***	-0.20***	-0.25***	-0.20***	0.17***	-0.27***	-0.53***	0.16***				
Tangible$_t$	0.04**	-0.03***	-0.01	0.12***	0.07***	0.23***	0.10***	-0.12***	-0.42***	0.32***	-0.22***	-0.20***	-0.01	-0.06***	0.25***	-0.07***			
OC$_t$	0.02**	0.05***	0.03***	-0.01	0.00	-0.08***	0.06***	0.06***	0.02***	-0.14***	0.04***	-0.07***	-0.05***	-0.02*	-0.02*	-0.07***	-0.37***		
AQ$_t$	-0.02***	0.07***	0.06***	0.06***	0.02**	0.07***	0.12***	-0.00	-0.20***	0.10***	-0.31***	-0.13***	-0.09***	-0.11***	0.16***	0.16***	0.20***	0.03***	
OverInvest$_t$	-0.073***	0.029***	0.031	-0.100***	-0.054***	-0.249***	-0.082***	0.074***	0.513***	-0.619***	0.127***	0.126***	-0.115***	-0.036***	-0.115***	0.173***	-0.177***	-0.077***	-0.031***

Table 4 The effect of information asymmetry on investment efficiency based on firms' proneness to over- and under-invest—Firm-year fixed effect model

This table presents fixed-effect regression results of eq.(2) specified as follows: $Invest_{i,t+1} = \alpha_0 + \alpha_1 Disp_{i,t} + \alpha_2 Disp_{i,t} \times OverInvest_{i,t} + \alpha_3 OverInvest_{i,t} + \alpha_4 AQ_{i,t} + \alpha_5 AQ_{i,t} \times OverInvest_{i,t} + \gamma Control_{i,t} + \lambda_i + \varepsilon_{i,t+1}$, where $Invest_{i,t+1}$ refers to the investment of firm *i* in year *t+1*, *OverInvest* is a ranked variable based on cash and leverage to measure a firm's proneness to under- or over-invest. *Disp, Error, Std* and *Spread* are four proxies of asymmetric information. The joint test is a test of whether the addition of the coefficient on information asymmetry and the coefficient on the interaction of information asymmetry and *OverInvest* is statistically negative. The numbers in brackets are the p-values. Detailed definitions of variables are reported in Table 1. Significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.

	(1)	(2)	(3)	(4)
	Disp	Error	Std	Spread
Disp	1.684***			
	[0.000]			
Disp x OverInvest	–2.935***			
	[0.000]			
Error		0.254***		
		[0.000]		
Error x OverInvest		–0.465***		
		[0.009]		
Std			4.649***	
			[0.000]	
Std x OverInvest			–7.057***	
			[0.000]	
Spread				6.847***
				[0.000]
Spread x OverInvest				–10.005***
				[0.000]
OverInvest	–0.368***	–0.352***	–0.431***	–0.374***
	[0.000]	[0.000]	[0.000]	[0.000]
Joint significance test	–1.250***	–0.211*	–2.409***	–3.158***
	[0.000]	[0.075]	[0.000]	[0.002]
AQ	0.336***	0.350***	0.180***	0.335***
	[0.000]	[0.000]	[0.000]	[0.000]
AQ x OverInvest	–0.762***	–0.789***	–0.429***	–0.767***
	[0.000]	[0.000]	[0.000]	[0.000]
Age	0.003***	0.003***	0.003***	0.003***
	[0.000]	[0.000]	[0.000]	[0.000]
Size	–0.089***	–0.090***	–0.086***	–0.092***
	[0.000]	[0.000]	[0.000]	[0.000]
MB	0.004***	0.004***	0.004***	0.004***
	[0.000]	[0.000]	[0.000]	[0.000]
Sdcfo	–0.097**	–0.103***	–0.069*	–0.096**
	[0.017]	[0.009]	[0.085]	[0.023]

Sdsales	–0.009	–0.010	–0.013	–0.012
	[0.629]	[0.593]	[0.496]	[0.543]
Sdinvest	–0.083***	–0.078***	–0.066***	–0.088***
	[0.000]	[0.000]	[0.000]	[0.000]
Loss	–0.022***	–0.026***	–0.013**	–0.026***
	[0.000]	[0.000]	[0.024]	[0.000]
Dividend	0.021***	0.019***	0.017**	0.018**
	[0.002]	[0.004]	[0.015]	[0.015]
Zscore	0.050***	0.049***	0.041***	0.045***
	[0.000]	[0.000]	[0.000]	[0.000]
Tangible	–0.068**	–0.074***	–0.004	–0.072**
	[0.012]	[0.004]	[0.883]	[0.012]
OC	–0.010	–0.007	–0.004	–0.011
	[0.180]	[0.327]	[0.560]	[0.150]
Intercept	0.905***	0.898***	0.901***	0.939***
	[0.000]	[0.000]	[0.000]	[0.000]
Number of observations	12,871	12,630	12,870	11,660
Number of firms	3,576	3,548	3,575	3,200
R^2	0.166	0.176	0.188	0.167

Table 5 The effect of information asymmetry on investment efficiency based on firms' proneness to over- and under-invest-- Two-dimensional Cluster model

This table presents regression results of eq. (2) specified as follows: $Invest_{i,t+1} = \alpha_0 + \alpha_1 Disp_{i,t} + \alpha_2 Disp_{i,t} \times OverInvest_{i,t} + \alpha_3 OverInvest_{i,t} + \alpha_4 AQ_{i,t} + \alpha_5 AQ_{i,t} \times OverInvest_{i,t} + \gamma Control_{i,t} + \lambda_i + \varepsilon_{i,t+1}$ with fixed-industry effect and with standard errors clustered in firm and year dimensions (proposed by Petersen (2009)). $Invest_{i,t+1}$ refers to the investment of firm *i* in year *t+1*, *OverInvest* is a ranked variable based on cash and leverage to measure a firm's proneness to under- or over-invest. *Disp*, *Error*, *Std* and *Spread* are four proxies of asymmetric information. The joint test is a test of whether the addition of the coefficient on information asymmetry and the coefficient on the interaction of information asymmetry and *OverInvest* is statistically negative. The numbers in brackets are the p-values. Detailed definitions of variables are reported in Table 1. Significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.

	(1)	(2)	(3)	(4)
	Disp	Error	Std	Spread
Disp	1.095**			
	[0.014]			
Disp x OverInvest	-1.796**			
	[0.035]			
Error		0.286**		
		[0.036]		
Error x OverInvest		-0.470*		
		[0.069]		
Std			5.200***	
			[0.000]	
Std x OverInvest			-8.614***	
			[0.000]	
Spread				8.030***
				[0.000]
Spread x OverInvest				-11.337***
				[0.000]
OverInvest	-0.168***	-0.160***	-0.331***	-0.198***
	[0.000]	[0.000]	[0.000]	[0.000]
Joint significance test	-0.701*	-0.184	-3.414***	-3.307***
	[0.089]	[0.138]	[0.000]	[0.002]
AQ	0.379***	0.379***	0.199***	0.383***
	[0.000]	[0.000]	[0.000]	[0.000]
AQ x OverInvest	-0.707***	-0.707***	-0.348***	-0.706***
	[0.000]	[0.000]	[0.000]	[0.000]
Age	-0.0003**	-0.0003*	-0.0003***	-0.0003*
	[0.030]	[0.052]	[0.008]	[0.086]
Size	-0.023***	-0.024***	-0.022***	-0.028***
	[0.000]	[0.000]	[0.000]	[0.000]
MB	0.010***	0.009***	0.009***	0.010***
	[0.000]	[0.000]	[0.000]	[0.000]
Sdcfo	0.107***	0.104**	0.103**	0.106**

	[0.009]	[0.012]	[0.025]	[0.018]
Sdsales	-0.055***	-0.054***	-0.053***	-0.055***
	[0.004]	[0.006]	[0.003]	[0.003]
Sdinvest	0.014	0.017	0.032**	0.016
	[0.415]	[0.324]	[0.047]	[0.348]
Loss	-0.039***	-0.040***	-0.024***	-0.040***
	[0.000]	[0.000]	[0.000]	[0.000]
Dividend	-0.009*	-0.010*	-0.014***	-0.011**
	[0.090]	[0.053]	[0.005]	[0.035]
Zscore	-0.004	-0.005	-0.004	-0.005
	[0.404]	[0.348]	[0.470]	[0.307]
Tangible	0.083***	0.083***	0.102***	0.088***
	[0.000]	[0.000]	[0.000]	[0.000]
OC	-0.022***	-0.023***	-0.019***	-0.023***
	[0.000]	[0.000]	[0.001]	[0.000]
Intercept	0.462***	0.465***	0.526***	0.520***
	[0.000]	[0.000]	[0.000]	[0.000]
Industry dummies	Yes	Yes	Yes	Yes
Number of observations	12,871	12,630	12,870	11,660
Number of firms	3,576	3,548	3,575	3,200
R^2	0.147	0.153	0.182	0.156

Table 6 The effect of information asymmetry on investment efficiency based on firms' deviations from the predicted investment levels

This table presents the results of the fixed-effect regression model of eq.(3), specified as follows: $Invest_{i,t+1} = \alpha_0 + \beta_1 Disp_{i,t} \times neg_{i,t+1} + \beta_2 Disp_{i,t} \times pos_{i,t+1} + \gamma Control_{i,t} + \lambda_i + \varepsilon_{i,t+1}$, where the investment of firm *i* in year *t+1*, $Invest_{i,t+1}$, is explained by the interaction term of dispersion in analysts' forecasts and the under-investment dummy, $Disp_{i,t} \times neg_{i,t+1}$, the interaction term of dispersion in analysts' forecasts and the over-investment dummy, $Disp_{i,t} \times pos_{i,t+1}$, and control variables. In columns (2), (4) and (6), median analyst forecast error, *Error*, is used as the proxy of information asymmetry. The numbers in brackets are the p-values. Detailed definitions of variables are reported in Table 1. Significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Disp	Error	Disp	Error	Disp	Error
Disp x neg	1.249***		0.671***		0.394***	
	[0.000]		[0.000]		[0.000]	
Disp x pos	–1.008***		-1.285***		–0.413**	
	[0.000]		[0.000]		[0.029]	
Error x neg		0.251***		0.142***		0.091***
		[0.000]		[0.000]		[0.006]
Error x pos		–0.635***		-0.733***		–0.190*
		[0.000]		[0.000]		[0.087]
AQ x neg					0.175***	0.177***
					[0.000]	[0.000]
AQ x pos					–0.439***	–0.440***
					[0.000]	[0.000]
Age			0.002***	0.002***	0.002***	0.002***
			[0.000]	[0.000]	[0.000]	[0.000]
Size			-0.066***	-0.069***	–0.061***	–0.064***
			[0.000]	[0.000]	[0.000]	[0.000]
MB			0.005***	0.004***	0.005***	0.004***
			[0.000]	[0.000]	[0.000]	[0.000]
Cash			0.139***	0.143***	0.122***	0.126***
			[0.000]	[0.000]	[0.000]	[0.000]
Leverage			-0.210***	-0.204***	–0.188***	–0.180***
			[0.000]	[0.000]	[0.000]	[0.000]
Sdcfo			-0.091**	-0.092**	–0.132***	–0.129***
			[0.026]	[0.020]	[0.001]	[0.001]
Sdsales			-0.026	-0.028	–0.016	–0.019
			[0.190]	[0.133]	[0.393]	[0.301]
Sdinvest			-0.047***	-0.038***	–0.045***	–0.040***
			[0.001]	[0.006]	[0.001]	[0.004]
Loss			-0.026***	-0.030***	–0.024***	–0.026***
			[0.000]	[0.000]	[0.000]	[0.000]
Dividend			0.019***	0.018***	0.021***	0.019***
			[0.007]	[0.007]	[0.003]	[0.004]
Zscore			0.028***	0.027***	0.026***	0.026***
			[0.000]	[0.000]	[0.000]	[0.000]
Tangible			0.048	0.046	0.037	0.037
			[0.103]	[0.105]	[0.189]	[0.172]

OC			0.013*	0.015**	0.013*	0.015**
			[0.089]	[0.042]	[0.065]	[0.029]
Intercept	0.164***	0.161***	0.491***	0.501***	0.460***	0.467***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Number of observations	12,871	12,630	12,871	12,871	12,871	12,630
Number of firms	3,576	3,548	3,576	3,576	3,576	3,548
R^2	0.016	0.009	0.083	0.178	0.180	0.195

Table 7 The effect of information asymmetry on investment efficiency based on firms' deviations from the predicted investment levels - Alternative proxies of information asymmetry

This table presents the fixed-effect results of the regressions on the effect of information asymmetry on investment efficiency when information asymmetry is measured by *Std* and *Spread*, which are respectively the standard deviation of daily stock return residuals and the average of daily high-low price spreads. Columns (1), (3) and (5) show the results of regression model specified as follows: $Invest_{i,t+1} = \alpha_0 + \beta_1 Std_{i,t} \times neg_{i,t+1} + \beta_2 Std_{i,t} \times pos_{i,t+1} + \gamma Control_{i,t} + \lambda_i + \varepsilon_{i,t+1}$. In columns (2), (4) and (6), *Std* is replaced by *Spread*. Detailed definitions of variables are reported in Table 1. *P*-values are reported in brackets. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Std	Spread	Std	Spread	Std	Spread
Std x neg	3.153***		2.612***		2.338***	
	[0.000]		[0.000]		[0.000]	
Std x pos	-1.985***		-1.898***		-1.479***	
	[0.000]		[0.000]		[0.000]	
Spread x neg		7.052***		6.298***		4.375***
		[0.000]		[0.000]		[0.000]
Spread x pos		-7.465***		-6.103***		-3.262***
		[0.000]		[0.000]		[0.000]
AQ x neg					0.067***	0.156***
					[0.004]	[0.000]
AQ x pos					-0.163***	-0.427***
					[0.000]	[0.000]
Age			0.002***	0.002***	0.002***	0.002***
			[0.000]	[0.000]	[0.000]	[0.001]
Size			-0.057***	-0.066***	-0.057***	-0.063***
			[0.000]	[0.000]	[0.000]	[0.000]
MB			0.005***	0.005***	0.005***	0.005***
			[0.000]	[0.000]	[0.000]	[0.000]
Cash			0.118***	0.117***	0.116***	0.104***
			[0.000]	[0.000]	[0.000]	[0.000]
Leverage			-0.148***	-0.183***	-0.148***	-0.167***
			[0.000]	[0.000]	[0.000]	[0.000]
Sdcfo			-0.079**	-0.092**	-0.094**	-0.130***
			[0.039]	[0.029]	[0.016]	[0.002]
Sdsales			-0.016	-0.023	-0.013	-0.011
			[0.403]	[0.254]	[0.480]	[0.563]
Sdinvest			-0.051***	-0.061***	-0.049***	-0.058***
			[0.000]	[0.000]	[0.000]	[0.000]
Loss			-0.014**	-0.026***	-0.015***	-0.025***
			[0.012]	[0.000]	[0.009]	[0.000]
Dividend			0.016**	0.015**	0.016**	0.018**
			[0.020]	[0.045]	[0.014]	[0.015]
Zscore			0.021***	0.023***	0.021***	0.023***
			[0.000]	[0.000]	[0.000]	[0.000]
Tangible			0.019	0.020	0.020	0.012
			[0.496]	[0.508]	[0.465]	[0.695]

OC			0.007	0.007	0.008	0.008
			[0.327]	[0.356]	[0.260]	[0.319]
Intercept	0.198***	0.168***	0.498***	0.539***	0.489***	0.513***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Number of observations	12,870	11,660	12,870	11,660	12,870	11,660
Number of firms	3,575	3,200	3,575	3,200	3,575	3,200
R2	0.158	0.05	0.230	0.150	0.235	0.195

Table 8 The effect of information asymmetry on investment efficiency based on firms' deviations from the predicted investment levels – Alternative measure of *pos* and *neg*

This table presents the results of the firm-year fixed effect regression model of eq.(3), specified as follows: $Invest_{i,t+1} = \alpha_0 + \beta_1 Disp_{i,t} \times neg_{i,t+1} + \beta_2 Disp_{i,t} \times pos_{i,t+1} + \gamma Control_{i,t} + \lambda_i + \varepsilon_{i,t+1}$, where the investment of firm *i* in year *t+1*, $Invest_{i,t+1}$, is explained by the interaction term of dispersion in analysts' forecasts and the under-investment dummy, $Disp_{i,t} \times neg_{i,t+1}$, the interaction term of dispersion in analysts' forecasts and the over-investment dummy, $Disp_{i,t} \times pos_{i,t+1}$, and control variables. The dummy variables, *Pos* and *Neg*, are defined based on the regression residuals of eq. (1). I drop the observations if the residual is lower than the median of the positive residuals and is higher than the median of the negative residuals. For the remaining observations, if the residual is positive, the dummy variable, *pos*, is coded one and otherwise coded zero. Similarly, the dummy variable, *neg*, is coded one for the observations with negative residuals and otherwise coded zero. *Disp*, *Error*, *Std* and *Spread* are four proxies of information asymmetry. The numbers in brackets are the p-values. Detailed definitions of variables are reported in Table 1. Significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.

	(1)	(2)	(3)	(4)
	Disp	Error	Std	Spread
Disp x neg	1.294***			
	[0.000]			
Disp x pos	-2.858***			
	[0.000]			
Error x neg		0.138**		
		[0.046]		
Error x pos		-0.695***		
		[0.004]		
Std x neg			3.462***	
			[0.000]	
Std x pos			-4.016***	
			[0.000]	
Spread x neg				5.713***
				[0.000]
Spread x pos				-6.976***
				[0.000]
AQ x neg	0.190***	0.200***	0.045	0.177***
	[0.000]	[0.000]	[0.290]	[0.000]
AQ x pos	-0.541***	-0.561***	-0.118**	-0.530***
	[0.000]	[0.000]	[0.033]	[0.000]
Age	0.006***	0.005***	0.005***	0.005***
	[0.000]	[0.000]	[0.000]	[0.000]
Size	-0.084***	-0.089***	-0.072***	-0.088***
	[0.000]	[0.000]	[0.000]	[0.000]
MB	0.005***	0.004***	0.006***	0.005***
	[0.001]	[0.005]	[0.000]	[0.001]

Cash	0.154***	0.155***	0.130***	0.123***
	[0.000]	[0.000]	[0.001]	[0.006]
Leverage	-0.244***	-0.235***	-0.174***	-0.208***
	[0.000]	[0.000]	[0.000]	[0.000]
Sdcfo	-0.182**	-0.184**	-0.137*	-0.159*
	[0.024]	[0.015]	[0.072]	[0.061]
Sdsales	-0.020	-0.019	-0.035	-0.001
	[0.614]	[0.617]	[0.347]	[0.979]
Sdinvest	-0.045*	-0.046*	-0.062**	-0.063**
	[0.087]	[0.070]	[0.014]	[0.024]
Loss	-0.029**	-0.038***	-0.020*	-0.037***
	[0.017]	[0.001]	[0.074]	[0.004]
Dividend	0.030**	0.024*	0.023*	0.020
	[0.036]	[0.075]	[0.092]	[0.209]
Zscore	0.034***	0.031***	0.025***	0.026***
	[0.000]	[0.000]	[0.003]	[0.005]
Tangible	0.086	0.074	0.062	0.051
	[0.147]	[0.183]	[0.267]	[0.418]
OC	0.010	0.014	-0.004	0.001
	[0.474]	[0.266]	[0.759]	[0.916]
Intercept	0.586***	0.612***	0.610***	0.667***
	[0.000]	[0.000]	[0.000]	[0.000]
Number of observations	6,436	6,331	6,435	5,768
Number of firms	2,659	2,642	2,658	2,377
R^2	0.198	0.212	0.285	0.204

Table 9 The effect of information asymmetry on investment efficiency based on firms' proneness to over- and under-invest -- Instrumental variables estimation

This table presents the results of the second-stage regression of the instrumental variables estimations of eq. (2), where the four proxies of firm-level information asymmetry are instrumented by their industry average level in each year, respectively. In the first stage, the firm-level *Disp*, *Error, Std,* and *Spread* are regressed on industry average *Disp, Error, Std,* and *Spread*, respectively, and other control variables. In the second stage, the predicted information asymmetry is used to explain investment with fixed-effect regression. Detailed definitions of variables are reported in Table 1. *P*-values are reported in brackets. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)
	Disp	Error	Std	Spread
Disp	9.537***			
	[0.000]			
Disp x OverInvest	-15.809***			
	[0.000]			
Error		1.268***		
		[0.000]		
Error x OverInvest		-1.833***		
		[0.008]		
Std			6.716***	
			[0.000]	
Std x OverInvest			-10.039***	
			[0.000]	
Spread				33.959***
				[0.000]
Spread x OverInvest				-49.370***
				[0.000]
OverInvest	-0.382***	-0.353***	-0.458***	-0.427***
	[0.000]	[0.000]	[0.000]	[0.000]
Joint significance test	-6.272***	-0.565	-3.322***	-15.411***
	[0.000]	[0.243]	[0.000]	[0.000]
AQ	0.181***	0.305***	0.101**	0.166***
	[0.000]	[0.000]	[0.021]	[0.001]
AQ x OverInvest	-0.473***	-0.715***	-0.259***	-0.479***
	[0.000]	[0.000]	[0.001]	[0.000]
Age	0.003***	0.003***	0.003***	0.003***
	[0.000]	[0.000]	[0.000]	[0.000]
Size	-0.087***	-0.092***	-0.084***	-0.099***
	[0.000]	[0.000]	[0.000]	[0.000]
MB	0.004***	0.003***	0.004***	0.004***
	[0.000]	[0.000]	[0.000]	[0.000]
Sdcfo	-0.071*	-0.101**	-0.053	-0.095**
	[0.098]	[0.011]	[0.189]	[0.031]
Sdsales	-0.012	-0.011	-0.014	-0.033
	[0.549]	[0.563]	[0.456]	[0.115]

Sdinvest	-0.073***	-0.080***	-0.057***	-0.071***
	[0.000]	[0.000]	[0.000]	[0.000]
Loss	-0.004	-0.019***	-0.008	-0.020***
	[0.538]	[0.002]	[0.205]	[0.002]
Dividend	0.019**	0.019***	0.014**	0.017**
	[0.010]	[0.005]	[0.039]	[0.028]
Zscore	0.044***	0.044***	0.037***	0.038***
	[0.000]	[0.000]	[0.000]	[0.000]
Tangible	-0.029	-0.063**	0.027	-0.025
	[0.316]	[0.017]	[0.320]	[0.400]
OC	-0.018**	-0.012*	-0.003	-0.010
	[0.016]	[0.085]	[0.699]	[0.193]
Intercept	0.931***	0.939***	0.906***	1.024***
	[0.000]	[0.000]	[0.000]	[0.000]
Number of observations	12,871	12,630	12,870	11,660
Number of firms	3,576	3,548	3,575	3,200

Table 10 The effect of information asymmetry on investment efficiency based on firms' deviations from the predicted investment levels -- Instrumental variables estimation

This table presents the results of the second-stage regression of the instrumental variables estimations of eq. (3), where the four proxies of firm-level information asymmetry are instrumented by their industry average level in each year, respectively. In the first stage, the firm-level *Disp, Error, Std,* and *Spread* are regressed on industry average *Disp*, *Error*, *Std,* and *Spread*, respectively, and other control variables. In the second stage, the predicted information asymmetry is used to explain investment with fixed-effect regression. Detailed definitions of variables are reported in Table 1. *P*-values are reported in brackets. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)
	Disp	Error	Std	Spread
Disp x neg	3.999***			
	[0.000]			
Disp x pos	–3.460***			
	[0.000]			
Error x neg		0.720***		
		[0.000]		
Error x pos		–0.654		
		[0.156]		
Std x neg			3.883***	
			[0.000]	
Std x pos			–0.763***	
			[0.008]	
Spread x neg				21.020***
				[0.000]
Spread x pos				–8.412***
				[0.000]
AQ x neg	0.115***	0.154***	0.058**	0.055**
	[0.000]	[0.000]	[0.015]	[0.048]
AQ x pos	–0.330***	–0.414***	–0.080***	–0.244***
	[0.000]	[0.000]	[0.007]	[0.000]
Age	0.001**	0.002***	0.002***	0.001***
	[0.013]	[0.000]	[0.000]	[0.008]
Size	–0.053***	–0.065***	–0.058***	–0.068***
	[0.000]	[0.000]	[0.000]	[0.000]
MB	0.005***	0.004***	0.005***	0.004***
	[0.000]	[0.000]	[0.000]	[0.000]
Cash	0.123***	0.122***	0.114***	0.096***
	[0.000]	[0.000]	[0.000]	[0.000]
Leverage	–0.162***	–0.167***	–0.128***	–0.134***
	[0.000]	[0.000]	[0.000]	[0.000]
Sdcfo	–0.101**	–0.113***	–0.066*	–0.102**
	[0.021]	[0.005]	[0.092]	[0.023]

Sdsales	–0.029	–0.024	–0.009	–0.025
	[0.164]	[0.192]	[0.643]	[0.248]
Sdinvest	–0.045***	–0.039***	–0.045***	–0.069***
	[0.003]	[0.005]	[0.001]	[0.000]
Loss	–0.004	–0.019***	–0.007	–0.017***
	[0.527]	[0.001]	[0.197]	[0.008]
Dividend	0.013*	0.018***	0.012*	0.014*
	[0.088]	[0.007]	[0.069]	[0.078]
Zscore	0.026***	0.023***	0.019***	0.015***
	[0.000]	[0.000]	[0.000]	[0.005]
Tangible	0.061**	0.041	0.021	0.013
	[0.049]	[0.138]	[0.448]	[0.679]
OC	0.008	0.011	0.004	0.001
	[0.322]	[0.140]	[0.554]	[0.893]
Intercept	0.434***	0.497***	0.547***	0.621***
	[0.000]	[0.000]	[0.000]	[0.000]
Number of observations	12,871	12,630	12,870	11,660
Number of firms	3,576	3,648	3,575	3,200

Table 11 The effect of information asymmetry on investment efficiency based on firms' proneness to over- and under-invest -- Robustness tests with alternative measures of investments

This table presents the results of the robustness tests of eq. (2) with alternative dependent variables. The dependent variable is the capital investment (*Capex*$_{t+1}$) of firm *i* at time *t+1*, measured as the ratio of capital expenditure to total fixed assets. *OverInvest* is a ranked variable based on cash and leverage to measure a firm's proneness to under- or over-invest. *Disp, Error, Std* and *Spread* are four proxies of asymmetric information. The joint test is a test of whether the addition of the coefficient on information asymmetry and the coefficient on the interaction of information asymmetry and *OverInvest* is statistically negative. The numbers in brackets are the p-values. Detailed definitions of variables are reported in Table 1. Significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.

	(1)	(2)	(3)	(4)
	Disp	Error	Std	Spread
Disp	1.055***			
	[0.000]			
Disp x OverInvest	-2.018***			
	[0.000]			
Error		0.132**		
		[0.041]		
Error x OverInvest		-0.254		
		[0.119]		
Std			3.211***	
			[0.000]	
Std x OverInvest			-5.130***	
			[0.000]	
Spread				5.211***
				[0.000]
Spread x OverInvest				-8.503***
				[0.000]
OverInvest	-0.315***	-0.300***	-0.362***	-0.325***
	[0.000]	[0.000]	[0.000]	[0.000]
Joint significance test	-0.962***	-0.121	-1.919***	-3.292***
	[0.000]	[0.264]	[0.000]	[0.001]
AQ	0.301***	0.310***	0.185***	0.287***
	[0.000]	[0.000]	[0.000]	[0.000]
AQ x OverInvest	-0.663***	-0.681***	-0.423***	-0.653***
	[0.000]	[0.000]	[0.000]	[0.000]
Age	0.003***	0.003***	0.003***	0.003***
	[0.000]	[0.000]	[0.000]	[0.000]
Size	-0.059***	-0.060***	-0.056***	-0.061***
	[0.000]	[0.000]	[0.000]	[0.000]
MB	0.001*	0.001	0.001*	0.002**
	[0.069]	[0.258]	[0.099]	[0.012]
Sdcfo	-0.007	-0.007	0.010	0.002
	[0.852]	[0.848]	[0.794]	[0.967]

Sdsales	-0.016	-0.018	-0.020	-0.019
	[0.387]	[0.303]	[0.266]	[0.298]
Sdinvest	-0.076***	-0.070***	-0.063***	-0.079***
	[0.000]	[0.000]	[0.000]	[0.000]
Loss	-0.013**	-0.015***	-0.006	-0.014**
	[0.019]	[0.003]	[0.259]	[0.011]
Dividend	0.017***	0.015**	0.014**	0.013*
	[0.009]	[0.017]	[0.032]	[0.056]
Zscore	0.030***	0.029***	0.024***	0.026***
	[0.000]	[0.000]	[0.000]	[0.000]
Tangible	-0.024	-0.030	0.021	-0.024
	[0.343]	[0.215]	[0.415]	[0.375]
OC	-0.020***	-0.019***	-0.016**	-0.022***
	[0.003]	[0.004]	[0.018]	[0.003]
Intercept	0.657***	0.657***	0.649***	0.684***
	[0.000]	[0.000]	[0.000]	[0.000]
Number of observations	12,733	12,494	12,732	11,532
Number of firms	3,555	3,526	3,554	3,179
R^2	0.104	0.110	0.118	0.106

Table 12 The effect of information asymmetry on investment efficiency based on firms' deviations from the predicted investment levels --Robustness tests with alternative measures of investments

This table presents the results of the robustness tests on the effect of information asymmetry on investment efficiency with alternative dependent variables. In panel A, the dependent variable is the capital investment ($Capex_{t+1}$) of firm *i* at time *t+1*, measured as the ratio of capital expenditure to total fixed assets. In panel B, The dependent variable is the residuals of eq. (1) specified as: $Invest_{i,t+1}=\alpha + \beta Q_{i,t} + \varepsilon_{i,t+1}$, where $Q_{i,t}$ measures the investment opportunities of a firm. This regression is estimated cross-sectionally for each industry with at least 20 observations in a given year based on the Fama and French (1997) 48-industry classification. Detailed definitions of variables are reported in Table 1. *P*-Values are reported in brackets. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Panel A: use capital investment as the dependent variable

	(5)	(6)	(7)	(8)
	Disp	Error	Std	Spread
Disp x neg	0.781***			
	[0.000]			
Disp x pos	–0.304*			
	[0.073]			
Error x neg		0.137***		
		[0.000]		
Error x pos		–0.166		
		[0.158]		
Std x neg			2.750***	
			[0.000]	
Std x pos			–3.636***	
			[0.000]	
spread x neg				6.661***
				[0.000]
spread x pos				–6.186***
				[0.000]
AQ x neg	0.140***	0.146***	0.034	0.155***
	[0.000]	[0.000]	[0.105]	[0.000]
AQ x pos	–0.940***	–0.949***	–0.340***	–0.823***
	[0.000]	[0.000]	[0.000]	[0.000]
Age	–0.002***	–0.002***	–0.002***	–0.002***
	[0.000]	[0.000]	[0.000]	[0.000]
Size	–0.067***	–0.066***	–0.061***	–0.068***
	[0.000]	[0.000]	[0.000]	[0.000]
MB	0.012***	0.012***	0.010***	0.011***
	[0.000]	[0.000]	[0.000]	[0.000]
Cash	0.103***	0.111***	0.091***	0.097***
	[0.000]	[0.000]	[0.000]	[0.000]
Leverage	–0.116***	–0.115***	–0.082***	–0.113***
	[0.000]	[0.000]	[0.000]	[0.000]

Sdcfo	–0.127***	–0.121***	–0.054	–0.104**
	[0.001]	[0.003]	[0.140]	[0.011]
Sdsales	0.002	0.003	–0.003	–0.001
	[0.928]	[0.872]	[0.842]	[0.975]
Sdinvest	0.007	0.008	0.017	0.005
	[0.603]	[0.597]	[0.192]	[0.728]
Loss	–0.025***	–0.027***	–0.017***	–0.026***
	[0.000]	[0.000]	[0.002]	[0.000]
Dividend	–0.003	–0.003	–0.008	–0.001
	[0.618]	[0.680]	[0.224]	[0.874]
Zscore	0.050***	0.053***	0.042***	0.049***
	[0.000]	[0.000]	[0.000]	[0.000]
Tangible	–0.637***	–0.635***	–0.518***	–0.632***
	[0.000]	[0.000]	[0.000]	[0.000]
OC	0.040***	0.043***	0.033***	0.042***
	[0.000]	[0.000]	[0.000]	[0.000]
Intercept	0.728***	0.699***	0.721***	0.743***
	[0.000]	[0.000]	[0.000]	[0.000]
Number of observations	12,733	12,494	12,732	11,532
Number of firms	3,555	3,526	3,554	3,179
R^2	0.350	0.346	0.445	0.375

Panel B: use the deviation from predicted investment level as the dependent variable

	(5)	(6)	(7)	(8)
	Disp	Error	Std	Spread
Disp x neg	0.503**			
	[0.030]			
Disp x pos	–1.205***			
	[0.003]			
Error x neg		0.099		
		[0.179]		
Error x pos		–0.640**		
		[0.010]		
Std x neg			3.119***	
			[0.000]	
Std x pos			–5.303***	
			[0.000]	
spread x neg				5.472***
				[0.000]
spread x pos				–10.894***
				[0.000]
AQ x pos	0.518***	0.520***	0.247***	0.468***
	[0.000]	[0.000]	[0.000]	[0.000]
AQ x pos	–0.879***	–0.888***	–0.308***	–0.829***
	[0.000]	[0.000]	[0.000]	[0.000]
Age	0.001	0.001	0.001	0.001
	[0.226]	[0.193]	[0.477]	[0.236]
Size	–0.013	–0.017**	0.001	–0.014
	[0.109]	[0.036]	[0.882]	[0.107]
MB	–0.011***	–0.011***	–0.010***	–0.009***
	[0.000]	[0.000]	[0.000]	[0.000]
Cash	0.092*	0.074	0.076	0.064
	[0.060]	[0.125]	[0.110]	[0.196]
Leverage	0.032	0.028	0.101**	0.072*
	[0.431]	[0.479]	[0.010]	[0.077]
Sdcfo	–0.020	–0.012	0.027	0.026
	[0.814]	[0.890]	[0.746]	[0.764]
Sdsales	0.013	0.009	0.011	–0.019
	[0.759]	[0.834]	[0.782]	[0.650]
Sdinvest	–0.014	–0.010	–0.033	–0.016
	[0.640]	[0.733]	[0.255]	[0.617]
Loss	–0.011	–0.014	0.002	–0.005
	[0.386]	[0.246]	[0.879]	[0.679]
Dividend	0.012	0.011	0.007	0.015
	[0.436]	[0.447]	[0.637]	[0.334]
Zscore	0.039***	0.035***	0.029***	0.035***
	[0.000]	[0.000]	[0.002]	[0.000]
Tangible	–0.026	–0.021	–0.071	–0.063
	[0.670]	[0.735]	[0.230]	[0.317]
OC	0.059***	0.062***	0.050***	0.058***

	[0.000]	[0.000]	[0.001]	[0.000]
Intercept	–0.226**	–0.208**	–0.259**	–0.215**
	[0.032]	[0.047]	[0.012]	[0.047]
Number of observations	12,871	12,630	12,870	11,660
Number of firms	3,576	3,548	3,575	3,200
R^2	0.091	0.092	0.152	0.107

References

Akerlof, G., 1970. The market for 'lemons': Quality uncertainty and the market mechanism. Quarterly Journal of Economics 84, 488-500.

Alti, A., 2003. How sensitive is investment to cash flow when financing is frictionless? Journal of Finance 58, 707-722.

Ascioglu, A., Hegde, S. P., McDermott, J. B., 2008. Information asymmetry and investment–cash flow sensitivity. Journal of Banking and Finance 32, 1036-1048.

Baker, M., Stein, J., Wurgler, J., 2003. When does the market matter? Stock prices and the investment of equity-dependent firms. Quarterly Journal of Economics 118, 969–1005.

Bertrand, M., Mullainathan, S., 2003. Enjoying the quiet life? Corporate governance and managerial preferences. Journal of Political Economy 111, 1043-1075.

Biddle, G., Hilary, G., 2006. Accounting quality and firm-level capital investment. The Accounting Review 81, 963–982.

Biddle, G., Hilary, G., Verdi, R., 2009. How does financial reporting quality improve investment efficiency? Journal of Accounting and Economics 48, 112–131.

Blanchard, O. J., Lopez-de-Silanes, F., Shleifer, A., 1994. What do firms do with cash windfalls? Journal of Financial Economics 36, 337–360.

Bryan, D. M., Tiras, S. L., 2007. The influence of forecast dispersion on the incremental explanatory power of earnings, book value, and analyst forecasts on market prices. The Accounting Review 82, 651-677.

Chen, F., Hope, O. K., Li, Q., Wang, X., 2011. Financial reporting quality and investment efficiency of private firms in emerging markets. The Accounting Review 86, 1255-1288.

Cho, S. Y., Lee, C., Pfeiffer Jr, R. J., 2013. Corporate social responsibility performance and information asymmetry. Journal of Accounting and Public Policy 32, 71-83.

Corwin, S. A., Schultz, P., 2012. A simple way to estimate bid-ask spreads from daily high and low prices. Journal of Finance 67, 719-760.

Dechow, P. M., Dichev, I. D., 2002. The quality of accruals and earnings: The role of accrual estimation errors. The Accounting Review 77, 35–59.

Dierkens, N., 1991. Information asymmetry and equity issues. Journal of Financial and Quantitative Analysis 26, 181-199.

Easley, D., O'Hara, M., 2004. Information and the cost of capital. Journal of Finance 59, 1553-1583.

Easterwood, J., Nutt, S., 1999. Inefficiency in analysts' earnings forecasts: Systematic misreaction or systematic optimism? Journal of Finance 54, 1777–1779.

Elton, E., Gruber, M., Gultekin, M., 1984. Professional expectations: Accuracy and diagnosis of errors. Journal of Financial and Quantitative Analysis 19, 351–363.

Fama, E., French, K., 1997. Industry costs of equity. Journal of Finance 43, 153–193.

Fazzari, S., Hubbard, R. G., Petersen, B. C., 1988. Financing constraints and corporate investment. Brookings Papers on Economic Activity 1, 141-206.

Fazzari, S., Hubbard, R. G., Petersen, B. C., 2000. Investment-cash flow sensitivities are not useful: A comment on Kaplan and Zingales. Quarterly Journal of Economics 115, 695–705.

Francis, J., LaFond, R., Olsson, P., Schipper, K., 2005. The market pricing of accruals quality. Journal of Accounting and Economics 39, 295-327.

Fried, D., Givoly, D., 1982. Financial analysts' forecasts of earnings: A better surrogate for market expectations. Journal of Accounting and Economics 4, 85-107.

García Lara, J. M., García Osma, B., Penalva, F., 2010. Conditional conservatism and firm investment efficiency. Working paper, Universidad Carlos III de Madrid.

Grossman, S. J., Hart, O. D., 1982. Corporate financial structure and managerial incentives, in J. McCall, ed.: The Economics of Information and Uncertainty, University of Chicago Press, Chicago.

Heaton, J. B., 2002. Managerial optimism and corporate finance. Financial Management 31, 33-45.

Holmstrom, B., 1999. Managerial incentive problems: A dynamic perspective. Review of Economic Studies 66, 169−182.

Jensen, M., 1986. Agency costs of free cash flow, corporate finance, and takeovers. American Economic Review 76, 323–329.

Jensen, M., Meckling, W. H., 1976. Theory of the firm: Managerial behavior, agency costs, and ownership structure. Journal of Financial Economics 3, 305–360.

Kaplan, S. N., Zingales, L., 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? Quarterly Journal of Economics 112, 169–215.

Kaplan, S. N., Zingales, L., 2000. Investment-cash flow sensitivities are not valid measures of financing constraints. Quarterly Journal of Economics 115, 707–712.

Krishnaswami, S., Subramaniam, V., 1999. Information asymmetry, valuation, and the corporate spin-off decision. Journal of Financial Economics 53, 73-112.

Lang, M. H., Lundholm, R. J., 1996. Corporate disclosure policy and analyst behavior. Accounting Review 71, 467–492.

Linck, J. S., Netter, J. M., Yang, T., 2008. The determinants of board structure. Journal of Financial Economics 87, 308—328.

Loh, R. K., Mian, G. M., 2006. Do accurate earnings forecasts facilitate superior investment recommendations? Journal of Financial Economics 80, 455−483.

Mansi, S. A., Maxwell, W. F., Miller, D. P., 2011. Analyst forecast characteristics and the cost of debt. Review of Accounting Studies 16, 116-142.

Maskara, P. K., Mullineaux, D. J., 2011. Information asymmetry and self-selection bias in bank loan announcement studies. Journal of Financial Economics 101, 684-694.

Modigliani, F., Miller, M. H., 1958. The cost of capital, corporate finance and the theory of investment. American Economic Review 48, 261-97.

Myers, S. C., 1977. Determinants of corporate borrowing. Journal of Financial Economics 5, 147–175.

Myers, S. C., 1984. The capital structure puzzle. Journal of Finance 39, 575-592.

Myers, S. C., Majluf, N. S., 1984. Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics 13, 187–221.

O’Brien, P. C., 1990. Forecast accuracy of individual analysts across nine industries. Journal of Accounting Research 28, 286-304.

O’Brien, P. C., Bhushan, R., 1990. Analyst following and institutional ownership. Journal of Accounting Research 28, 55–76.

O'Brien, P. C., 1988. Analysts' forecasts and earnings expectations. Journal of Accounting and Economics 10, 53-83.

Ohlson, J. A., 2001. Earnings, book values, and dividends in equity valuation: An empirical perspective. Contemporary Accounting Research 18, 107-120.

Payne, J. L., Thomas, W. B., 2003. The implications of using stock-split adjusted I/B/E/S data in empirical research. The Accounting Review 78, 1049-1067.

Petersen, M., 2009. Estimating standard errors in finance panel data sets: Comparing approaches. Review of Financial Studies 22, 435–480.

Richardson, S., 2006. Over-investment of free cash flow. Review of Accounting Studies 11, 159-189.

Shleifer, A., Vishny, R. W., 1989. Management entrenchment: The case of manager-specific investments. Journal of Financial Economics 25, 123-139.

Stiglitz, J. E., Weiss, A., 1981. Credit rationing in markets with imperfect information. American Economic Review 71, 393-410.

Thomas, S., 2002. Firm diversification and asymmetric information: Evidence form analysts' forecasts and earnings announcements. Journal of Financial Economics 64, 373-396.

Verdi, R., 2006. Financial reporting quality and investment efficiency. Working paper, Massachusetts Institute of Technology.

Young, M. N., Peng, M. W., Ahlstrom, D., Bruton, G. D., Jiang, Y., 2008. Corporate governance in emerging economies: A review of the principal–principal perspective. Journal of Management Studies 45, 196-220.