Managerial Overconfidence and Corporate Policy Decisions in UK Companies

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ABSTRACT

Managerial overconfidence, as a particular form of managerial irrationality, concerns that some managers are less than completely rational and tend to overestimate the outcome of the investment projects under their control. This study focuses on the impact of managerial overconfidence on corporate policy decisions. There are two main objectives. First, it explores the consequences of managerial overconfidence for investment decisions and the cash holding policy by emphasizing the role of financial constraints. Second, it investigates the potential role of managerial overconfidence in determining debt maturity. Using an original and very detailed dataset for a large sample of UK listed firms, we show that investment by overconfident managers tend to be more sensitive to internal funds in financially constrained firms identified by leverage, dividend, age and cash. Meanwhile, a cash holding policy can be associated with investment decision by overconfident managers. We argue that, though investment can increase cash flow sensitivity of cash in financially constrained firms identified by leverage and dividend, managerial overconfidence can reduce this positive relationship. Moreover, managerial overconfidence can induce a biased debt maturity structure. It seems that overconfident managers can take advantage of short-term debt to signal their perceived firms' quality to the market. Hence, firms with managerial overconfidence tend to increase the negative relationship between long-term debt and firms' quality. Finally, we find that the impact of managerial overconfidence on corporate decision can also vary with different corporate governance mechanisms. We show that the impact of managerial overconfidence on corporate policies in firms with weak corporate governance mechanisms (i.e. lower ratio of non-executive directors in boards, lower blockholders' ownership) is pronounced, whereas, in firms with good corporate governance mechanisms, it turns to be insignificant.

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Chapter 1

Introduction

1.1 Motivation

Traditional research in corporate finance deals with issues of how the effectiveness of corporate financial and investment decisions suffers from asymmetric information and agency problems. The underlying assumption is that agents/managers in firms act entirely rationally (Barberis and Thaler, 2003; Baker *et al.*, 2004). Agents/managers can update their expertise correctly and use it to make decisions to maximize their utility. It admits people are probably not rational actors, but in a competitive market they would be driven out of the market. However, the proponents of behavioural corporate finance provide evidence that people's deviations from predicted behaviour are present at the market level and argue that capital structure (Heaton, 2002; Helliar *et al.*, 2005; Hackbarth, 2008) and capital budget decisions (Statman and Caldwell, 1987; Gervais *et al.*, 2006) can be better understood by considering managerial irrationality[1, 2].

In these studies, managerial overconfidence, as a particular form of managerial irrationality, has been increasingly emphasized. Overconfidence stems from phenomena such as the 'better-than-average' effect[3] and 'narrow confidence intervals'[4], which have long been studied in psychology. Though managerial overconfidence is a widespread phenomenon, economists start implementing the presence of this cognitive bias into economic models since the 1990s. But most developed overconfidence research is from the perspectives of financial markets. Only recently, it starts to consider managerial overconfidence in the corporate context. As far as the empirical literature is concerned, there is even less analysis of the impact of managerial overconfidence on corporate decisions. The less

[1] Managerial irrationality includes loss-aversion, such as making a heuristic evaluation of a risky situation (see Kahneman and Tversky, 1979), aversion to regret and reluctance to acknowledge losses (see Thaler, 1980), procrastination (see Thaler and Shefrin, 1981) and overconfident biases.
[2] Another implication of agents' irrationality is investor irrationality, which explains stock price bubbles, and market over/under-reaction (see Blanchard and Watson, 1982; Barberis *et al.*, 1998; Daniel *et al.*, 1998).
[3] Svenson's (1981) study shows that 80% of drivers in Texas believe their driving ability is above average.
[4] Larwood and Whittaker (1977) found that people tend to be unrealistic in their predictions of success. Cooper *et al.*, (1988) found entrepreneurial overconfidence. Weinstein (1980) found that people are especially overconfident about projects to which they are highly committed.

explored field is due to the limited scope of available data sets. It is much easier to access data sets about stock market forecast and turnover than to access data sets related to managerial psychological characteristics.

Another reason for taking managerial overconfidence seriously is that it is not easily affected by standard incentive contracts such as stock-based or option-based compensation designed to solve agency problems (Barberis and Thaler, 2003; Stein, 2003). In fact, overconfident managers unintentionally make biased decisions while thinking that they are serving the best interests of shareholders, even if they are not actually doing so.

Finally, a study of managerial overconfidence in the corporate context is not to isolate overconfidence effects from the conventional explanations. It is an integration of many respects which include agency problems, asymmetric information and managerial overconfidence. Traditional finance is still the centrepiece; however, managerial overconfidence is a catalyst within this field. Hence, in the presence of market frictions, managerial overconfidence will have unique effects on corporate decisions. To give more new insights on the interplay of managerial overconfidence and other corporate characteristics would be of considerable instructive.

1.2 Research Design

The premise behind managerial overconfidence in our analysis is that overconfident managers tend to overestimate the prospects of projects under their control. In terms of investment decisions, too, they tend to overestimate the outcomes of their investment projects. Recent literature has documented the consequences of this irrational behaviour as low-return takeovers (Roll, 1986; Doukas and Petmezas, 2007) and overinvestment (Malmendier and Tate, 2005). In the same vein, the managerial overestimation of firms' prospects can shed light on their financing preferences (Heaton, 2002; Stein, 2003). Overconfident managers are reluctant to use external funds unless they have exhausted internal funds, since they believe their firms' value in the market is unfairly low. This

induces an implication that the investment undertaken by overconfident managers increases with internal funds when firms are facing costly external financing and limited internal funds for investment.

The foremost response to the investment decisions of overconfident managers is their management of cash holdings. The existing literature regards holding cash as a buffer against transaction costs (Keynes, 1936) and capital market imperfections, such as asymmetric information (Myers and Majluf, 1984) and agency costs of debt financing (Jensen and Meckling, 1976; Myers, 1977). However, a key drawback of investing in liquid assets is its low rate of return (Kim *et al.*, 1998). Thus, there may be another explanation for a cash holding structure, in that investment decisions may influence firms' cash holding policies. For instance, if firms expect to experience high costs of external financing, hoarding cash today means passing up current investment projects. Thus, an increase in internal funds can generate an increase in investment and an increase in cash holding. Moreover, an increase in internal funds can provide more opportunities for overconfident managers to achieve their desired investment level. Also, their desired investment level is usually higher than the level desired by non-overconfident managers. Therefore, overconfident managers think the benefits of their desired investment should be greater than the benefits of accumulating cash. And they would rather increase their investment with internal funds than increase their cash holdings.

Another manifestation of the impact of managerial overconfidence on corporate financial policies concerns debt maturity. The majority of empirical studies on debt maturity focus on the influences of asymmetric information and agency costs of debt and equity (see Barclay and Smith, 1995; Guedes and Opler, 1996; Datta *et al.*, 2005). However, these studies do not tackle the potential role played by managerial overconfidence. To deeply understand this issue, we argue that overconfident managers may have biased preference of debt maturity. It builds on our initial premise that overconfident managers tend to overestimate the prospects of their firms. In their perspective, the debt market undervalues their firms. Therefore, firms with overconfident managers tend to issue more short-term debt than firms with non-overconfident managers. In other words,

overconfident managers can take advantage of short-term debt as a signalling role of their firms' quality (Flannery, 1986).

These arguments lay further grounds for the research that we conduct in our thesis. We follow an investigation into whether overconfident managers can affect their internal financing policy, which is a choice between cash holding and other investment projects. In addition, we test whether managerial overconfidence can affect managers' external financing policy such as debt maturity, which is a choice between short-term debt and long-term debt.

1.3 Objectives

The main objective of this thesis is to investigate the extent to which managerial overconfidence can affect firms' investment decisions and financial policies. Three important aspects of our study, which differentiate it from previous research, are as follows:

First, we attempt to establish a link between managerial overconfidence and the internal financing policy. It is presented in two stages. First, we analyze the impact of managerial overconfidence on investment decisions. When firms expect to face limited internal funds for their investment, an increase in internal funds can induce overconfident managers to increase their investment more than non-overconfident managers. Second, we examine whether the impact of managerial overconfidence on investment can further affect firms' cash holding policy. In particular, we focus on the fact that the impact of managerial overconfidence on internal financing decisions is not homogeneous but varies with financial constraints. To do so, we identify firms as financially constrained and unconstrained by using firm-specific characteristics, e.g. size, leverage, dividend, age. In order to measure managerial overconfidence, we consider the aggregate stock dealings by all executives in the open market during the sample year. When the amount of shares purchased by a firm's executive directors during one calendar year is greater than the amount of shares sold, this firm is classified as a net buyer. Since overconfidence is a persistently psychological

factor, we identify those firms which have been habitual net buyers for certain durations during our sample period as firms with managerial overconfidence. To test the robustness of our results, we also measure managerial confidence using outsiders' perception of the executive directors captured by press. During our sample period, when the total number of articles describing executive directors as the optimistic or confident is higher than the total number of articles describing executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident, this firm will be classified as a firm with managerial overconfidence.

Second, we discuss the linkage between managerial overconfidence and firms' external financing policy investigating the empirical determinants of firms' debt maturity. We take into consideration the complicated ways in which managerial overconfidence interacts with firm-specific characteristics, e.g. firms' quality. The underlying notion is the signalling role of short-term debt on firms' quality available to the market. We argue that overconfident managers believe their firms are undervalued by the debt market, which then leads their firms to pay a higher premium on long-term debt than they expected. In order to avoid this, overconfident managers have an incentive to issue short-term debt rather than long-term debt. Therefore, firms with overconfident managers are more disposed to choose short-term debt to signal their perceived quality than firms with non-overconfident managers.

Third, we attempt to investigate whether the effects of managerial overconfidence on corporate decisions vary in different corporate governance environments. It has been suggested that the potential prescription for managerial overconfidence could be outsider monitoring (Heaton, 2002; Malmendier and Tate, 2005; Doukas and Petmezas, 2007). By that they mean that outsiders are capable of drawing managerial attention to information that may indicate that their perceptions are wrong. If this is the case, when firms have weak governance mechanisms, monitoring by outsiders will not be an effective constraint on biased decisions. Hence, we can argue that the impact of managerial overconfidence on corporate policies will be consistently significant in those firms. When firms have good governance mechanisms, however, monitoring by

outsiders will be more effective and can constrain overconfident managers from undertaking biased decisions[5]. In such firms, therefore, the impact of managerial overconfidence on corporate policies becomes insignificant. To investigate this, we divide firms by using a set of corporate governance attributes respectively such as board structure and ownership concentration[6].

Our thesis uses a unique dataset that includes detailed information on accounting data, ownership structure, board structure, managerial share dealings and outside perception of managers of a large sample of UK listed companies. Several factors combine to make the UK a particularly interesting environment to study. First, the debate about how to interpret the overconfidence hypothesis is much less developed in Europe than in the US. Second, in the wake of several corporate scandals in the early 1990s, especially in the UK, corporate governance issues have become increasingly important (see in Cadbury, 1992; Hampel Committee, 1998, Dahya and McConnell, 2005) and the effectiveness of the boards of UK firms has been highly recommended. Consequently, an intensive investigation of managerial overconfidence issues and the effectiveness of various alternative governance mechanisms in the UK may be important.

1.4 Main Findings

The thesis is organized as follows. Chapter 2 gives a detailed analysis of the impact of managerial overconfidence on investment-cash flow sensitivity by using a sample of UK listed firms over the period 2002-2006. We take the graphical analysis approach used in Hubbard (1998) and apply it to the presence of managerial overconfidence. This centres on the view that the slope of demand curve for capital is determined by growth opportunity, and the optimal level of investment is the interaction point of demand and supply curves. Since

[5] We assume that the biased decision is a recurrent problem as in Kahneman and Lovallo (1993). In their study, the 'outside' view is the one can assess the present position by comparing to other similar cases. However, if it is not, then effective monitoring can not constrain managers' biased decisions.

[6] We consider the lack of consensus regarding the governance role of these attributes, i.e. board size, non-executive ratio, blockholders' ownership and divide firms into subgroups using each of them.

overconfident managers tend to overestimate their future returns from investment, the growth opportunities perceived by firms with overconfident managers are greater than those firms without overconfident managers. Hence the slope of demand curve for investment in firms with managerial overconfidence is much flatter than for firms without managerial overconfidence. With financially constrained firms, when internal funds increase, we find that those with overconfident managers may increase investment more than firms without overconfident managers. This implies that managerial overconfidence can significantly increase investment-cash flow sensitivity of cash in financially constrained firms. With financially unconstrained firms, the fluctuation of internal funds is independent of the level of investment. Finally, we aim to provide a detailed investigation of the roles of corporate governance mechanisms in influencing corporate investment decisions by overconfident managers. We argue that the impact of managerial overconfidence on cash flow sensitivity of investment will be significant in financially constrained firms with weak corporate governance mechanisms. To do so, we divide constrained firms into two subgroups according to their board size, ratio of non-executive directors and blockholders' ownership respectively. Median values of the three attributes are the benchmarks in this classification.

The results presented in Chapter 2 support our view that managerial overconfidence can be an important factor in determining firms' investment decisions. Our findings indicate that managerial overconfidence can significantly increase investment-cash flow sensitivity in financially constrained firms in leverage, dividend, cash and age groups. However, the relationship between managerial overconfidence and investment-cash flow sensitivity in financially unconstrained firms is uncertain. Moreover, we observe that the positive relationship between managerial confidence and cash flow sensitivity of investment remains significantly positive in financially constrained firms with weak corporate governance mechanisms (e.g. low ratio of non-executive directors or low blockholders' ownership). By contrast, the positive relationship between managerial overconfidence and cash flow sensitivity of investment becomes insignificant in financially constrained firms with good corporate governance mechanisms (e.g. high ratio of non-executive directors or high

blockholders' ownership). Our results provide no consistent evidence that the positive relationship between managerial overconfidence and cash flow sensitivity of investment varies with board size.

Building on the analysis of Chapter 2, Chapter 3 seeks to establish a relationship between investment decisions and cash holding policy using a panel data of UK listed firms over the period 1996-2006. While the previous literature has discussed the relationship between cash policy and investment choices, most of them are concerned with the determinants of cash holding or the impact of cash holding on investment, rather than the impact of investment decisions on cash holding. We conduct our analysis in two stages. We first evaluate the extent to which investment influences cash flow sensitivity of cash by emphasizing the importance of financial constraints. For example, financially constrained firms choose to increase investment and cash with cash flow in the first stage. Higher investment expenditure may limit the available sources for saving cash and increase cash flow fluctuations in the future. Consequently, an increase in investment expenditure may finally induce financially constrained firms to save more cash out of their cash flow. In other words, we can predict that investment can increase cash flow sensitivity of cash in financially constrained firms.

Next, we discuss whether investment decisions by overconfident managers can also affect cash flow sensitivity of cash, especially in financially constrained firms. This is because overconfident managers believe that the benefits of their desired investment should be greater than the benefits of accumulating cash. In other words, we may not be able to find a positive relationship between investment and cash flow sensitivity of cash in financially constrained firms with overconfident managers.

Finally, via GMM estimation of a dynamic model, we can study firms' cash holdings in terms of their cash holdings in the previous period and their target levels. This dynamic analysis is conducted in financially constrained and unconstrained firms respectively. Accordingly, we predict that there will be

differences between the adjustment speeds of financially constrained and unconstrained firms. Financially unconstrained firms can much more easily change their cash holding level by choosing among several alternative sources of financing. By contrast, financially constrained firms are more likely to face future cash shortfalls and their target cash levels are relatively higher. In order to adjust to the target levels, they have to pass up some positive NPV (net present value) projects and accumulate cash out of cash flow. Hence, financially constrained firms are expected to have lower adjustment speeds to their target cash level — either because of the low return of cash holding, or else because they have higher levels to adjust.

The results presented in Chapter 3 indicate that firms with less dividend payouts and lower investment expenditure tend to hold more cash. In addition, our results reveal a non-linear relationship between managerial ownership and cash holding. When managerial ownership is at a low level, an increase in ownership can align the conflict between managers and shareholders and less cash will be required. However, when managerial ownership exceeds a certain level, the alignment effects of managerial ownership are replaced by the entrenchment effects of it and the relationship between managerial ownership and cash holding becomes positive. Finally, when managerial ownership is substantially high, the interests of managers converge to the interests of shareholders and the relationship between ownership and cash holding is back to be negative. More importantly, we find a significant and positive relationship between investment and cash flow sensitivity of cash holding in financially constrained firms with lower dividend payouts or lower leverage. However, this significant relationship can not be found in financially constrained firms with managerial overconfidence. Finally, our dynamic panel data regressions show that UK firms adjust partially toward target cash holding and that the adjustment speed is much slower in younger firms with smaller size and lower leverage.

Chapter 4 aims to establish a linkage between managerial overconfidence and debt maturity policy by using a sample of UK listed firms over the period 2002-2006. First, based on the traditional theories of asymmetric information and

agency costs, we investigate the direct effects of firm-specific characteristics on debt maturity (long-term debt ratio). Specifically, we investigate the non-linear impact of managerial ownership on debt maturity. Below a low level, managerial ownership is good because it can incentivise the managers to act in the interest of shareholders. So we can predict a negative relationship between managerial ownership and debt maturity. However, when managerial ownership is above a certain level, managers can not act in the interest of other minority shareholders. And the alignment benefits are replaced by private benefits from long-term debt. In this case, therefore, we can predict a positive relationship between managerial ownership and debt maturity. Second, we test the role of managerial overconfidence in dealing with firms' debt maturity. In the presence of asymmetric information, we hypothesize that managerial overconfidence can increase the negative relationship between firms' quality and long-term debt. That is, overconfident managers believe their firms have been undervalued by the market, which leads their firms to pay a higher premium on long-term debt contracts than they expected. To avoid this, overconfident managers have an incentive to issue more short-term debts to signal their perceived quality than non-overconfident managers. Meanwhile, in the presence of agency cost, we hypothesize that managerial overconfidence can increase the negative relationship between growth opportunity and long-term debt. That is, overconfident managers realize short-term debt can alleviate the underinvestment problems and give them opportunities to invest their desired project. Third, we further consider whether the impact of managerial overconfidence on debt maturity varies with corporate governance mechanisms. We use a more cautious way (than Chapter 2) to divide sample into three subgroups according to the board size, the ratio of non-executive directors and the blockholders' ownership respectively: smaller-size board, medium-size board and larger-size board; lower, medium and higher ratio of non-executive directors; lower, medium and higher level of blockholders' ownership.

The results presented in Chapter 4 indicate that firms with larger size, higher leverage ratio, worse quality and lower liquidity tend to issue more long-term debt. In addition, the non-linear relationship between managerial ownership and debt maturity is supported by our evidence. More importantly, managerial

overconfidence can increase the negative relationship between firms' quality and long-term debt. It is in line with our hypothesis that firms with overconfident managers are more disposed to issue short-term debt to signal their firms' quality to the market than those without overconfident managers. However, we find limited evidence that managerial overconfidence can increase the negative relationship between firms' growth opportunity and long-term debt.

Finally, our findings strongly support our empirical hypothesis that the significantly negative impact of managerial overconfidence on the relationship between debt maturity and firms' quality persists in firms with weak corporate governance mechanisms (e.g. lower ratio of non-executive directors, lower blockholders' ownership). Meanwhile, managerial ownership can act as an important incentive mechanism when the monitoring mechanism is less effective. And we find that the effect of managerial ownership is still significant in weakly governed firms. In contrast, the impacts of managerial overconfidence and managerial ownership on debt maturity both turn to be insignificant in firms with good corporate governance mechanisms (medium ratio of non-executive directors, medium level of blockholders' ownership).

Chapter 5 presents the main conclusions of this thesis. In particular, we emphasize how managerial overconfidence can lead to biased investment and sub-optimal corporate policy decisions. We also demonstrate that this effect can vary with different corporate governance mechanisms. Finally, we discuss several promising avenues for future research.

Chapter 2

Managerial Overconfidence and Corporate Investment: Empirical Evidence from the UK

2.1 Introduction

The existing literature attributes the wedge between internal and external funds to asymmetric information and agency problems among different stakeholders. Since the pioneering work of Fazzari *et al.* (1988), there has been a profusion of empirical articles providing evidence that investment is more sensitive to cash flow in financially constrained firms than in financially unconstrained firms (see e.g. Hoshi *et al.* 1991; Fazzari and Petersen, 1993; Himmelberg and Petersen, 1994). The underlying notion of these studies is that because of costly external funds, the fluctuations of limited internal funds can change the level of investment, leading to a positive cash flow sensitivity of investment. However, studies from Kaplan and Zingales (1997) and Cleary (1999) present opposite results. They use qualitative and quantitative information contained in firms' annual reports and creditworthiness respectively, to distinguish between financially constrained and unconstrained firms and find that firms with less financial constraints have greater sensitivity of investment to cash flow.

Despite these controversial findings, they all ignore the potential roles that personal characteristics, especially managerial overconfidence, may play in determining corporate decisions. Cooper *et al.* (1988) argue that entrepreneurs tend to overestimate the possibility of success. For example, 81% of entrepreneurs believe their chance of success in new projects is at least 70%, and 33% of entrepreneurs believe theirs are to be 100% certain. In fact, only about 25% of these new projects exist after five years. Similar behaviour can also be found in trading markets (Barberis and Thaler, 2003), in which most people believe that they have sufficient information to justify a trade, while, in fact, the information they have is weak.

As far as corporate investment is concerned, Roll (1986) was the first to introduce CEO's overconfidence as a way of explaining why many takeovers are *ex post* value destroying. Also, Heaton (2002) proposes that overconfident managers may invest in some projects with negative net present values (NPV

thereafter), which are positive in their perspectives. Both papers assume that overconfident managers tend to overestimate the future return of investment under their control. However, these authors did not directly tackle the measurement issue of managerial overconfidence in order to provide further evidence. A notable exception is Malmendier and Tate (2005), who use the timing of option exercises and the habitual acquisition of company stock to identify managerial overconfidence. They argue that when overconfident managers have sufficient internal funds for investment and are not disciplined by the capital market or corporate governance mechanisms, they overinvest relative to the optimal investment level. By contrast, when they do not have sufficient internal funds, they are reluctant to use costly external funds (debt or equity) and, curb their investment as a consequence. Additional cash flow then provides an opportunity to invest more to their desired level. They report a positive relationship between investment and CEOs' overconfidence in the US. Investments by these CEOs are significantly more responsive to cash flow, especially in those equity-dependent firms identified by the KZ index.

Although Malmendier and Tate (2005) have been successful in providing supporting evidence for the significant role of CEOs' overconfidence in determining investment across firms in the US, there has been surprisingly little attempt in the current literature, especially in the UK, to keep up with this pace. Moreover, it has also left an unanswered empirical question: can the impact of overconfident behaviour on investment vary with corporate governance mechanisms? It has been suggested that a strong outsider monitoring by governance mechanism can potentially constrain irrational managerial behaviour (Kahneman and Lovallo, 1993). In their view, when biased decisions are recurrent problems, outsiders can yield a more realistic estimate via comparison with other similar cases, rather than restrict to the details of the case at hand. The objective of this chapter is to extend the investigation of these studies by analysing empirically whether the impact of managerial overconfidence on investment is homogeneous across all firms in the UK. To do so, we focus on all executive directors' behaviour rather than just that of CEOs. In particular, we aim to provide a detailed examination of the roles of financial constraints and

monitoring governance mechanisms in influencing the corporate investment decisions by overconfident managers.

Our analysis is conducted in two stages, which we believe significantly distinguishes our work from the existing research.

First, apart from Malmendier and Tate's (2005) two-period model, we add the impact of managerial overconfidence into the graph originating from Hubbard (1998) and emphasize the importance of the financial constraints. This is based on the view that the slope of demand curve for capital is determined by the growth opportunity or the future profitability of capital. Since overconfident managers tend to overestimate the future return of investment, then the growth opportunity perceived by overconfident managers is greater than the one perceived by non-overconfident managers. Our graph implies that firms with managerial overconfidence can increase investment. More importantly, an increase in internal funds in financially constrained firms with managerial overconfidence can generate higher investment than financially constrained firms without managerial overconfidence, while financially unconstrained firms cannot display such a positive relationship. We, therefore, hypothesize that in financially constrained firms, managerial overconfidence can increase investment-cash flow sensitivity, whereas in financially unconstrained firms, managerial overconfidence is independent of investment-cash flow sensitivity.

Second, we consider whether the impact of managerial overconfidence on investment-cash flow sensitivity varies according to different corporate governance mechanisms. For example, in the presence of a weak corporate governance mechanism, biased investment decisions by overconfident managers cannot be constrained by firms' monitoring mechanisms and their positive impacts on investment-cash flow sensitivity should still be held. Accordingly, for financially constrained firms, we hypothesize that managerial overconfidence can consistently increase the investment-cash flow sensitivity in firms with weak corporate governance mechanisms. In contrast, if investment biases are recurrent

problems, then a governance mechanism with strong monitoring from outsiders may restrain them. And managerial overconfidence cannot consistently increase the investment-cash flow sensitivity in financially constrained firms with good corporate governance mechanisms.

To investigate these empirical hypotheses, we use a sample of the UK listed firms over the period 2002–2006. To assist our estimation, we set up a unique data set, which includes firms' accounting data, share dealing information for each executive director, ownership concentration and board structure. To measure managerial overconfidence we consider executive directors' stock dealing activities in the open market. This proxy, first used by Malmendier and Tate (2005) in the context of CEOs' overconfidence, is a dummy variable. It equals 1 when the net amount of stock purchasing by all executive directors is positive for one year, which indicates the firm is a net buyer this year. In particular, since overconfidence is a persistently psychological factor, we identify those firms which have been habitual net buyers for all years during 2003-2006 as firms possessing managerial overconfidence (OVER 1). Meanwhile, we consider those firms which have been habitual net buyer for at least three years during 2003-2006 as an alternative measurement of managerial overconfidence (OVER 2). Apart from that, we also verify the robustness of the results to another alternative overconfidence measurement (OVER 3), which is based on outside perception by using the business press which characterizes executive directors as "confident" or "optimistic" (Malmendier *et al.*, 2007). When the number of articles describing a firm's executive directors as "confident" or "optimistic" is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006, this firm is identified as the one with managerial overconfidence. Furthermore, we identify firms as financially constrained firms and unconstrained firms according to top (bottom) three deciles of their size, leverage, dividend payouts, age and cash holding distributions. Finally, to identify the effectiveness of the corporate governance mechanisms, we employ a set of three governance attributes such as proxies for board structure and ownership concentration. We use these attributes respectively

to divide firms. They are firms with large or small board, firms with high or low ratio of nonexecutive directors in board room or firms with high or low blockholders' ownership. We aim to find whether the impact of managerial overconfidence on investment-cash flow sensitivity varies with different conditions. And median values of these three attributes are the benchmarks in this classification.

The analysis in this chapter provides several interesting findings.

First, we use a cross-sectional average (CSA) method to estimate our hypothesis. In particular, we use two different periods to give more evidence: one is the dependent variable is measured in year 2006 and the other is the dependent variables is measured in year 2005. Accordingly, all the independent variables are measured by average-past values over 2002-2005 and 2002-2004 respectively. We find that financially constrained firms generally exhibit a positive relationship between managerial overconfidence and cash flow sensitivity of investment. It is statistically significant in leverage, dividend, age and cash groups. In contrast, this positive relationship cannot be consistently found in financially unconstrained firms. This is in line with our first argument that investment decisions by overconfident managers in financially constrained firms should be more sensitive to cash flow than investment decisions by non-overconfident managers. An increase in cash flow can induce them to increase their investment to their desired level.

Second, we observe that the positive relationship between managerial overconfidence and cash flow sensitivity of investment is remained in financially constrained firms with small-size boards, low ratio of nonexecutive directors in board room or low blockholders' ownership. It is statistically significant in dividend, age and leverage groups. This is in line with our second argument that weak monitoring by corporate governance mechanisms, such as firms with low ratio of non-executive directors or low blockholders' ownership, cannot influence the positive impact of managerial overconfidence on investment.

Third, all these findings have been supported by our robustness checks using two alternative measures of managerial overconfidence (OVER2 and OVER3). We generally find that in financially constrained firms in leverage, dividend, age and cash groups, managerial overconfidence can positively affect the investment-cash flow sensitivity. And this relationship is kept to be significant when constrained firms with low ratio of non-executive directors or low blockholders' ownership. However, we do not find any further supportive evidence that the impact of managerial overconfidence on investment-cash flow sensitivity varies with the board size.

The remainder of the chapter is organized as follows. In Section 2.2 we discuss the theoretical background and present our empirical hypotheses. In Section 2.3 we introduce the data, classification scheme and empirical specifications used in our analysis. Section 2.4 contains our empirical tests. Our univariate analysis is to provide preliminary evidence on the relationship between overconfidence and investment and multivariate results provide empirical evidence for our hypothesis. Robustness checks have also been included in this section. Section 2.5 presents our conclusion.

2.2 Theoretical Background and Our Hypotheses

In this section, we first provide a literature review of the relationship between investment-cash flow sensitivity and investment decisions emphasizing the importance of financial constraints. We then discuss whether investment decisions by overconfident managers can be effected by the financial constraints. We finally discuss whether investment decisions by overconfident managers vary in the corporate governance regime.

2.2.1 Financial Constraints and Investment Decisions

In the first instance, it is convenient to recall that in a perfect capital market, capital is well allocated such that the marginal product of capital is equal in each investment project (Modigliani and Miller, 1958). However, in an imperfect capital market, various frictions result in costly external financing and influence the effectiveness of the capital allocation in investment. Two main issues of these frictions have been discussed by traditional research: one is the asymmetric information and the other is agency problems from debt financing. Both incorporate the role of financial constraints in determining investment that limited internal funds and costly external financing prevent firms from raising external funds to undertake all profitable investment projects.

2.2.1.1 Asymmetric Information and Financial Constraint

The asymmetric information in the context of capital market refers to the situation where some information about firms is known to managers but not to outside investors. For example, in debt market, since lenders cannot differentiate between high-risk (or quality) and low-risk applicants, they cannot attain price discrimination (e.g. increase interest rates) to set up a loan contract. The reason for this is that when interest rates increase, adverse selection (Akerlof, 1970) can lead to equilibrium such that all low-risk applicants will withdraw from the capital market. On the other hand, if applicants do get a loan, moral hazard (Blanchard and Fisher, 1989; Milgrom and Roberts, 1992) can induce them to invest in riskier projects. These two sorts of consideration result in credit rationing (Stiglitz and Weiss, 1981) that the interest rate of the supply for loanable funds exceeds the interest rate of the demand. Consequently, applicants (or firms) are simply unable to access all debt financing they want at the prevailing market interest rate. Furthermore, costly debt financing and limited liability will induce firms to pass up some positive NPV projects. This is because firms do not take into account the gain to debt holders in all states of nature in

which the project maybe profitable but not profitable enough to ensure that the firm will remain solvent (Myers, 1977).

It is also argued that in equity market, managers can take advantage of the private information they possess and issue new shares when this information suggests that their shares are overvalued by the market (e.g. Greenwald, Stiglitz and Weiss, 1984; Myers, 1984; Myers and Majluf, 1984). Then, new equity issuance can be rationally interpreted by the market as bad news (see *announcement effects* in Asquith and Mulline, 1986; Masulis and Korwar, 1986; Mikkelson and Partch, 1986). As a result, firms with good quality are reluctant to issue new shares, whereas firms with poor quality are not. Also, the former may pass up some valuable investment projects.

Finally, firms' response to costly debt and equity financing is to follow a 'pecking order', formalized by Myers and Majluf (1984) and Myers (1984). That is, firms prefer internal financing to external financing for their investment projects. When internal financing is not sufficient for investment, they turn to external financing and prefer to issue debts rather than new equity. The reason for this is that firms choose to issue equity and invest if and only if the NPV of the investment project is at least equal to the amount (ΔN [7]) by which the shares are overvalued ($\Delta N<0$) or undervalued ($\Delta N>0$), otherwise firms have to pass up some valuable investment projects. In order to avoid passing up valuable projects, firms can reduce ΔN by issuing safest securities such as debts in which the absolute value of ΔN is always less for debt than for equity.

In summary, asymmetric information problems can create a wedge between the cost of external financing and internal financing. Empirically, larger firms are believed to be more diversified, have higher reputation in capital markets and are at lower risk of default, thus they face less informational asymmetry. However, smaller firms are more likely to face higher asymmetric information costs (see Collins *et al.*, 1981; Gilchrist and Himmelberg, 1995) and tend to be financially

[7] ΔN is the amount of mis-valuation.

constrained firms. Firm size is defined as the natural logarithm of total assets (SIZE 1) in 2002 prices. To test the robustness of the results, we also define firm size as the natural logarithm of total sales (SIZE 2) in 2002 prices.

The age of a firm can also be used as a financial constraint criterion. The underlying argument is that younger firms are more likely to face asymmetric information problems since it is not possible for them to have long-term relationships with outsider investors as do older firms (Oliner and Rudebush, 1992; Schaller, 1993; Berger and Udell, 1995). We calculate a firm' age as the number of years that the firm has been incorporated in 2006 and use the natural logarithm of one plus of this number(AGE).

2.2.1.2 Agency Costs of Debt Financing and Financial Constraint

Agency costs of debt can also increase the cost of external funds. Two types of conflicts can describe the origin of agency costs. The conflict between bondholders and shareholders has been identified as a principal–agent problem, in which managers are assumed to act on behalf of the shareholders as the agents and bondholders act as the principals. In order to maximize firms' value for shareholders, managers may be motivated to choose riskier projects than those agreed with bondholders (Jensen and Meckling, 1976). This asset substitution problem would result in shareholders expropriating wealth from bondholders, since shareholders do not have to pay any extra gains from riskier projects to bondholders, yet bondholders would bear the risk of failure. In the attempt to align the different interests between agents and principals, monitoring, mandatory audit and bonding costs for overseeing the agent's behaviour are incurred. Although such costs are initially borne by the principal, they will be transferred to the agent through contracting.

Another conflict is between shareholders and bondholders, which induces the underinvestment problem associating with debt overhang. A large amount of debt can discourage implementation of new investment, because any profits

generated from the new investment will accrue to bondholders (Myers, 1977) rather than to shareholders. This potential transfer of wealth from shareholders to bondholders may induce the former to reject some projects, even those projects with positive NPV. Bondholders may anticipate this incentive problem and will discount it accordingly in the current price at which they purchase debt (Barnea *et al.*, 1980).

As far as the ability to issue debt is concerned, leverage ratio can be considered. The larger the cost of external debt financing is, the lower the leverage ratio is expected to be. Accordingly, we predict that firms with higher leverage are more likely to be financially unconstrained firms, and vice versa (Castanias, 1983; Bradley *et al.*, 1984; John, 1993). However, one may argue that higher leverage, to some extent, can increase the likelihood of business failure (Ferri and Jones, 1979; Titman and Wessels, 1988; Whited, 1992). If this is the case, we might predict that higher leveraged firms are more likely to be financially constrained firms. We use the ratio of total debt to total assets to calculate firms' leverage (LEV).

In addition, the larger the cost of external debt financing is, the larger the retention of earnings is expected to be. This is because retained earnings are the main source of internal financing such as dividend payouts, regardless of firm size. Lintner (1956) suggests dividend policy cannot be changed until new earning levels are sustainable. La Porta *et al.* (2000) advance two alternative agency models of dividend: 'outcome model' and 'substitute model'. In the outcome model, dividend is the legal protection of shareholders which hinders managers benefitting themselves. In the substitute model, dividend is used to establish reputation rather than for a legal protection. They find empirical support for the outcome model in those countries with better legal protection. In summary, firms with higher dividend payouts should face lower agency costs of external financing. Dividend payout is a popular strategy to identify financially constrained and unconstrained firms as well (e.g. Fazzari et al., 1988; Kaplan and Zingales, 1997 etc.). We compute dividend payout (DIV 1) as the ratio of dividend payments to total assets, in line with Ozkan and Ozkan (2004), Arslan *et*

al. (2006) and Florackis and Ozkan (2007). We also use the ratio of dividend payments to net income to calculate dividend payouts (DIV 2), in line with Antoniou *et al.* (2008).

2.2.1.3 Investment-Cash Flow sensitivity and Financial Constraint

As described above, on one hand, firms with unlimited access to capital or sufficient internal funds for their investment can be regarded as financially unconstrained firms. On the other hand, firms with limited access to capital and insufficient internal funds for their investment can be regarded as financially constrained firms. Financial constraints can be used to interpret the relationship between corporate investment and cash flow, and become central issues with regard to the sensitivity of investment to cash flow.

In his comprehensive survey, Hubbard (1998) illustrates the linkage between internal funds and investment decisions. Figure 2.1 shows the linkage between net worth, the cost of external finance and investment. It includes a demand curve (D) for capital and a supply curve (S) for capital. The horizontal axis is the quantity of capital and the vertical axis is the cost of capital. The slope of the D curve is determined by the firm's investment opportunities and the location of the S curve is determined by the cost of capital (r). Then, in a perfect capital market, the first-best investment level (K*) is at the intersection of the D and S curves.

In an imperfect capital market, the supply curve $S(W_0)$ splits into two segments. The horizontal segment is at the interest rate *r* up to a level of internal funds W_0, in which there is no information costs. The upward-sloping segment is determined by information cost. The higher the information cost a firm faces, the steeper the upward-sloping supply curve will be. Given information costs and internal funds W_0, then the investment level in equilibrium is K_0. When internal funds increase from W_0 to W_1 and information costs remain the same, the supply curve shifts from $S(W_0)$ to $S(W_1)$ and investment level in equilibrium increases from K_0 to K_1. However, the investment level in equilibrium K_1 is still lower than the first-best investment level K* in a perfect capital market.

Figure 2.1 implies that given the level of investment opportunities, information costs and market interest rates, firms with a reduction in net worth (or internal funds) should reduce their investment, and vice versa. If a firm has good investment opportunities but is short of internal funds for their investment, it may have to pass up some investment projects.

Most empirical studies use cash flow as a proxy for internal funds (net worth) in an investment model. We use the sum of pre-tax profits and depreciation over total assets to calculate cash flow (CFLOW) and the ratio of capital expenditure in fixed assets to total assets to calculate investment (I), which are in line with Arslan *et al.* (2006). We expect a positive relationship between cash flow and investment, and this relationship is expected to be significant in financially constrained firms.

2.2.1.4 Empirical Evidence

Since investment-cash flow sensitivity increases with the degree of financial constraints, we can expect that investment-cash flow sensitivity should be greater in financially constrained firms. The majority of empirical studies in this area have attempted to use different criteria to split firms into financially constrained and financially unconstrained firms. These can be size, bond rating, commercial paper rating, bank relation, KZ index or dividend payout, etc.

a. Supporting Evidence

Using dividend payouts as their splitting criterion, Fazzari *et al.* (1988) examine the influence of financial constraints on investment by looking at the sensitivity of investment to cash flow. They use different investment models, among them the neoclassical model, accelerator investment model and Q model, and different estimation methods to take account of the measurement error, such as using fixed firm and year effects, instrumental variables, first and second differences of all variables in their tests. Their results tend to reach a consistent conclusion that

financially constrained firms incline to have higher investment-cash flow sensitivity.

Their result provokes a number of subsequent studies to confirm this linkage. These studies mainly depend on Tobin' *q* model and use different splitting approaches such as size, age, business group affiliation, dividend payout ratios, and non-oil or oil subsidiaries of oil companies.

For instance, Devereux and Schiantarelli (1990) attribute agency costs rather than asymmetric information costs to firm size because they believe managerial ownership is more concentrated in smaller firms. They find that larger firms in the UK rely more heavily on cash flow financing than smaller firms. They adopt firms' age as another classification scheme and find that younger firms are more exposed to asymmetric information and have higher cash flow sensitivity of investment. Similar results for younger firms were also found in the US (Oliner and Rudebush, 1992) and Canada (Schaller, 1993).

In Hoshi *et al.* (1991), business group affiliation is another classification approach. Owing to the monitoring role of financial intermediation, the authors argue that firms with closer relations with banks have lower debt agency costs and fewer asymmetric information problems. They classify firms into affiliated and independent firms and find that there is greater cash flow sensitivity of investment for firms that are associated with banks. Similar results were found in different countries based on this classification (see e.g. Italy (Schiantarelli and Sembenelli, 1995), Korea (Cho, 1995), Germany (Elston and Albach, 1995) and Canada (Chirinko and Schaller, 1995)).

Lamont (1997) tries to test the cash flow sensitivity of investment by using a group of firms that have businesses both in oil and non-oil industries. He argues that a decrease in cash flow in companies' oil segment can reduce investment in their non-oil subsidiaries. In fact, he finds a correlation between cash flow from oil subsidiaries and investment from non-oil subsidiaries of 26 large diversified

companies. That is, when oil revenues fell following the collapse of oil prices in 1986, investment by firms' subsidiaries unrelated to the oil business also declined. Although the sample size is small, it is still robust evidence that cash flow is important in investment.

Another strand in this area is to use the Euler equation describing firms' investment decisions without using Tobin's q, but controlling future profitability. For example, Whited (1992) particularly considers the role of debt financing constraints on investment. This classification criterion is firms' leverage level including debt ratio, interest coverage ratio and rated debt level. The Euler estimation provides evidence of a significant relationship between cash flow and investment spending for financially unhealthy firms with a high debt ratio or a high interest coverage ratio, or without rated debt.

Moreover, using the first-order conditions of the optimization process of a standard neoclassical model of investment with quadratic costs of adjustment, Bond and Meghir (1994) derive an Euler equation. According to their Euler equation, the investment is a function of discounted expected future investment, adjusted for the impact of the expected changes in the input prices and net marginal output[8]. They use a dummy variable to identify liquidity-constrained firms, which equals zero when dividend payout is positive and new share issuance is zero for two periods, otherwise one. They show that for liquidity-constrained firms, the standard Euler equation is not a valid model to describe investment behaviour. By contrast, for liquidity-unconstrained firms, investment behaviour can be described by the standard Euler equation.

The effect of financial constraints on investment has also been examined for a wide range of investment. Besides expenditure on plant and equipment, working capital, R&D expenditure and inventory investment have been analysed in the literature above. For example, Fazzari and Petersen (1993) examine the effects of financial constraints on working capital. They use dividend payout ratio as a

[8] Although it is based on the macroeconomics which is some distance from our main idea, it can still give us an original clue for the Euler equation.

criterion to distinguish financially constrained and unconstrained firms and find that low-payout firms have higher sensitivities of working capital investment to cash flow. Himmelberg and Petersen (1994) find that smaller manufacturing firms' R&D spending is highly dependent upon operating cash flow. Carpenter *et al.* (1994) suggest that smaller firms and firms without bond rating tend to have a higher sensitivity of inventory investment to cash flow.

b. Criticisms

One important criticism of the above strand of literature is the use of Tobin's q in the Q model to control for investment opportunity. It is argued that the relationship between cash flow and investment could stem from the correlation between cash flow and omitted or mismeasured investment opportunities (Tobin's q). Therefore, alternative measures of investment opportunities need to be constructed to test whether when these opportunities are more adequately measured, cash flow still plays a significant role in firms' investment.

Gilchrist and Himmelberg (1995) estimate a set of vector autoregressive forecasting equations to build a 'fundamental q' as a proxy for the expected value of marginal q conditional on observed fundamentals. This allows the role of cash flow as a forecasting variable to be distinguished from its role as an explanatory variable of investment. When they use the dividend-payout ratio to identify financially constrained firms, they find contradictory results as did Fazarri *et al.* (1988). However, when considering firm size, commercial paper ratings and bond ratings, it reveals a higher sensitivity of investment to cash flow in financially constrained firms.

Erickson and Whited (2000) analyse the measurement error problem by creating measurement-error consistent generalized method of moments (GMM) estimators. With this method, they find that Tobin's q suffers from substantial measurement error. Instead, the consistent estimators imply that Tobin's q has good explanatory power. Furthermore, they argue that many stylized facts in the empirical investment literature potentially result from measurement error in

Tobin's q. In particular, they find that cash flow becomes insignificant; while the point estimates of the q-coefficient roughly triple in magnitude relative to the OLS baseline estimation (e.g. the estimated coefficient increases from 0.014 to 0.044). Similarly, in the work of Gomes (2001), optimal investment is sensitive to both Tobin's q and cash flow irrespective of whether firms are financially constrained or not. He finds that in the absence of financial constraints, the standard investment regression predicting cash flow is an important determinant of investment only if one ignores Tobin's q. Thus the investment-cash flow sensitivity is probably due to the measurement error in Tobin's q and an identification problem.

More recently, Alti (2003) proposes that cross-sectional variations in the informational content of cash flows regarding investment opportunities could generate the patterns reported by Fazzari *et al.* (1988), even without financial constraints. Tobin's q is shown to be a more noisy measure of the investment opportunities in young firms, since the long-term growth options add noise to the part of q that measures near-term investment. When Tobin's q is replaced by the 'noise-free' q, the investment sensitivity to expected cash flow is eliminated.

Finally, Carpenter and Guariglia (2008) introduce 'alongside q' as a new proxy for investment opportunities measuring the firm's contractual obligations for future investment. When they include q in their investment regression, they find that the explanatory power of cash flow falls for large firms but remains unchanged in small firms.

Another important criticism of hypothesis of the positive relationship between investment and cash flow originates from the validity of the financial constraints' criterion. Kaplan and Zingales (1997, 2000) re-examine some of the firms studied by Fazzari *et al.* (1988) by using their own identification of financial constraints. This identification is based on the availability and demand for funds from qualitative and quantitative information contained in the firms' various reports. Conversely, they find that financially unconstrained firms appear to have greater sensitivities of investment to cash flow than financially constrained firms.

Kadapakkam *et al.* (1998) examine the different impacts of cash flow on firm investment in six OECD countries by using firm size as their classification. They adopt three measures of firm size: total sale, market value and total assets. They find that investment-cash flow sensitivity is generally highest in the largest firms and lowest in the smallest firm. They interpret this as meaning that larger firms are more flexible in timing investment and more susceptible to managerial agency problems.

Cleary (1999) classifies firms according to his financial constraint index (Z_{FC}). He computes Z_{FC} a score based on six variables such as firm liquidity, leverage, profitability and growth. Two steps are included in this process: first is to classify firms into constrained or unconstrained firms according to some characteristics. Second, a statistical analysis is performed to delivers a coefficient for each of the six control variables. This analysis is similar to a probit or a logit estimation. His results show that the investment decisions with high creditworthiness (Z_{FC}) are significantly more sensitive to cash flow.

Allayannis and Mozumdar (2004) examine whether the puzzling results by Kaplan and Zingales (1997) and Cleary (1999) are driven by the fact of firms being in bad shape. When cash shortfall is severe, the firm can only make essential investment such that any decrease in investment is impossible. Thus, investment cannot respond to cash flow. They use negative cash flow as a proxy to identify firms that are in bad shape and confirm the validity of this proxy according to firms' growth rates, debt ratings, debt ratios and dividend changes. They provide evidence that these puzzling results are largely due to firms' negative cash flow. And Kaplan and Zingales' (1997) results are also affected by an influential observation in a small sample.

Finally, Moyen (2004) reconciles the conflicting empirical results by using an unconstrained model and a constrained model. With the constrained model, firms cannot access external debt or equity, while with the unconstrained model, firms can issue debt and access external equity at zero cost. They find that, in the

constrained model, unconstrained firms use debt and cash flow to increase their investment and dividend payouts, while constrained firms can only use cash flow to increase their investment or dividend payouts. Consistent with Kaplan and Zingales' results (1997), they find cash flow sensitivity of investment is lower in constrained firms. Meanwhile, in unconstrained firms, firms can adjust their debt level over time and invest more than firms in the constrained model. Low-dividend firms, regarded as financially unconstrained firms in this model, exhibit higher investment-cash flow sensitivity. That is because paying off debts accounts for a larger proportion of cash flow in unconstrained firms than unconstrained firms. Unconstrained firms have lower dividends than constrained firms and exhibit higher investment-cash flow sensitivity. This is in line with results from Fazzari *et al.* (1988).

2.2.2 Financial Constraint, Investment and Managerial Overconfidence

The above traditional models of investment behaviour implicitly assume that managers are rational, while behavioural finance assumes that managers can be irrational. Recently, researchers in behavioural finance became interested in the analysis of causes and consequences of overconfidence. In this section, we present the related background to this issue followed by our hypothesis.

2.2.2.1 Background

Since the 1990s, overconfidence has also become a field of interest for economists, mainly in the context of behaviour on financial markets. Overconfidence is defined as an overestimation of one's knowledge or precision of private information. Some puzzles found on the financial markets were successfully accounted for once overconfidence of investors was assumed, which include excessive trading volumes (Barber and Odean, 2001), security misevaluation (Chuang and Lee, 2006) and so on. However, the existence of managerial overconfidence in the corporate finance context is less explored. Two main directions of overconfidence research in the context of corporate finance

are included: one is the study of merger and acquisition and the other is the study of internal corporate financing structures.

Roll (1986) publishes one of the first studies introducing individual-level overconfidence into the context of merger and acquisition. This study uses CEO overconfidence to explain why many takeovers are ex post value destroying. According to his 'hubris' theory, the takeover could be interpreted such that the decision-makers convince themselves that the valuation of their target firms is correct and that the market does not reflect this correct value, which leads to too high bids and ex post loss. Following Roll's argument, Malmendier and Tate (2008) analyse corporate merger and acquisition using a sample of US firms. They empirically find that overconfident CEOs in the sample are not only more likely to conduct mergers than their rational counterparts, but also their mergers are proven to be much less profitable. Moreover, acquiring firms with overconfident CEOs suffer from higher negative price effects on stock prices following announcements.

On the other hand, there are some studies of the overconfidence issues in the corporate context. For example, in a questionnaire study by March and Shapira (1987), they find that managerial decisions are removed from the standard decision making theory. Managers believe they are able to control the risks rather than a gambler and are more risk-seeking than their peers, which is in line with the view of the better-than-average effect. Also, in Camerer and Lovallo (1999), most business failures can be explained by the fact that entrepreneurs strongly believe in their relative skill and forecast negative returns for an average market entry, with themselves being an exception to the rule.

Moreover, Heaton (2002) argues that optimistic managers are those who overestimate the probability of good project performance but underestimate bad performance. Optimistic managers sometimes advance a biased cash flow forecast and believe their firms to be undervalued by the market. Hence, they prefer to use internal funds to invest. And some profitable investment projects

will be passed up (*underinvestment*) because of the costly external financing in their perspective. Meanwhile, they also tend to overvalue the investment opportunities and thus tend to undertake investment with negative present value (*overinvestment*).

Despite these valuable insights, very few studies directly use a measurement to identify overconfidence with the notable exception of Malmendier and Tate (2005). They use a sample of Forbes 500 CEOs and construct three managerial overconfidence measurements: Holder 67, Longholder and Net Buyer. The first two use the timing of option exercises to identify overconfidence and the third concerns the habitual acquisition of company stock. In particular, Holder 67 considers the statues of each individual option package in the sample at the end of the vesting period. If an option is more than 67 % in-the-money at some point in the fifth year, the CEO should have exercised at least some portion of the package during or before the fifth year. If the CEO failed to exercise such an option during or before the fifth year, he/she will be classified as overconfident. Longholder classifies a CEO as overconfident if he/she ever holds an option until the last year of its duration. Net buyer examines the tendency of CEOs' stock purchasing behaviour despite their high exposure to company-specific risk and classifies a CEO as overconfident if he/she buys more stocks on net than their selling on net during their first five sample years.

In addition, Malmendier and Tate (2005) set up a theoretical model to demonstrate the impact of managerial overconfidence on corporate investment in an efficient capital market. They assume that managers are not self-interested and their aim is to maximize current shareholders' value and that CEOs' overconfidence is perceived by his/her overestimation of investment return. The authors propose two predictions: first, that the investment-cash flow sensitivity of overconfident CEOs is higher than those who are not overconfident; and second, that the investment-cash flow sensitivity of overconfident CEOs is more pronounced in equity-dependent firms without sufficient cash and riskless debt

for investment than in firms with sufficient cash and riskless debt for investment. The first prediction is supported by using their three managerial overconfidence measurements noted above and the second is confirmed by using "Longholder" to measure managerial overconfidence.

More recently, Ben-David *et al.* (2007) collect a survey data set of CFOs' quarterly stock market forecasts in the US. They find that CFOs are significantly miscalibrated in the predictions of short-term and long-term stock market returns. That is 'only 40% of stock market realizations fall within the 80% confidence intervals that executives provide'. They also find supportive evidence that overconfident CFOs rely more on cash flow, have higher investment and prefer longer maturities of debt.

In summary, the review presented above show that managerial overconfidence can affect corporate financing structure and overconfidence in the corporate context needs further research. Hence, in this chapter, we focus on the impact of managerial overconfidence on investment decision.

2.2.2.2 Our hypothesis

In the spirit of Malmendier and Tate (2005), we focus on the role of financial constraints in determining the relationship between investment-cash flow sensitivity and managerial overconfidence. In particular, we extend the graphical analysis as in Hubbard (1998) to demonstrate our initial hypothesis.

Figures 2.2 and 2.3 describe the links among net worth, the cost of external finance and investment in financially constrained and unconstrained firms, respectively. Both figures include demand curve for capital (D) and supply curve for capital (S). The horizontal axis is the quantity of capital and the vertical axis the cost of capital. In line with Hubbard, the slope of demand curve (D) is determined by the growth opportunity and the slope of supply curve (S) is determined by the information costs.

The main difference between ours and Hubbard's analysis is that we include two types of demand curves: a demand curve (D_m) with managerial overconfidence and a demand curve (D) without managerial overconfidence. Since the slope of a demand curve is determined by investment opportunity, we argue that the slope of D_m is flatter than the slope of D in both Figures 2.2 and 2.3. We reason that overconfident managers are assumed to overestimate their abilities to generate higher and positive returns. Thus, they overinvest when they have sufficient internal funds but curtail investment when they need external funds. This is in line with the description of overconfident managers' investment behaviour reported in the work of Malmendier and Tate (2005). This tendency could be represented by higher perceived investment opportunities. Another difference is that the starting points for demand curves D and D_m in our figures are at different levels. We reason that, given certain costs of capital, overconfident managers can invest more than non-overconfident managers. In other words, overconfident managers decide not to invest at a higher cost of capital than do non-overconfident managers.

Figure 2.2 describes investment decisions in financially unconstrained firms. When a firm has sufficient internal funds for investment, both non-overconfident and overconfident managers will invest to their desired optimal investment (K^* and K_m^*). Their investment levels are independent of changes in internal funds(S).

Figure 2.3 describes investment decisions in financially constrained firms. When a firm does not have sufficient internal funds for investment, then the $S(W_0)$ curve splits into two segments. One is a horizontal segment up to the initial internal funds W_0, and the other is an upward segment, in which the slope is determined by the information cost. Given the initial internal funds W_0, we can find the desired capital stock K_0 and K_{0m} for investment in firms with non-overconfident managers and overconfident managers, respectively. Shortages of internal funds in financially constrained firms are denoted by the gap between W_0 and K_0 (K_{0m}). Given an investment opportunity, when internal funds increase from W_0 to W_1, we will find that desired capital stock increases from K_0 to K_1

(K_{1m}) in firms without overconfident managers and with overconfident managers, respectively. Using geometrical theory, we can find that the change between K_0 and K_{1m} is higher than the change between K_0 and K_1, which means that an increase in internal funds can induce overconfident managers to increase investment more than do non-overconfident managers. Finally, this positive relationship between investment cash-flow sensitivity and managerial overconfidence is robust even if we consider not only information cost but also cost of private information for project risks and quality, which can be realized by changing the cost of funds.

In summary, overconfident managers increase their investment in response to an increase in cash flow when they face financial constraints. In contrast, firms with overconfident managers cannot display such determinate behaviour in investment when they do not face financial constraints. Empirically, we expect that cash flow sensitivity of investment can be increased by managerial overconfidence in financially constrained firms. However, managerial overconfidence does not necessarily increase cash flow sensitivity of investment in financially unconstrained firms.

2.2.3 The Role of Corporate Governance Mechanism

In the following text, we discuss whether the biased impact of managerial overconfidence on investment cash-flow sensitivity varies with the corporate governance mechanism. We want to test whether a corporate governance mechanism can serve as an outside monitoring role in overconfident behaviour? In other words, we attempt to analyze whether the impact of managerial overconfidence on investment decisions is kept to be pronounced in a weak governance mechanism (or a weak monitoring mechanism).

This analysis is in the spirit of Kahneman and Lovallo (1993). They argue that organizational optimism can be best alleviated by introducing an 'outside' view when the cognitive biases can be treated as recurrent problems. By that they

mean that outsiders are capable of drawing managerial attention to information that may indicate that their perceptions are wrong. The information is obtained from a comparison with other similar cases rather than focus on the decision itself. Also, Malmendier and Tate (2005) emphasize that overconfident managers can still invest sub-optimally even if managerial private incentives are perfectly aligned and/or they are not facing any informational asymmetries. Moreover, overconfident managers even believe that they are acting in the best interests of shareholders, although they are not actually, from the perspective of shareholders. Thus, a standard incentive contract such as a stock-based compensation is unable to mitigate the biased impact of overconfidence. Instead, the governance mechanism of an active or independent board of directors would be able to control the biased behaviour. In summary, managerial overconfidence as cognitive biases can not be easily avoided. However, if this bias is a recurrent problem, then the most effective prescription for managerial overconfidence can be the strong outsider monitoring by corporate governance mechanisms.

As far as the investment by overconfident managers is concerned, we hypothesize that managerial overconfidence can consistently increase the investment-cash flow sensitivity in constrained firms with weak corporate governance mechanisms. However, the relationship between overconfident managers' investment decision and the effective governance mechanism will be more complicated. The biased investment could be restrained when it is a recurrent problem and noticed by an effective governance mechanism. It also depends on the condition that the effective governance mechanism is capable of influencing managers' decision making. Under these conditions, we can argue managerial overconfidence cannot consistently increase the investment-cash flow sensitivity in firms with good corporate governance mechanism.

In order to identify firms as those with effective monitoring mechanisms or those with weak monitoring mechanisms, we focus on a number of related issues such as ownership concentration and board structure. A monitoring function can be explained by a classic principal-agent framework, in which the board or outside shareholders is regarded as the "principal" and management as the "agent". And the effectiveness of the monitoring role is related to their structure.

First, ownership concentration can exert a monitoring role in firms' management to align shareholder–manager conflicts. Grossman and Hart (1988) argue that the monitoring benefits are related to their shareholdings. In particular, non-management investors with substantial stakes should have more incentives to maximize their firms' value and are able to collect information and oversee management, while those with few stakes should have fewer incentives (Jensen and Meckling, 1976; Shleifer and Vishny, 1986 and 1997; Friend and Lang, 1988). However, Shleifer and Vishny (1997) argue that large investors may represent their own interest, which need not coincide with the interests of other investors in the firms, or with the interests of employees and managers. Woidtke (2002) also argues that non-management shareholders may focus on political or social issues other than firm performance. Thus, not all shareholders benefit from the monitoring by institutional investors. We include blockholders' ownership (BLOCK) as a measure of ownership concentration, which refers to the sum of shares of all shareholders (rather than manager) with a stake greater that 3 %. To estimate our hypothesis, we split firms into firms with high (low) blockholders' ownership when the value of BLOCK is higher (lower) than the median value. And we predict that the impact of managerial overconfidence on investment-cash flow sensitivity is kept significantly in financially constrained firms with low blockholders' ownership.

Second, boards can exert a monitoring role or an advisory role in influencing management as well (Mace, 1986; Adams and Ferreira, 2008). For example, board members can use their expertise to counsel management on their strategic directions. The effectiveness of the monitoring role of the board room is related to the board's degree of independence. And the degree of board independence is related to observable board characteristics such as size or composition (the proportion of outside directors on the board).

It is believed that larger boards are better for corporate performance because they have a range of expertise to help make better decisions, and are harder for a powerful CEO to dominate. As Peace and Zahra (1991) point out, large and powerful boards help to strengthen the linkage between corporate performance

and their external environments. A positive relationship could be expected between board size and the board's capacity for monitoring.

However, other papers have leaned towards smaller board. For instance, Jensen (1993) point out the 'great emphasis on politeness and courtesy at the expense of truth and frankness in boardrooms'. He states that boards having more than seven or eight people are unlikely to function effectively. Lipton and Lorsch (1992) argue that larger boards are more cumbersome than smaller boards. When boards become too big, agency problems (e.g. free-rider problem) increase within the board and the board becomes more symbolic and less a part of the management process. Yermack (1996), Eisenberg *et al.* (1998) and Mak and Yuanto (2005) support this view empirically. Yermack (1996) finds a significant negative relationship between Tobin's *q* and board size in a sample of large U. S. firms. Eisenberg *et al.* (1998) finds that board size and profitability are negatively correlated in a sample of small and mid-size Finnish firms. Using a sample of firms listed in Singapore and Malaysia, Mak and Yuanto (2003) find that a firm valuation is highest when the board has five directors, a number considered relatively small in those countries. Finally, Wu (2000) addresses a marketplace view of the importance of board size. She finds that average board size decreased over the period of 1991-1995. This might due to the pressure from CalPERS that market investors seems to think that small boards do better job of monitoring management than do large boards.

Therefore, the relationship between the effectiveness of boards' monitoring roles and board size would be an empirical issue. In this respect, we use the sum of the number of executives and non-executives to measure board size (BOARD). In particular, we split firms into two subgroups: firms with large-size boards and small-size boards. We assign firms to those with large-size (small-size) boards when those firms' board sizes are larger (smaller) than the median value. Given that large-size boards can not play an effectively monitoring role, we predict that the impact of managerial overconfidence on investment-cash flow sensitivity should remain significantly positive in financially constrained firms with large-size boards.

In addition to board size, the issue of controlling boards by independent directors has received considerable attention, especially after the corporate scandals afflicting the likes of Enron, Tyco, Adelphi and others (examples in Burns (2004), Luchetti and Lublin (2004), and Solomon (2004)). Independent directors are believed to curtail the agency problems. Especially in the UK, the importance of non-executive directors has been increasingly recommended (see Cadbury, 1992; Hampel Committee, 1998; Dahya and McConnell, 2005). It is widely acknowledged that non-executive directors are appointed to act in the shareholders' interests and have an incentive to build reputation as expert monitors (Fama and Jensen, 1983; Hart, 1995). The beneficial monitoring and advisory functions of outsider directors have been extensively supported by empirical studies (see e.g. Brickley and James, 1987; Weisbach, 1988; Byrd and Hickman 1992; Brickley *et al.*, 1994). However, non-executives are usually characterized by a lack of information about the firm. Agrawal and Knoeker (1996) suggest that boards expanded for political reasons often result in too many outsiders on the board, which does not help performance. They reason that non-executive directors tend to regard their roles as advisory rather than disciplinary. Moreover, Hermalin and Weisbach (1988) suggest that a board's independence depends on a bargaining game between the board and the management. That is the executive directors prefer a less independent board, while the boards prefer to keep their independence. When executive directors have demonstrated their good performance, the board's independence declines. Franks *et al.* (2003) find no evidence that non-executive directors do not perform a disciplinary function on firms' management in the UK. And there is no evidence that the faction of outside directors on board is correlated with firm performance and that firms with more independent directors achieve improved firm profitability (see Morck *et al.*, 1988; Hermalin and Weisbach, 2003; Mehran, 1995; Klein, 1998 and Bhagat and Black, 2000).

In our analysis, we use the ratio of total number of non-executives to total number of directors (RATIO) for this issue. We split firms into firms with high (low) ratio of nonexecutive directors in board when the value of RATIO is higher (lower) than the median value. If outside directors play the positive role in board's monitoring and control function, we predict that the impact of

managerial overconfidence on investment-cash flow sensitivity is consistently significant in financially constrained firms with low ratio of non-executive directors.

2.3 Data and Methodology

2.3.1 Data

We use a large sample of non-financial listed UK firms over the period 2002–2006. The initial data are available from the DataStream and Hemscott Guru Academic Database (Hemscott hereafter). The whole data set is constructed as follows.

First, the data for companies' accounting information were mainly collected from DataStream between 2002 and 2006. We use Datastream to collect information for the following variables: MTB, firm size, investment, leverage, dividend payouts, cash holding and cash flow. For firms' age, we mainly download from the Datastream. As a further check, we used the companies' website and London Stock Exchange Yearbook. We only chose those firms that had no missing data over the period 2002–2006.

Second, information on share dealings by all executive directors (2003–2006), ownership concentration (2004–2005) and board structure (2004–2005) are from Hemscott. This database provides detailed information about the share dealings of each director in the open market for each year, the level of each director, ownership concentration, and the number of executive directors and non-executive directors. The biggest problem we found is that all this information could only be downloaded from separate files. For example, in order to get information about the amount of share dealings by executive directors, two different files must be combined: (a) the file that contains the share dealings of each director; (b) the file that contains the names of each executive director in each company. In addition, we note that those firms without any share dealings

in one of the sample years will be missed from the downloaded files. We then have to add this missing information into the file and set the amount of share dealings by executive directors as zero in these firms. There will be similar compilations for us in collecting other information about ownership concentration and board structure.

Finally, to ensure that these outliers do not contaminate our results, we trim data within the range of 1–99%. After matching Datastream and Hemscott, we end up with a data set of 578 listed firms. In addition, we divide firms into 15 sectors with 15 dummy variables to control for sector effects (see Appendix A). Table 2.1 provides the definitions of the variables used in this chapter.

Table 2.2 provides the summary statistics of all our variables. We observe that the average investment (I) is 0.045. The average cash flow (CFLOW) is 0.052, which is lower than some studies. The reason for this is because the average levels of cash flow from 2002 to 2003 are much lower (about 0.026–0.041) than the other two years from 2004 to 2005 (about 0.074–0.076). Cash holding level (CASH) is 0.129, which is rather higher than that reported by Ozkan and Ozkan (2004), and may be due to the different sample period. Average leverage (LEV) is about 0.169, firm's size (SIZE 1) is around 11.352, dividend payout (DIV 1) is approximately 0.02 and average market-to-book value (MTB) is 1.864 which are all line with work on the UK by Ozkan and Ozkan (2004) , Florackis (2005) and Florackis and Ozkan (2007). As a further check, we also include SIZE 2 and DIV 2 to provide more results, which are 10.98 and 0.582 respectively. These two values are higher than the ones (9.16 and 0.43) reported by Antoniou *et al.* (2008). This might be due to their different time period, which they collect the data over the period 1987-2000.

As far as the board structure and ownership concentration are concerned, average board size (BOARD) in the UK is 7.179, and about 51.3% are non-executive directors (RATIO). All major shareholders (BLOCK) with at least 3% shares hold more than 37% of the remaining shares. This is in line with other UK works

by Florackis and Ozkan (2007) and Florackis (2005). Finally, we find in our sample, about 43.1% of firms are net buyers in the stock market in each year. Accordingly, our overconfidence variables (OVER 1 and OVER 2), which are based on the information of net buyer, are about 10.6% and 27.5%. Moreover, the alternative overconfident variable (OVER 3), which is based on the information of outside perception, is about 38.1%.

Table 2.3 presents the Pearson's correlation for the variables used in our regression. The results are generally in line with our expectations. Cash flow (CFLOW) and market-to-book ratio (MTB) as main determinants are both positively correlated with investment (I). Firms with larger size (SIZE 1 and SIZE 2) and higher leverage (LEV) and dividend payouts (DIV 1) tend to invest more. And it shows investment (I) is positively related to age (AGE) but not at a statistically significant level. However, it shows that age (AGE) is positively correlated with firm size, dividend and leverage, which implies that firm age could be used to identify financially constrained firms and unconstrained firms. It also shows that the relationship between cash holdings (CASH) and investment (I) is an negative one, which reveals that firms are more likely to retain cash and curtail investment.

Moreover, our three alternative managerial overconfidence measures (OVER 1, OVER 2 and OVER 3) are significantly and positively correlated with each other. It also indicates that firms with managerial overconfidence tend to invest more. However, such findings do not lead to concrete inferences for the potential interaction effect of managerial overconfidence and investment-cash flow sensitivity.

2.3.2 Methodology

2.3.2.1 Classification Scheme

As discussed in Section 2.2, size, leverage, dividend payouts, and age can be used to identify financially constrained and unconstrained firms. In addition, we also use cash holding as another alternative classification method. Cash holding

is believed to increase the capacity of firms' investment. Consistent with this argument, Almeida *et al.* (2004) contend that financially constrained firms are more probably exposed to costly external financing and have greater propensity to save cash out of cash flow. They find that firms with smaller size, lower dividend payouts and lower credit and bond rating tend to accumulate cash. Moreover, Arslan *et al.* (2006) argue that firms with cash holding lower than their optimal levels are those financially constrained firms that exhibit greater cash flow sensitivity of investment. Therefore, we argue that firms retaining lower cash tend to be financially constrained firms, while those with much higher cash holding tend to be financially unconstrained firms.

Apart from the above five criteria, KZ index has also been used to measure financial constraints. KZ index stems from a paper of Kaplan and Zingales (1997) use a mix of quantitative and qualitative information from disclosure filings to classify a firm's level of financial constraints. They found that investment-cash flow sensitivity does not monotonically increase with financial constraints level. Therefore investment-cash flow sensitivity is not a useful measure of financial constraints in their conclusion. In their KZ index, five explanatory variables are included, in which they believe that financial constraints is positively related to leverage and Q and negatively related to cash flow, cash levels and dividends. And the coefficients of these variables are used to construct the KZ index of financial constraints.

However, recent papers have questioned whether the KZ index is an appropriate measure of financial constraints. For example, Almeida *et al.* (2004) use four different firm-specific characteristics (e.g. size, dividend payout, common paper ratings and bond ratings) to identify financially constrained firms and find they are not closely related to the KZ index. Whited and Wu (2006) use an Euler equation approach to identify the relative importance of several firm and industry characteristics in determining a firm's level of financial constraints. They found their index of constraints has no correlation with the KZ index.

Moreover, Hadlock and Pierce (2008) recently revaluate the validity of the KZ index. They question the generality and the mechanism link of the KZ index. The generality means the generality of inferences derived from it. They argue that the coefficients of the five components of the KZ index are calculated based on a sample of 49 manufacturing firms from 1970s and early 1980s. These firms are large, grow rapidly, pay low dividends, and satisfy a survival requirement, which limit the generality. They also argue that there is a mechanical link between the five components of the index and constraints categories. For example, in the KZ index, it will not be surprise to find more-cash holding firms have been regarded as less constrained firms. Instead, they consider a more representative sample of 356 firms over 1995-2004 and entirely based on qualitative statement rather than a mix of qualitative and quantitative information in the KZ index. When they estimate ordered logit model of constraint status as a function of the five components of the KZ index, they find only leverage and cash flow are consistently significantly related to financial constraints. Thus, they conclude that the KZ index is not an appropriate measure of financial constraints.

Hence, we consider the five conventional firm-specific characteristics to be the criteria of identifying financially constrained and unconstrained firms:

SIZE: our sample is divided based on their average value of total assets over the period 2002–2005 and assigned to the financially constrained firms when those firms are in the bottom three deciles (smaller) of the size distribution. Meanwhile, we assign those firms which are in the top three deciles (larger) of the size distribution to the financially unconstrained firms.

LEVERAGE: our sample is divided based on their average value of leverage over the period 2002–2005 and assigned to the financially constrained firms when those firms are in the bottom three deciles (lower) of the leverage distribution, and vice versa.

DIVIDEND: our sample is divided based on their average value of dividend over the period 2002–2005 and assigned to the financially constrained firms when those firms are in the bottom three deciles (lower) of the whole dividend distribution, and vice versa.

AGE: our sample is divided based on their age and assigned to the financially constrained firms when those firms are in the bottom three deciles (younger) of the age distribution, and vice versa.
CASH: our sample is divided based on their average value of cash holding over the period 2002–2005 and assigned to the financially constrained firms when those firms are in the bottom three deciles (lower) of the cash holding distribution, and vice versa.

Furthermore, in order to classify firms into weak-governed firms and good-governed firms, we adopt a set of the above variables, such as board size (BOARD), non-executive ratio (RATIO) and blockholders' ownership (BLOCK), to identify them. In particular, we use the median values of them to split firms into two subgroups respectively. Median values of them are the benchmark in our classifications. We aim to find whether the impact of managerial overconfidence on financially constrained firms varies with board size, non-executive ratio or blockholders' ownership.

2.3.2.2 Overconfidence Measurement

We use the stock purchase decision to define our main overconfidence measurement (OVER 1). First, this is a net buyer approach, which is different from the managerial ownership approach. Although the level of managerial ownership has been suggested as a proxy for managerial confidence in some studies, we still question the validity of this measurement. The reason is that the level of ownership cannot fully reflect the active purchase decisions by directors. For example, new stock grants as a sort of compensation can also change the level of managerial ownership. And directors can offset any changes in the level of managerial ownership by new stock grants whenever they sell firms' shares. However, executive directors' stock purchase is in addition to the stock grants and options exercised during the year[9]. Such purchases cannot be motivated by tax consideration or by the concerns about underdiversification (Jin and Kothari,

[9] The share dealing information in Hemscott has already clarified whether the dealing is purely done in the open market or because of exercise option/stock grants.

2005). Also, stock purchase in an open market is costly for managers. This is because when directors purchase shares of their firms, they send positive signals about the future value of the firm to the market and the signals are costly for directors since it puts at risk their own wealth.

Second, in the UK, regulation of insider transactions is much stricter than in the US. Insiders are much more unlikely to take advantage of the undisclosed information (Fidrmuc *et al.*, 2005). For example, in the UK, stock holdings of 5% or more (3% or more from 1990) and increases in holdings of 1% or more above 5% in a listed company must be disclosed within five days (two days from 1990) of the holding being purchased (Short and Keasey, 1999). Therefore, inside managers can hardly benefit from stock purchasing. However, even with such kinds of consideration, overconfident managers may still think a firm's value perceived by the market is much lower than the value perceived by themselves. So, they have greater propensity to purchase stock as a net buyer.

Additionally, Odean (1998a, 1998b, 1999) suggests that behavioural bias such as investors' overconfidence can generate higher trading volume in the financial market. He notes that overconfident investors, at the individual level, trade more aggressively, which results in a lower profit. Accordingly, he finds that overconfident traders exhibit lower expected utility than rational traders and hold underdiversified portfolios.

Moreover, Longholder and Holder 67, which are based on CEOs' persistent holding of options after vesting, have been mainly used by Malmendier and Tate (2005). This approach may be reasonable if the cost of diversification is smaller than the cost of early exercise of options, but otherwise the practice cannot not be used to measure overconfidence (Jin and Kothari, 2005). Hence a net buyer approach can be a more reasonable proxy for overconfidence.

Finally, we consider whether there exist other alternative explanations of our net buyer approach. For example, the directors' share dealings may due to inside

information or signalling concern. When directors have positive inside information of their future stock prices, they are more likely to buy stocks. And, when the market has not such information and the firm's stock price is undervalued, investment may be sensitive to cash flow. In our analysis, we especially control this by emphasizing the persistence. As suggested in Malmendier and Tate (2005), positive information is viewed as a transitory rather than a fixed effect. It is unlikely that directors can repeatedly receive positive draw. Thus, our net buyer approach requires that the executive directors purchase additional shares for a specific length. Moreover, if directors would like to send a positive signal of their firms' prospect to the market, they would also be likely to purchase more shares. However, the signalling can decrease asymmetric information costs and eliminate the positive relationship between investment-cash flow sensitivity and the stock-based proxy for managerial overconfidence. And our hypothesis in turn dispels this alternative explanation.

All in all, our main overconfidence variable (OVER 1) is set up according to stock purchasing in the open market and is similar to that in Malmendier and Tate (2005). When his/her amount of shares purchased during the sample period is larger than the amount of shares sold, the manager will be classified as a net buyer or overconfidence. In this chapter, we accumulate all executive directors' annual stock purchase amount (positive value) and selling amount (negative value) during 2003–2006. Accordingly, firms will be regarded as those with managerial overconfidence when the net amount of stock dealing is positive for all these four years. This not only allows us to distinguish managerial overconfidence from other explanations (such as inside information or signalling motives) that would cause simultaneous failure, but also accounts for their persistently overconfident behaviour. We also use OVER 2 to check the robustness, which regards firms as those with managerial overconfidence when the net amount of stock dealings is positive for at least three years over 2003-2006.

To give more evidence, we also measure managerial confidence (OVER 3) using outsiders' perception of the executive directors captured by the press. A similar

approach can be found in Malmendier *et al.* (2007) and Hribar and Yang (2006). We collect data on the press coverage of our sample executive directors in all available business articles using Nexis UK. We count the total numbers of articles over 2003-2006 referring to the executive directors using the words "confident" or "confidence"; "optimistic" or "optimism"; and "reliable" , "cautious" , "practical" , "frugal" , "conservative" , or "steady." We also hand-check each article to ensure that the articles are used to describe the executive directors and to identify articles that use the terms in negated form. When the total number of articles describing executive directors as the optimistic or confident is higher than the total number of articles describing executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident, this firm will be classified as a firm with managerial overconfidence and OVER 3 equals 1, otherwise 0.

2.3.2.3 Empirical Specification

In our primary analysis, the investment model only includes cash flow and investment opportunities which are concerned with the effects of internal funds on investment (Fazzari *et al.*, 1988) where the market-to-book value ratio controls for the demand of the internal funds and cash flow controls for the supple side. The basic specification is as follow:

$$(1) I_i = \alpha_1 + \alpha_2 MTB_i + \alpha_3 CFLOW_i + \alpha_4 OVER_i + \alpha_5 CFLOW_i * OVER_i + \varepsilon_i$$

where I is the capital investment expenditure, CFLOW is cash flow, MTB is market-to-book value, OVER represents three kinds of managerial overconfidence variable and ε_i is the error term.

We also add more control variables (X_i) in our model to check the robustness of our estimation. X_i includes a vector of control variables such as size (SIZE 1 and SIZE 2), leverage (LEV), dividend payouts (DIV 1 and DIV 2) and age (AGE), cash holding (CASH). The specification is as follow:

(2) $I_i = \alpha_1 + \alpha_2 MTB_i + \alpha_3 CFLOW_i + \alpha_4 OVER_i + \alpha_5 CFLOW_i * OVER_i + A_6 X_i + \varepsilon_i$

In both specifications, we especially concern about the coefficient (α_5) of the interaction of CFLOW and OVER. According to our hypotheses, we expect to find that α_5 is positive in financially constrained firms, especially in firms with weak governance mechanisms.

2.4 Empirical Results

2.4.1 Univariate Analysis

We report univariate mean comparison of main independent variables by different investment quartiles in Table 2.4. The investment quartiles are based on data from 2006. Then, we use t-test to test whether the firms' characteristics (e.g. investment, market-to-book value, cash flow, cash holding, size, leverage and dividend) and managerial overconfidence in the first-quartile are significantly different from those in the fourth quartile.

In Table 2.4, the mean value of MTB is monotonically increasing with investment from the second to the fourth quartiles. This is consistent with the prediction that investment is positively related to growth opportunity. However, the MTB in first quartile is quite higher. We reason that it can be attributed to cash holding, in that firms with the lowest investment also hold the highest cash reserves, which mean that cash holding can facilitate more investment opportunities in the future, but curb the current investment.

Cash flow as a proxy for internal funds plays an important role in determining investment, which also increases with investment quartiles. As far as other firms' characteristics are concerned, dividend payouts and size consistently increase from the first to the fourth quartile, which means firms with lower dividend payouts and smaller size always have lower investment. Leverage and age increases with investment from the first to the third quartile, which also provides evidence that younger firms with lower leverage have lower investment. These variables in the first and fourth quartiles differ significantly at 1% level, except for DIV2 and MTB.

Finally, managerial overconfidence (OVER 1 and OVER 2) has a positive relationship with corporate investment and displays a clear difference between the first and fourth investment quartiles and t-test is significant at 1% level. This is robust in our press portrayal measurement (OVER 3). The results are in line with our correlation matrix, that managerial overconfidence is positively related with firms' investment expenditure.

2.4.2 Regression Results

2.4.2.1 The Role of Managerial Overconfidence

We examine the impact of managerial overconfidence on investment decisions by employing the average cross-sectional regression (CSA) approach. As suggested by Rajan and Zingales (1995), the dependent variable is based on time *t*, while other independent variables are based on averaged values from lagged time *t-1* to time *t-n*. Averaged value can mitigate annual adjustment of each firm or extreme values and lagged value can deal with endogeneity. To provide robust results, we estimate our hypothesis by using two average cross-sectional regressions over two different periods. For example, our dependent variable I (investment) is measured in years 2006 and 2005 respectively, while other independent variables including financial constraint proxies are average-past

values over 2002-2005 and 2003-2005. Similar methods have also been used in Marchica and Mura (2007).

We start with a baseline CSA regression (equation 1) on our whole sample to show the determinants of investment in Table 2.5. It includes investment opportunity (MTB), cash flow (CFLOW), and managerial overconfidence variable (OVER 1). We also include the interaction term of CFLOW and OVER 1 to test whether managerial overconfidence itself can influence corporate investment levels. In Table 2.5, the dependent variable is measured in year 2006, while other variable are measured by the average values over 2002-2005. We find the positive impacts of cash flow and investment opportunity on investment for all firms. In particular, the impact of cash flow on investment is significant at the 1% level, which suggests cash flow (CFLOW) as a proxy for internal funds is preferred by firms to invest and is an important determinant of investment. In addition, we find that managerial overconfidence (OVER 1) has positive impacts on investment. More importantly, the coefficient of OVER 1 *CFLOW is significantly positive. This implies that overconfident managers tend to increase their investment with internal funds.

We then compare the different impacts of managerial overconfidence on investment between financially constrained and unconstrained firms in Table 2.5. Using size, leverage, dividend, age and cash holding to identify financially constrained and unconstrained firms, we mainly concern whether managerial overconfidence can significantly increase the investment-cash flow sensitivity in financially constrained firms.

The most important result in Table 2.5 refers to the coefficient of the interaction term (OVER 1* CFLOW). For example, in leverage (LEV), age (AGE), cash (CASH) and dividend (DIV 2) groups, this coefficient consistently displays positive at 5-10% significance levels in financially constrained firms. In particular, the value of coefficient (OVER 1*CFLOW) is in a range from 0.155 to 0.230, which suggests that for each unit of additional cash flow, a constrained

firm with overconfident managers can increase around 0.185 units of investment. Whereas, in financially unconstrained firms, the impact of managerial overconfidence on investment-cash flow sensitivity is indeterminate. This implies that, in financially unconstrained firms, overconfident managers can invest at the first-best level in their perspective, which is independent of cash flow. The different impacts of managerial overconfidence on investment-cash flow sensitivity imply that overconfident managers tend to increase investment with cash flow when they are facing financial constraints. It also reveals the fact that overconfident managers prefer to use internal funds for investment in financially constrained firms.

As far as the impact of investment opportunity (MTB) is concerned, we find a positive relationship between MTB and investment in financially constrained firms identified by size, leverage, dividend and age. However, the results are only statistically significant in the leverage and size groups. This cannot provide supportive evidence that a positive role of growth opportunities in determining investment decisions especially in financially constrained firms. Similar results could also be found in Aslan *et al.* (2006), in which they discuss the corporate investment in Turkey.

Finally, Table 2.5 reveals that financially constrained firms, except in size groups, exhibit significantly a positive relationship between investment and cash flow, whereas the significant relationship cannot be found consistently in financially unconstrained firms. This is in line with previous studies (see e.g. Fazzari *et al.*, 1988; Hoshi *et al.*, 1991; Fazzari and Petersen, 1993; Himmelberg and Petersen, 1994) on investment that report that investment-cash flow sensitivity should be more pronounced in financially constrained firms. When firms are facing limited cash flow and costly external funds for their investment, their investment should be more sensitive to cash flow. Moreover, the F-tests are rejected in the size groups (SIZE 1 and SIZE 2), which indicates that size cannot serve as a good identification in our test.

To provide more evidence, we estimate the regression with more control variables (equation 2). Table 2.6 and Table 2.7 present the results of the average cross-sectional regressions, in which the dependent variable is measured in years 2006 and 2005 respectively. In these two tables, we find consistent results with our baseline regression. In financially constrained firms identified by leverage, dividend, age and cash holding, the investment-cash flow sensitivity is significantly positive. But the financially constrained firms in size groups identified by SIZE 1 and SIZE 2 do not display a positive relationship between cash flow and investment. And some F-tests are still rejected in size groups. Also, the adjusted R-squared value is very low in size groups, which implies that the data of financial constrained firms identified by size does not fit the model well in our sample. Moreover, we find that the coefficient of OVER 1*CFLOW is significantly positive in financially constrained firms identified by leverage, dividend, age and cash holding. These are consistent with the results of our baseline regression and support our hypothesis that managerial overconfidence can increase investment-cash flow sensitivity in financially constrained firms.

Moreover, as for other control variables, we find a positive relationship exists between cash holding and investment and it is statically significant in financially constrained firms identified by leverage, dividend and age in Table 2.6 and Table 2.7. This indicates that in financially constrained firms, more cash holdings can facilitate more investment in the future.

2.4.2.2 The Role of Corporate Governance Mechanism

A following question that emerges from our empirical analysis could be: given a firm run by managerial overconfidence and weak corporate governance mechanism, to what extent does managerial overconfidence affect their investment decisions?

We then use board size (BOARD), non-executive directors ratio (RATIO) and blockholders' ownership (BLOCK) respectively to classify firms as mentioned in

Section 2.2.3. We mainly expect to find that managerial overconfidence, especially in financially constrained firms, could persistently increase firms' cash flow sensitivity of investment when firms' monitoring mechanisms are weak(firms with large board size, low non-executive directors or low blockholders' ownership). When the biased investment decision is a recurrent problem, then the potential prescription for managerial overconfidence can be strong outsider monitoring by corporate governance mechanism. If this is the case, we predict that the impact of managerial overconfidence on investment may turn to be insignificant in these firms.

In Tables 2.8 and 2.9, we present the results of comparing firms with large-size boards with those with small-size boards over the different time periods. In particular, we only consider financially constrained firms in leverage, dividend, age and cash groups, in which the significant relationship between managerial overconfidence and investment-cash flow sensitivity has been found in our previous estimates. In these two tables, we find some evidence that the positive impact of managerial overconfidence in investment-cash flow sensitivity varies with the board size. That is in leverage, age and dividend groups, managerial overconfidence remains a positive and significant influence on investment-cash flow sensitivity for firms with large-size boards, while managerial overconfidence play an indeterminate role on investment-cash flow sensitivity for firms with small-size boards. This is consistent with some governance studies (see, Jensen, 1993; Lipton and Lorsch, 1992) that firms with large-size boards are more cumbersome. When boards become too big, they become less effective because the coordination and process problems overwhelm the advantages from more expertise to draw on.

We then follow another governance attribute: the ratio of non-executive directors in boards (RATIO). In Tables 2.10 and 2.11, we present the results of financially constrained firms with high or low ratio of non-executive directors according to the different time periods. We find that the positive impact of managerial overconfidence on investment-cash flow sensitivity is significant for constrained firms with low RATIO in leverage, dividend and age groups. It indicates that,

when non-executive directors have fewer incentives to oversee managers' behaviour, managerial overconfidence can increase investment with cash flow to their desired level. By contrast, we find that the positive relationship between managerial overconfidence and investment-cash flow sensitivity turns to be statistically insignificant in constrained firms with high RATIO. This supports the view that more non-executive directors in boards can act as professional referees to ensure that managers stimulates action align with shareholders' interests. They are useful in disciplining management and overconfident investment can be restrained when the biased investment by overconfident managers is a recurrent problem.

Finally, we use blockholders' ownership (BLOCK) to provide more evidence. In Tables 2.12 and 2.13, we present the results of financially constrained firms with high or low blockholders' ownership using different time periods. We find that the positive impact of managerial overconfidence is kept to be significant for constrained firms with low blockholders' ownership (BLOCK) in leverage, dividend, age and cash groups. It reveals that, when non-management shareholders' ownership is low, they cannot monitor management effectively and the impact of managerial overconfidence on investment-cash flow sensitivity remains significant. By contrast, managerial overconfidence can no longer consistently affect investment-cash flow sensitivity in constrained firms with high blockholders' ownership. This provides supportive evidence that the impact of managerial overconfidence might be restrained when non-management shareholders with large ownership can monitor management successfully and exercise influence over managers of the firms they invest in.

2.4.3 Robustness Checks

For the robustness purpose, we adopt two alternatives measures of managerial overconfidence (OVER 2) and (OVER 3) in our estimations. OVER 2 is based on managers' share dealing information and OVER 3 is based on press portrayal. When firms have been identified as net buyers for at least three years (2003–

2006) rather than all years in our previous analysis, OVER 2 in our regression will be assigned as a value of 1, otherwise a value of 0. OVER 3 is also a dummy variable. It equals 1 when the number of articles describing executive directors as optimistic or confident is larger than the number of articles describing executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise.

2.4.3.1 The Role of Managerial Overconfidence

Tables 2.14 and 2.15 present the results for our estimation of the different roles of managerial overconfidence (OVER 2) in financially constrained and unconstrained firms using the different time periods. And Tables 2.16 and 2.17 present the results for our estimation of the different roles of managerial overconfidence (OVER 3) in financially constrained and unconstrained firms according to the different time periods. Since, size group (SIZE 1 and SIZE 2) do not provide any supportive evidence in our main estimation, we only do the robustness checks for other five groups. Consistent with our previous results in Tables 2.5, 2.6 and 2.7, we find that financially constrained firms display a positive relationship between managerial overconfidence and investment-cash flow sensitivity. The coefficient of OVER 2*CFLOW or OVER 3 * CFLOW is statistically significant at 5-10% level. Moreover, in all groups, financially constrained firms exhibit positive investment-cash flow sensitivity. The coefficient of CFLOW is statistically significant at the 1–5% level. In contrast, we cannot find any positive relationship between managerial overconfidence and investment-cash flow sensitivity in financially unconstrained firms. In summary, these results are consistent with our prediction that investment by overconfident managers is more sensitive to cash flow in financially constrained firms.

2.4.3.2 The Role of Corporate Governance Mechanism

We then investigate the monitoring role of corporate governance mechanism in investment by overconfident managers. Accordingly, Tables 2.18-2.23 present

the results using OVER 2 as a proxy for managerial overconfidence. And Tables 2.24-2.29 provide evidence using OVER 3 as a proxy for managerial overconfidence.

As for board size (Tables 2.18, 2.19, 2.24 and 2.25), we do not find any supportive results that managerial overconfidence can persistently increase investment-cash flow sensitivity in firms with large-size boards. Instead, our results reveal that managerial overconfidence can persistently increase investment-cash flow sensitivity in firms with small-size boards, which is contrary to our previous results. Furthermore, due to our classification, the subsample size decreases a lot resulting in some poor F-tests in our estimation.

As for the ratio of non-executive directors (Tables 2.20, 2.21, 2.26 and 2.27) we find consistent evidence that managerial overconfidence consistently increase investment with internal funds in constrained firms with low non-executive directors' ratio. And according to the valid F-test, we find the results are robust in leverage, cash and dividend (DIV2) groups.

Finally, as for the blockholders' ownership (Tables 2.22, 2.23, 2.28 and 2.29), we find a positive relationship between managerial overconfidence and cash flow sensitivity of investment is held in constrained firms with lower blockholders' ownership. And it is statistically significant in cash, dividend (DIV2) and age groups.

In sum, the robustness results support our prediction that the impact of managerial overconfidence on investment-cash flow sensitivity should be greater in financially constrained firms. Meanwhile, the results reveal that for constrained firms with low ratio of non-executive directors or with low blockholders' ownership, the effect of managerial overconfidence on investment-cash flow sensitivity is held. While, the effect of managerial overconfidence on investment-cash flow sensitivity is not held in constrained firms with high ratio

of non-executive directors or with high blockholders' ownership. However, we do not find consistent results for firms with various board sizes.

2.5 Conclusion

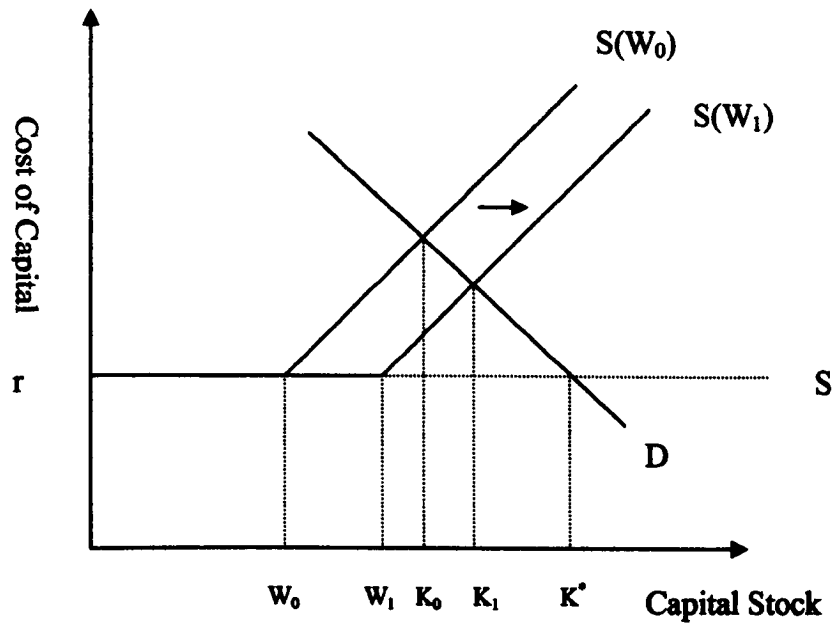
This chapter examines the impact of managerial overconfidence on investment decisions in a sample of UK firms. There are two important features of our analysis. First, we focus on the importance of financial constraints in determining the linkage between managerial overconfidence and investment-cash flow sensitivity. In particular, we use size, leverage, dividend, age and cash holding to identify firms as financially constrained and unconstrained firms. Second, we have attempted to test whether corporate governance mechanisms working as the monitoring management can check overconfident managers' investment. To do so, we use a set of governance variables, such as board size, non-executive directors' ratio and blockholders' ownership, to split firms into two subgroups.

Consistent with our predictions, our results indicate that managerial overconfidence can increase investment-cash flow sensitivity in financially constrained firms identified by leverage, dividend, age and cash. But we do not find any supportive results in size classification. Overconfident managers tend to overestimate the outcomes of their investment and tend to invest more. In financially constrained firms, overconfident managers are more sensitive to cash flow to pursue their desired investment level. By contrast, managerial overconfidence is independent of investment-cash flow sensitivity in financially unconstrained firms. That is because overconfident managers in financial unconstrained firms can much easier to access various sources of capital to pursue their desired investment. Both results are consistent in our robustness checks using two other alternative measures of managerial overconfidence.

In addition, our results provide evidence that the impact of managerial overconfidence on investment varies in corporate governance regime. In particular, we argue that firms with large (small) board size, low (high) ratio of

non-executive directors in boards or low (high) blockholders' ownership tend to have weak (good) corporate governance mechanism. And the weak corporate governance mechanism cannot affect the impact of managerial overconfidence on constrained firms in that the positive relationship between managerial overconfidence and investment-cash flow sensitivity is still held in those firms. Our results show that the positive relationship between managerial overconfidence and investment-cash flow sensitivity is kept to be significant in constrained firms with low ratio of non-executive directors in boards or with low blockholders' ownership. This implies that lower proportions of non-executive directors or investors with lower ownership cannot provide effective monitoring, nor influence the biased investment decisions by overconfident managers. In contrast, we find the positive relationship managerial overconfidence and investment-cash flow sensitivity in financially constrained firms changes to be insignificant in the presence of good corporate governance mechanism. However, we do not find any consistent results that the impact of managerial overconfidence on investment-cash flow sensitivity varies with the board size.

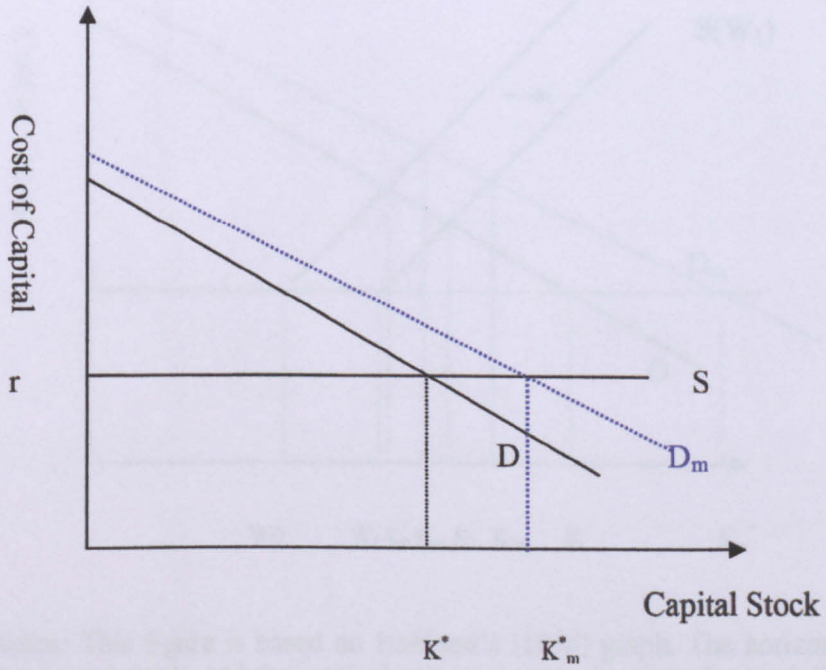
Figure 2.1: Investment Decisions with Capital Market Perfection or Imperfection.



Notes: This figure is reproduced from Hubbard's (1998) graph. The horizontal axis represents the capital stock, and the vertical axis represents the cost of capital. D is the demand for capital by firms and r represents the real interest rate in the market. The horizontal S is the supply curve in a perfect capital market. Given a growth opportunity, D and S intersect at the capital stock of K^*. K^* is the first-best capital stock in a perfect capital market.

$S(W_0)$ is the supply curve with two components in an imperfect capital market: the horizontal one which is at r up to the level of net worth (W_0) and the up-sloping line. The slope of it is determined by growth opportunity. K_0 is the equilibrium capital stock in an imperfect capital market, which is lower than K^*. Given a constant growth opportunity, an increase in net worth from W_0 to W_1, can shift the supply curve from $S(W_0)$ to $S(W_1)$. K_1 is the new equilibrium level of capital stock, which is higher than K_0 but is lower than the first-best K^*.

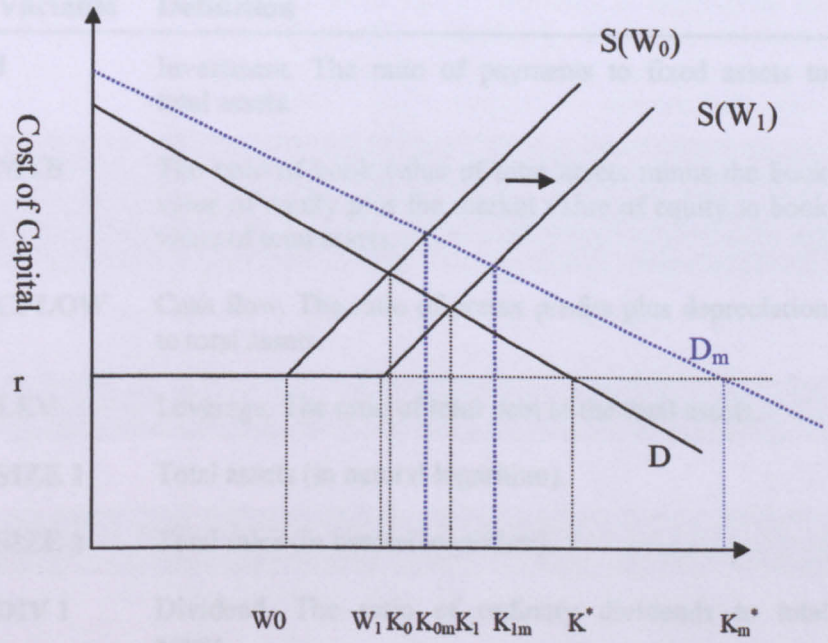
Figure 2.2: Managerial Investment Decisions: Financially Unconstrained Firms.



Notes: This figure is based on Hubbard's (1998) graph. The horizontal axis represents the capital stock, and the vertical axis represents the cost of capital. D is the demand for capital by firms and r represents the real interest rate in the market. The horizontal S is the supply curve in a perfect capital market. Given a growth opportunity, D and S intersect at the capital stock of K^*. K^* is the first-best capital stock for financially unconstrained firms with non-overconfident managers.

The key point here is that we consider investment decisions by overconfident managers. Given that overconfident managers tend to overestimate the future return of investment, they perceive the growth opportunity to be higher than that perceived by non-overconfident managers. Hence, the slope of their demand curve (D_m) is flatter than D. K^*_m is the equilibrium capital stock of financially unconstrained firms with overconfident managers.

Figure 2.3: Managerial Investment Decisions: Financially Constrained Firms.



Notes: This figure is based on Hubbard's (1998) graph. The horizontal axis represents the capital stock, and the vertical axis represents the cost of capital. D is the demand for capital by firms and r represents the real interest rate in the market. The horizontal S is the supply curve in a perfect capital market. Given a growth opportunity, D and S intersect at the capital stock of K^*. K^* is the first-best capital stock for financially unconstrained firms with non-overconfident managers.

$S(W_0)$ is the supply curve with two components for financially constrained firms: the horizontal one which is at r up to the level of net worth (W_0) and the up-sloping line. The slope of it is determined by growth opportunity. K_0 is the equilibrium capital stock, which is lower than K^*. Given a constant growth opportunity, an increase in net worth from W_0 to W_1, can shift the supply curve from $S(W_0)$ to $S(W_1)$. K_1 is the new equilibrium level of capital stock for financially unconstrained firms with non-overconfident managers, which is higher than K_0 but is lower than the first-best K^*.

We consider investment decisions by overconfident managers. Given that overconfident managers tend to overestimate the future return of investment, they perceive the growth opportunity to be higher than that perceived by non-overconfident managers. Hence, the slope of their demand curve (D_m) is flatter than D. K^*_m is the equilibrium capital stock of financially unconstrained firms with overconfident managers. Given a constant growth opportunity, an increase in net worth from W_0 to W_1, can shift the supply curve from $S(W_{0m})$ to $S(W_{1m})$. K_{1m} is the new equilibrium level of capital stock for financially unconstrained firms with non-overconfident managers, which is higher than K_{0m} but is lower than the first-best K^*_m. More importantly, the changing amount from K_{0m} to K_{1m} is greater than the distance K_0 to K_1.

Table 2.1: Variables, Definitions and Sources.

Variable	Definition	Sources
I	Investment. The ratio of payments to fixed assets to total assets.	Datastream
MTB	The ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of total assets.	Datastream
CFLOW	Cash flow. The ratio of pretax profits plus depreciation to total assets.	Datastream
LEV	Leverage. The ratio of total debt to the total assets.	Datastream
SIZE 1	Total assets (in natural logarithm).	Datastream
SIZE 2	Total sales (in natural logarithm).	Datastream
DIV 1	Dividend. The ratio of ordinary dividends to total assets.	Datastream
DIV 2	Dividend. The ratio of ordinary dividends to earnings before dividend.	Datastream
CASH	Cash holding. Total ratio of total cash and equivalents to total assets.	Datastream
AGE	The number of years that a firm has been incorporated in 2006 plus one in natural logarithm.	Datastream & Internet
BOARD	Board size. The total number of directors in the boardroom.	Hemscott
RATIO	The ratio of total number of non-executive directors to total number of all directors.	Hemscott
BLOCK	Blockholders' ownership. The total percentage of shareholding by shareholders (other than managers) with ownership greater than 3%.	Hemscott
NET BUYER	Net buyer. A dummy variable, which takes the value of 1 if the net amount of share dealings by all executive directors is positive and 0 otherwise.	Hemscott
OVER 1	A dummy variable, which takes the value of 1 if a firm has been identified as net buyer for all years over 2003–2006 and 0 otherwise.	Hemscott
OVER 2	A dummy variable, which takes the value of 1 if a firm has been identified as net buyer for at least 3 years over 2003–2006 and 0 otherwise.	Hemscott

OVER 3	A dummy variable, which takes the value of 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise.	NexisUK

Notes: Datastream database provides accounting and market data. Hemscott Guru Academic database provides financial data for the UK's top 300,000 companies and detailed data on all directors of UK listed companies. Nexis UK is a single most powerful global news and business information service.

Table 2.2: Descriptive Statistics. (N=578)

Variables	Mean	S.D.	25%	Median	75%
I	0.045	0.051	0.013	0.030	0.060
MTB	1.864	1.858	1.062	1.400	2.013
CFLOW	0.052	0.185	0.019	0.087	0.150
SIZE 1	11.352	2.217	9.737	11.197	12.756
SIZE 2	10.980	3.040	9.459	11.227	12.970
LEV	0.169	0.164	0.015	0.138	0.268
DIV 1	0.020	0.026	0.000	0.015	0.029
DIV 2	0.582	10.511	0.000	0.167	0.472
AGE	3.199	0.912	2.398	3.091	3.989
CASH	0.129	0.161	0.024	0.071	0.170
BOARD	7.179	2.551	5	7	9
BLOCK	37.372	22.197	21.283	35.845	51.210
RATIO	0.513	0.158	0.4	0.5	0.615
OVER 1	0.106	0.308	0	0	0
OVER 2	0.275	0.447	0	0	1
OVER 3	0.381	0.486	0	0	1

Notes: This table provides descriptive statistics for the main variables used in our analysis. Investment is measured in 2003-2006, OVER 1 and OVER 2 and OVER 3 is measured over 2003–2006 and internal corporate governance variables are measured over 2004–2005. All other variables are measured over 2002–2005. Definitions of all variables are provided in Table 2.1.

Table 2.3: Correlated Matrix (N=578)

	I	MTB	CFLOW	SIZE 1	SIZE 2	LEV	DIV 1	DIV 2	AGE	CASH	OVER1	OVER2	OVER3
I	1												
MTB	0.002	1											
CFLOW	0.242***	-0.155***	1										
SIZE 1	0.131***	-0.190***	0.387***	1									
SIZE 2	0.114***	-0.274***	0.512***	0.846***	1								
LEV	0.099***	-0.147***	0.140***	0.397***	0.358***	1							
DIV 1	0.082***	0.146***	0.542***	0.281***	0.332***	-0.004	1						
DIV 2	0.017***	0.080***	0.066**	0.075**	0.087***	0.028	0.107***	1					
AGE	0.040	-0.253***	0.280***	0.277***	0.329***	0.160***	0.255***	0.051*	1				
CASH	-0.073**	0.386***	-0.377***	-0.407***	-0.396***	-0.437***	-0.136***	-0.079***	-0.289***	1			
OVER 1	0.095***	0.010	-0.007	0.062**	0.045	-0.013	0.057*	-0.003	0.001	0.014	1		
OVER 2	0.133***	-0.062**	-0.042	0.142***	0.092***	0.016	0.032	0.017	-0.034	0.015	0.558***	1	
OVER 3	0.067**	0.099***	0.119***	0.139***	0.105***	-0.015	0.026***	0.017	-0.012	-0.106***	0.102***	0.108***	1

Notes: This table presents the Pearson's Correlation matrix for the main variables used in our analysis. Definitions of all the variables are provided in Table 2.1. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 2.4: Firm Characteristics by Investment Quartiles.

Investment quartiles	First quartile	Second quartile	Third quartile	Fourth quartile	*t*-test
MTB	1.911	1.666	1.802	1.821	
	(1.572)	(1.077)	(1.237)	(1.072)	0.81
CFLOW	-0.025	0.033	0.078	0.116	
	(0.195)	(0.151)	(0.125)	(0.131)	-10.18***
SIZE1	10.422	11.141	11.911	11.881	
	(1.952)	(2.259)	(2.102)	(2.141)	-8.56***
SIZE2	9.373	10.978	11.949	11.621	
	(3.498)	(2.598)	(2.346)	(2.582)	-8.79***
LEV	0.134	0.172	0.194	0.184	
	(0.164)	(0.152)	(0.141)	(0.153)	-3.74***
DIV1	0.014	0.018	0.023	0.024	
	(0.021)	(0.020)	(0.023)	(0.025)	-5.34***
DIV2	0.295	0.303	0.325	0.314	
	(2.534)	(1.151)	(1.375)	(1.805)	-0.11
AGE	2.937	3.191	3.475	3.216	
	(0.794)	(0.902)	(0.957)	(0.905)	-3.94***
CASH	0.164	0.149	0.096	0.107	
	(0.177)	(0.157)	(0.121)	(0.105)	4.70***
OVER 1	0.083	0.093	0.107	0.138	
	(0.276)	(0.292)	(0.310)	(0.346)	-2.13**
OVER 2	0.228	0.239	0.284	0.349	
	(0.421)	(0.427)	(0.452)	(0.478)	-2.94***
OVER 3	0.339	0.339	0.422	0.422	
	(0.474)	(0.474)	(0.495)	(0.495)	-2.06**

Notes: This table provides univariate mean comparisons of firm-specific characteristics by investment quartiles. It also provides standard deviation comparison in parentheses. The t-statistics is for the difference of means between the first (lowest investment) and the fourth quartiles (highest investment). ***and ** indicate coefficient is significant at 1% and 5%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.5: CSA Baseline Regressions (2006): Cash Flow Sensitivity of Investment and Managerial Overconfidence (OVER 1).

Dependent variables		Independent variables								
Investment		MTB	CFLOW	OVER1	OVER1*CFLOW	Constant	Obs.	F	R^2	Adj.R^2
Predicted		+	+ in constrained	+/–	+ in constrained					
All Firms		0.002 (0.98)	0.051 (2.65)***	0.009 (1.39)	0.115 (2.19)**	0.037 (9.74)***	578	4.53***	0.17	0.15
SIZE 1	Constrained	0.001 (1.75)*	0.007 (0.27)	0.004 (0.27)	0.057 (0.87)	0.031 (5.52)***	173	1.16	0.23	0.15
	Unconstrained	–0.010 (1.89)*	0.249 (4.44)**	0.016 (0.75)	0.062 (0.36)	0.038 (5.35)***	173	5.48***	0.34	0.27
LEV	Constrained	0.003 (1.92)*	0.051 (3.75)**	0.035 (2.63)***	0.175 (2.72)***	0.024 (5.26)***	173	7.37***	0.38	0.32
	Unconstrained	0.005 (0.48)	0.047 (0.55)	–0.032 (1.48)	0.360 (1.44)	0.043 (4.68)***	173	2.14*	0.23	0.15
DIV 1	Constrained	0.002 (0.79)	0.052 (2.50)**	0.031 (1.31)	0.204 (1.39)	0.037 (5.67)***	173	2.18*	0.22	0.13
	Unconstrained	–0.010 (2.65)***	0.238 (4.89)***	–0.002 (0.08)	0.136 (0.89)	0.031 (4.72)***	173	7.20***	0.31	0.24
AGE	Constrained	0.001 (0.36)	0.048 (1.96)*	0.027 (2.02)**	0.155 (2.06)**	0.038 (5.63)***	169	2.88**	0.23	0.14
	Unconstrained	0.004 (0.76)	–0.036 (0.31)	–0.019 (1.72)*	0.300 (1.51)	0.047 (4.54)***	176	2.06*	0.22	0.14
CASH	Constrained	–0.0001 (0.02)	0.120 (3.22)***	–0.010 (0.67)	0.230 (1.70)*	0.039 (5.59)***	173	4.61***	0.22	0.14
	Unconstrained	0.001 (0.28)	0.044 (2.25)**	0.011 (0.87)	0.073 (1.31)	0.037 (5.93)***	173	2.26*	0.23	0.14

SIZE 2	Constrained	0.0001 (0.02)	0.007 (0.26)	0.015 (0.78)	0.098 (1.23)	0.036 (5.23)***	173	1.61	0.22	0.14
	Unconstrained	−0.009 (1.62)	0.232 (4.32)***	0.019 (0.85)	0.100 (0.58)	0.035 (5.63)***	173	6.56***	0.36	0.29
DIV 2	Constrained	0.003 (1.36)	0.056 (3. 12)***	0.025 (1.76)*	0.182 (1.75)*	0.034 (6.47)***	236	3.76***	0.20	0.14
	Unconstrained	−0.015 (3.97)***	0.214 (3.87)***	−0.029 (1.35)	0. 264 (1.83)*	0.044 (7.39)***	173	5.74***	0.30	0.23

Notes: This table shows the impact of managerial overconfidence on investment-cash flow sensitivity. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER 1 equals 1 when firms have been identified as net buyers for four years over 2003–2006, otherwise equals 0. Firms are identified as constrained and unconstrained firms by using their size, leverage, dividend, age and cash holding as explained in Section 2.3.2.1. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.6: CSA Regressions(2006): Cash Flow Sensitivity of Investment and Managerial Overconfidence(OVER 1).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 1	OVER1* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
		+	+ in constrained	+	+/–	+/–	+	+/–	+/–	+ in constrained					
All Firms		0.002 (0. 90)	0.071 (2.90)***	0.0002 (0.21)	0.031 (1.67)*	–0.177 (1.87)*	0.001 (0.29)	0.034 (1.77)*	0.010 (1.46)	0.115 (2.39)**	0.031 (2.44)**	578	2.62**	0.18	0.15
SIZE1	Constrained	0.0001 (0.06)	0.004 (0.14)	–0.006 (0.78)	0.055 (1.01)	0.183 (0.81)	0.005 (0.61)	0.032 (0.99)	0.009 (0.53)	0.069 (1.01)	0.059 (0.94)	173	1.19	0.11	0.01
	Unconstrained	–0.005 (1.23)	0.292 (4.42)***	–0.001 (0.32)	0.032 (1.09)	0.582 (2.36)**	0.002 (0.46)	0.090 (1.17)	0.013 (0.52)	0.093 (0.51)	0.030 (0.80)	173	2.87***	0.40	0.31
LEV	Constrained	0.003 (1.20)	0.058 (3.28)*	–0.002 (0.25)	0.105 (0.60)	0.040 (0.33)	–0.004 (0.91)	0.018 (2.51)**	0.034 (2.71)***	0.178 (2.55)**	0.035 (1.62)	173	4.02***	0.39	0.30
	Unconstrained	0.004 (0.62)	0.125 (1.61)	–0.002 (0.89)	–0.008 (0.25)	–0.816 (2.75)***	–0.002 (0.41)	0.032 (1.49)	–0.032 (0.93)	0.420 (1.90)	0.081 (2.75)***	173	2.12**	0.30	0.20
DIV1	Constrained	0.0001 (0.04)	0.063 (3.11)***	0.001 (0.45)	0.072 (1.67)*	–1.429 (0.28)	–0.006 (0.98)	0.077 (2.50)**	0.030 (1.38)	0.225 (1.66)*	0.015 (0.36)	173	2.15**	0.27	0.16
	Unconstrained	–0.007 (1.57)	0.251 (4.91)***	0.0001 (0.05)	–0.001 (0.04)	–0.287 (1.67)*	–0.003 (0.84)	–0.020 (0.55)	0.0003 (0.01)	0.127 (0.82)	0.047 (1.99)**	173	3.56**	0.33	0.23
AGE	Constrained	0.001 (0.20)	0.066 (2.73)***	0.002 (0.54)	0.077 (1.40)	–0.366 (1.46)	0.001 (0.08)	0.068 (2.06)*	0.026 (1.90)*	0.183 (2.37)**	–0.001 (0.05)	169	3.52***	0.29	0.18
	Unconstrained	0.009 (1.90)*	0.001 (1.60)	0.001 (2.58)***	0.043 (1.14)	–0.288 (0.86)	0.007 (0.62)	0.022 (0.49)	–0.019 (1.06)	0.294 (1.53)	0.021 (0.47)	176	2.09**	0.25	0.14
CASH	Constrained	0.002 (0.32)	0.145 (2.90)***	0.001 (0.51)	0.008 (0.30)	–0.232 (1.07)	–0.001 (0.31)	–0.454 (1.39)	–0.008 (0.48)	0.237 (1.76)*	0.038 (1.53)	173	2.60***	0.24	0.13
	Unconstrained	–0.0005 (0.18)	0.047 (1.80)*	0.002 (0.52)	0.062 (1.09)	0.022 (0.12)	–0.004 (0.93)	0.048 (1.91)*	0.010 (0.78)	0.079 (1.37)	0.012 (0.33)	173	1.89*	0.26	0.15

SIZE2	Constrained	−0.0002 (0.06)	0.004 (0.19)	0.001 (0.38)	0.049 (0.99)	−0.002 (1.13)	0.0006 (1.13)	0.035 (1.06)	0.021 (1.17)	0.132 (0.65)	0.012 (0.57)	173	1.20	0.14	0.02
	Unconstrained	−0.012 (1.73)*	0.261 (4.28)***	0.001 (0.70)	0.037 (1.18)	−0.002 (0.88)	0.076 (0.90)	0.076 (0.90)	0.022 (0.91)	0.090 (0.51)	0.055 (1.38)	173	3.30***	0.38	0.29
DIV2	Constrained	0.001 (0.42)	0.069 (3.42)***	0.0002 (0.08)	0.086 (2.26)**	−0.001 (0.85)	−0.006 (1.48)	0.077 (2.66)***	0.024 (2.66)***	0.192 (1.81)*	0.028 (1.50)	236	3.64***	0.27	0.20
	Unconstrained	−0.015 (4.08)***	0.203 (3.73)***	−0.001 (0.73)	−0.025 (1.18)	−0.001 (1.26)	−0.001 (0.22)	−0.043 (1.41)	−0.029 (1.34)	0.267 (1.06)	0.070 (2.52)**	173	3.22**	0.32	0.22

Notes: This table shows the impact of managerial overconfidence on investment-cash flow sensitivity. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER 1 equals 1 when firms have been identified as net buyers for four years over 2003–2006, otherwise equals 0. In the first five groups, SIZE 1 and DIV 1 are included, while in the last two groups, SIZE 2 and DIV 2 are included. Firms are identified as constrained and unconstrained firms by using their size, leverage, dividend, age and cash holding as explained in Section 2.3.2.1. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.7: CSA Regressions(2005): Cash Flow Sensitivity of Investment and Managerial Overconfidence(OVER 1).

Dependent variable		Independent variables												
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 1	OVER1* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
All Firms		0.001 (0.63)	0.092 (5.53)***	0.0002 (0.16)	0.020 (1.79)*	−0.266 (2.18)**	−0.001 (0.31)	0.038 (1.53)	0.013 (1.86)*	0.104 (2.20)**	0.036 (2.63)***	578	4.90***	0.18	0.14
SIZE1	Constrained	−0.002 (1.07)	0.040 (1.75)*	0.003 (0.60)	−0.038 (1.40)	0.338 (1.50)	0.005 (0.93)	0.038 (0.57)	0.009 (0.74)	0.067 (1.35)	−0.003 (0.06)	173	1.98*	0.16	0.12
	Unconstrained	−0.0004 (0.06)	0.247 (3.42)***	−0.001 (0.38)	0.051 (1.56)	−0.602 (2.01)**	0.002 (0.34)	0.080 (1.10)	0.018 (0.84)	0.066 (0.40)	0.024 (0.68)	173	1.93*	0.35	0.35
LEV	Constrained	0.001 (0.42)	0.083 (3.24)***	0.0004 (0.12)	−0.099 (0.45)	−0.222 (1.30)	−0.008 (1.34)	0.036 (1.97)*	0.021 (1.48)	0.142 (2.35)**	0.054 (1.67)*	173	3.23***	0.23	0.10
	Unconstrained	0.004 (0.69)	0.162 (1.62)	−0.0001 (0.04)	−0.003 (0.09)	−0.826 (2.50)**	−0.002 (0.52)	0.097 (1.27)	−0.018 (0.84)	0.381 (1.56)	0.064 (1.89)*	173	2.22**	0.28	0.17
DIV1	Constrained	0.0003 (0.11)	0.067 (2.39)**	0.002 (0.47)	−0.008 (0.27)	−1.275 (0.18)	−0.004 (0.60)	0.048 (1.70)*	0.036 (1.31)	0.246 (1.64)	0.030 (0.70)	173	1.71*	0.23	0.11
	Unconstrained	0.002 (4.10)***	0.213 (1.10)	0.001 (0.58)	−0.011 (0.59)	−0.371 (1.85)*	−0.003 (0.92)	0.021 (0.33)	0.024 (1.21)	−0.056 (0.50)	0.040 (1.70)*	173	2.80***	0.24	0.13
AGE	Constrained	0.004 (1.30)	0.059 (2.89)***	0.004 (1.66)	−0.030 (0.91)	−0.416 (1.64)	−0.021 (0.85)	−0.001 (0.05)	0.021 (1.48)	0.155 (2.22)**	0.048 (0.95)	169	3.18***	0.25	0.14
	Unconstrained	0.0003 (0.05)	0.131 (1.06)	−0.001 (0.63)	0.056 (1.53)	−0.393 (2.74)***	−0.007 (0.71)	0.058 (0.47)	0.007 (1.75)*	0.159 (0.99)	0.072 (1.45)	176	2.23**	0.26	0.15
CASH	Constrained	−0.002 (0.39)	0.123 (2.75)***	0.0001 (0.04)	0.029 (1.11)	0.024 (0.10)	−0.004 (0.95)	0.063 (1.77)*	−0.0002 (0.02)	0.207 (1.74)*	0.058 (2.11)**	173	3.19***	0.25	0.14
	Unconstrained	−0.002 (0.74)	0.070 (3.04)***	0.005 (1.46)	−0.037 (1.24)	−0.114 (0.62)	−0.005 (0.94)	0.042 (1.10)	0.003 (0.24)	0.059 (1.32)	0.007 (0.21)	173	2.31**	0.25	0.14

SIZE2	Constrained	−0.001 (0.52)	0.018 (0.85)	0.006 (2.02)**	−0.007 (0.24)	0.004 (1.87)**	−0.005 (0.80)	0.042 (1.20)	0.033 (1.61)	0.179 (1.23)	0.003 (0.10)	173	1.70*	0.18	0.07
	Unconstrained	−0.005 (0.63)	0.199 (3.21)***	−0.002 (0.93)	0.047 (1.29)	0.001 (0.52)	−0.003 (0.67)	0.054 (0.76)	0.026 (1.34)	0.068 (0.45)	0.061 (1.66)*	173	2.80***	0.33	0.24
DIV2	Constrained	0.0001 (0.25)	0.062 (2.45)**	0.002 (0.81)	0.022 (0.81)	0.0004 (0.17)	−0.005 (0.97)	0.052 (1.42)	0.034 (2.22)*	0.227 (2.29)**	0.029 (1.32)	236	2.68***	0.22	0.14
	Unconstrained	−0.008 (2.22)**	0.203 (1.44)	−0.0004 (0.32)	−0.017 (0.77)	−0.001 (1.86)**	0.0003 (0.09)	−0.076 (3.05)***	0.009 (0.48)	0.013 (0.13)	0.013 (0.23)	173	3.31***	0.30	0.20

Notes: This table shows the impact of managerial overconfidence on investment-cash flow sensitivity. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER 1 equals 1 when firms have been identified as net buyers for all years over 2003–2006, otherwise equals 0. In the first five groups, SIZE 1 and DIV 1 are included, while in the last two groups, SIZE 2 and DIV 2 are included. Firms are identified as constrained and unconstrained firms by using their size, leverage, dividend, age and cash holding as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.8: CSA Regressions (2006): The Roles of Corporate Governance Mechanism (Board Size).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 1	OVER1* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
Predicted		+	+	+	+/−	+/−	+	+/−	+/−	+ in small-size					
LEV	Small-size	0.003 (0.95)	0.043 (1.89)*	0.002 (0.59)	0.389 (1.65)	−0.067 (0.37)	−0.064 (1.13)	0.027 (0.95)	0.024 (1.47)	0.131 (1.98)**	0.009 (0.23)	106	2.01**	0.34	0.19
	Large-size	0.0004 (0.14)	0.117 (3.38)***	0.006 (1.95)*	−0.210 (0.76)	0.102 (0.53)	−0.003 (0.69)	−0.006 (0.19)	0.041 (1.93)*	0.181 (1.86)*	0.111 (3.33)***	67	3.60***	0.65	0.49
DIV1	Small-size	0.001 (0.59)	0.044 (1.75)*	0.006 (1.34)	0.020 (1.86)*	1.397 (0.31)	−0.005 (0.90)	0.048 (1.52)	0.010 (0.52)	0.094 (1.27)	−0.022 (0.58)	122	2.10**	0.25	0.10
	Large-size	0.020 (0.14)	0.070 (1.32)	−0.020 (1.13)	0.206 (1.49)	8.537 (0.32)	−0.008 (0.33)	0.199 (2.34)**	−0.006 (0.11)	0.572 (3.86)***	0.111 (3.33)***	51	3.52***	0.58	0.32
AGE	Small-size	0.001 (0.30)	0.068 (2.28)**	0.008 (1.77)*	0.050 (1.21)	−0.553 (1.43)	−0.006 (0.24)	0.070 (2.37)**	0.024 (1.16)	0.147 (1.65)	−0.052 (0.86)	97	2.46**	0.36	0.19
	Large-size	−0.005 (0.48)	0.050 (0.78)	−0.004 (0.43)	0.112 (0.95)	−0.321 (0.51)	0.005 (0.17)	0.129 (1.26)	0.003 (0.09)	0.421 (2.33)**	0.111 (3.33)***	72	2.41**	0.39	0.12
CASH	Small-size	0.008 (1.19)	0.008 (0.22)	0.007 (1.57)	−0.004 (0.13)	0.178 (0.38)	0.005 (0.98)	0.056 (0.13)	−0.010 (1.16)	0.225 (1.86)*	−0.062 (1.39)	74	1.95*	0.41	0.20
	Large-size	0.003 (0.43)	0.331 (4.30)***	−0.005 (1.69)	0.030 (0.81)	−0.619 (2.16)**	−0.007 (1.27)	−1.133 (2.16)**	0.027 (0.57)	0.093 (0.33)	0.136 (2.98)***	99	3.57**	0.40	0.22
DIV2	Small-size	0.003 (1.29)	0.035 (1.43)	0.004 (2.19)**	0.018 (0.86)	−0.002 (0.88)	−0.007 (1.51)	0.036 (1.26)	0.008 (0.61)	0.080 (1.41)	0.003 (0.21)	155	2.28**	0.27	0.15
	Large-size	0.013 (2.79)***	0.095 (2.46)**	−0.010 (2.27)**	0.179 (2.46)**	−0.002 (1.06)	−0.003 (0.36)	0.178 (2.56)**	−0.006 (0.25)	0.657 (4.49)***	0.141 (3.04)***	81	7.35***	0.60	0.46

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER 1 equals 1 when firms have been identified as net buyers for all years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with small board size and ones with large board size as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.9: CSA Regressions(2005): The Roles of Corporate Governance Mechanism (Board Size).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 1	OVER1* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
Predicted		+	+	+	+/–	+/–	+	+/–	+/–	+ in small-size					
LEV	Small-size	0.0004 (0.01)	0.095 (2.47)**	0.004 (0.70)	–0.138 (0.40)	–0.358 (1.31)	–0.014 (1.67)*	0.0427 (0.97)	–0.001 (0.05)	–0. 042 (0.48)	0.037 (0.57)	106	2.13**	0.27	0.12
	Large-size	–0.001 (0.65)	0.081 (2.85)***	–0.006 (2.19)**	–0.016 (0.06)	0.098 (0.55)	0.004 (0.86)	–0.0001 (0.00)	0.043 (4.94)***	0.309 (5.57)***	0.088 (2.81)***	67	13.09***	0.59	0.40
DIV1	Small-size	–0.0002 (0.06)	0.053 (2.36)**	0.003 (0.57)	–0.027 (0.96)	5.483 (0.66)	–0.013 (1.45)	0.034 (0.59)	–0.001 (0.05)	0.022 (0.29)	0.047 (0.86)	122	2.93**	0.20	0.10
	Large-size	–0.020 (1.22)	0.108 (3.25)***	–0.009 (1.39)	–0.003 (0.05)	5.023 (0.21)	0.012 (0.91)	0.156 (2.21)**	0.010 (0.18)	0.697 (3.83)***	0.138 (1.84)*	51	4.67***	0.69	0.50
AGE	Small-size	0.002 (0.75)	0.046 (1.42)	0.009 (1.75)*	0.071 (1.49)	–0.628 (1.70)*	–0.056 (1.48)	0.018 (0.55)	0.016 (1.10)	0.002 (0.02)	0.088 (1.10)	97	1.92*	0.25	0.05
	Large-size	0.0001 (0.03)	0.083 (2.29)**	0.003 (0.86)	–0.003 (0.06)	–0.512 (1.33)	–0.001 (0.04)	0.023 (0.49)	0.014 (0.59)	0.274 (2.60)**	0.013 (0.20)	72	3.11***	0.49	0.26
CASH	Small-size	0.004 (0.46)	0.013 (0.31)	0.008 (1.63)	0.010 (0.31)	0.362 (0.62)	–0.003 (0.41)	–0.385 (0.61)	–0.003 (0.20)	0.352 (2.02)*	–0.042 (0.70)	74	1.95*	0.31	0.07
	Large-size	0.003 (0.34)	0.300 (4.63)***	–0.005 (1.78)*	0.068 (1.59)	–0.304 (1.19)	–0.007 (1.32)	–0.988 (1.16)	0.0003 (0.00)	0.149 (0.74)	0.129 (3.08)***	99	3.76***	0.40	0.22
DIV2	Small-size	0.0002 (0.01)	0.041 (1.12)	0.002 (1.89)*	–0.020 (2.81)**	–0.001 (0.37)	–0.008 (1.27)	0.033 (0.62)	0.012 (0.88)	0.084 (1.18)	0.003 (1.32)	155	2.28**	0.27	0.15
	Large-size	0.010 (2.25)**	0.101 (3.12)***	–0.001 (0.65)	0.067 (1.62)	0.007 (1.35)	–0.001 (0.11)	0.118 (2.14)**	0.013 (0.55)	0.668 (4.24)***	0.058 (1.92)*	81	5.40***	0.63	0.50

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER 1 equals 1 when firms have been identified as net buyers for all years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with small board size and ones with large board size as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.10: CSA Regressions(2006): The Roles of Corporate Governance Mechanism (Non-executive Ratio).

Dependent variable		Independent variables												
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 1	OVER1* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
Predicted		+	+	+	+/−	+/−	+	+/−	+/−	+ in low-ratio					
LEV	Low-ratio	0.002 (1.23)	0.027 (1.10)	0.001 (0.25)	0.271 (1.26)	0.158 (0.81)	−0.002 (0.35)	0.010 (0.50)	0.050 (3.61)***	0.323 (5.19)***	0.016 (0.49)	104	6.49**	0.59	0.48
	High-ratio	0.004 (0.60)	0.086 (2.60)***	−0.004 (2.19)**	0.048 (0.10)	−0.123 (0.41)	0.001 (0.13)	0.040 (0.62)	0.011 (0.58)	0.104 (1.36)	0.059 (1.56)	69	3.09***	0.33	0.20
DIV1	Low-ratio	0.001 (0.38)	0.033 (1.54)	0.003 (0.78)	0.038 (1.44)	3.112 (0.60)	−0.010 (1.38)	0.026 (1.31)	0.050 (2.03)**	0.510 (2.78)***	0.020 (0.52)	101	1.97*	0.45	0.33
	High-ratio	−0.004 (0.71)	0.103 (2.56)**	−0.003 (0.43)	0.115 (1.03)	−1.948 (0.09)	−0.007 (0.50)	0.141 (1.98)*	−0.034 (0.98)	−0.019 (0.16)	0.074 (0.80)	72	4.67***	0.32	0.20
AGE	Low-ratio	0.001 (0.50)	0.029 (1.23)	0.006 (1.67)*	0.040 (1.27)	0.129 (0.39)	−0.036 (1.88)*	0.038 (1.85)*	0.027 (1.43)	0.336 (2.87)***	0.034 (0.76)	94	1.92*	0.25	0.05
	High-ratio	−0.003 (0.45)	0.107 (1.75)*	−0.003 (0.46)	0.179 (1.32)	−0.712 (1.83)*	0.028 (0.91)	0.156 (1.29)	0.019 (0.67)	0.191 (1.62)	−0.013 (0.12)	75	3.11***	0.34	0.26
CASH	Low-ratio	0.005 (0.43)	0.052 (0.71)	0.002 (0.73)	−0.005 (0.21)	0.832 (2.89)***	0.001 (0.22)	−0.534 (0.99)	−0.024 (0.51)	0.302 (1.14)	0.020 (0.49)	77	2.86***	0.36	0.14
	High-ratio	0.016 (1.74)*	0.149 (2.16)**	−0.001 (0.33)	0.058 (1.48)	−0.517 (1.67)*	−0.002 (0.30)	−0.026 (0.06)	0.008 (0.47)	0.084 (0.55)	0.028 (0.89)	96	2.07**	0.36	0.16
DIV2	Low-ratio	0.002 (0.85)	0.032 (1.32)	0.002 (0.71)	0.044 (1.60)	−0.005 (4.44)***	−0.010 (1.68)*	0.029 (1.74)*	0.039 (2.07)	0.462 (2.31)**	0.028 (1.22)	121	10.00***	0.42	0.30
	High-ratio	−0.003 (0.55)	0.114 (3.03)***	−0.001 (0.49)	0.135 (1.73)*	0.001 (0.16)	−0.008 (1.34)	0.131 (2.11)**	0.008 (0.42)	0.110 (1.20)	0.055 (1.51)	115	1.87*	0.33	0.18

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER 1 equals 1 when firms have been identified as net buyers for all years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high ratio of non-executive directors and ones with low ratio as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.11: CSA Regressions(2005): The Roles of Corporate Governance Mechanism (Non-executive Ratio).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 1	OVER1* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
LEV	Low-ratio	0.0003 (0.12)	0.077 (2.27)**	0.001 (0.24)	0.026 (0.07)	−0.326 (1.05)	−0.011 (1.04)	0.010 (0.26)	0.027 (1.65)	0.371 (3.87)***	0.064 (1.10)	104	10.52**	0.59	0.48
	High-ratio	−0.002 (0.46)	0.112 (2.24)**	−0.004 (0.96)	0.126 (0.30)	0.001 (0.00)	−0.005 (0.60)	0.107 (0.99)	0.006 (0.23)	0.178 (1.36)	0.074 (1.74)*	69	1.83*	0.33	0.20
DIV1	Low-ratio	0.001 (0.29)	0.039 (1.28)	−0.0004 (0.07)	−0.035 (0.93)	3.096 (0.35)	−0.015 (1.42)	−0.012 (0.45)	0.038 (1.18)	0.682 (2.62)***	0.089 (1.34)	101	1.97*	0.45	0.33
	High-ratio	−0.006 (1.33)	0.115 (1.94)*	−0.002 (0.31)	0.015 (0.35)	11.869 (1.48)	0.008 (0.84)	0.115 (1.21)	−0.026 (0.48)	−0.043 (0.17)	0.048 (0.63)	72	4.67***	0.32	0.20
AGE	Low-ratio	0.007 (1.99)*	0.047 (1.43)	0.006 (1.18)	−0.080 (1.77)*	−0.267 (0.71)	−0.051 (1.62)	−0.024 (0.78)	−0.015 (0.97)	0.300 (2.27)**	0.092 (1.35)	94	2.27**	0.25	0.05
	High-ratio	−0.004 (1.30)	0.080 (1.87)*	0.002 (0.45)	0.042 (0.70)	−0.800 (2.01)*	0.039 (1.19)	0.037 (0.85)	0.035 (1.52)	0.209 (1.73)*	−0.057 (0.74)	75	2.39**	0.34	0.26
CASH	Low-ratio	0.003 (0.35)	0.044 (0.81)	0.001 (0.23)	−0.003 (0.14)	1.070 (3.24)***	0.003 (0.52)	−1.051 (1.95)*	−0.001 (0.01)	0.281 (1.29)	0.029 (0.67)	77	5.60***	0.36	0.14
	High-ratio	0.017 (1.42)	0.161 (2.85)***	−0.004 (1.25)	0.108 (2.45)**	−0.468 (1.26)	−0.006 (1.01)	0.131 (0.27)	0.011 (0.91)	0.052 (0.43)	0.073 (1.72)*	96	1.89*	0.36	0.16
DIV2	Low-ratio	0.001 (0.46)	0.028 (0.86)	0.001 (0.28)	−0.020 (0.62)	−0.004 (3.00)***	−0.013 (1.41)	−0.007 (0.28)	0.045 (1.80)*	0.671 (2.93)***	0.065 (1.53)	121	3.86***	0.42	0.30
	High-ratio	−0.005 (1.49)	0.105 (2.45)**	0.001 (0.24)	0.059 (1.23)	0.004 (1.89)*	−0.003 (0.44)	0.115 (1.44)	0.017 (0.94)	0.162 (1.41)	0.032 (1.18)	115	2.72*	0.33	0.18

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER 1 equals 1 when firms have been identified as net buyers for all years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high ratio of non-executive directors and ones with low ratio as explained in Section 2.3.2.1. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.12: CSA Regressions(2006): The Roles of Corporate Governance Mechanism (Blockholder Ownership).

Dependent variable		Independent variables												
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 1	OVER1* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
Predicted		+	+	+	+/−	+/−	+	+	+/−	+ in low-ownership					
LEV	Low-ownership	0.001 (0.25)	0.052 (2.17)**	−0.002 (0.79)	−0.094 (0.65)	0.153 (1.02)	−0.005 (1.12)	0.006 (0.27)	0.048 (4.09)***	0.446 (8.36)***	0.053 (1.83)*	81	20.52***	0.60	0.47
	High-ownership	0.003 (1.06)	0.041 (1.07)	0.0001 (0.04)	0.359 (1.24)	0.156 (0.76)	−0.004 (0.62)	0.038 (1.05)	0.032 (2.58)**	0.108 (2.35)**	0.023 (0.53)	92	2.60**	0.49	0.34
DIV1	Low-ownership	−0.001 (0.34)	0.053 (2.16)**	0.008 (1.48)	−0.002 (0.06)	−4.282 (0.52)	0.004 (0.37)	0.044 (1.55)	0.061 (2.95)**	0.592 (6.37)***	−0.056 (1.00)	84	11.27***	0.58	0.46
	High-ownership	0.004 (0.64)	0.044 (1.81)*	−0.004 (0.58)	0.103 (1.75)*	3.879 (0.39)	−0.013 (1.40)	0.050 (1.22)	0.014 (0.73)	0.072 (0.91)	0.093 (1.30)	89	4.67***	0.32	0.12
AGE	Low-ownership	−0.002 (0.75)	0.0975 (2.63)**	0.004 (1.56)	0.013 (0.30)	−0.310 (1.35)	−0.023 (1.53)	0.021 (0.87)	0.016 (0.86)	0.269 (2.37)**	0.048 (1.33)	89	3.61**	0.51	0.36
	High-ownership	0.006 (0.79)	0.073 (1.21)	−0.005 (0.68)	0.193 (1.75)*	−0.129 (0.23)	0.016 (0.50)	0.085 (2.26)**	0.022 (1.12)	0.118 (1.55)	0.021 (0.25)	80	3.11***	0.36	0.12
CASH	Low-ownership	−0.005 (0.58)	0.117 (1.68)*	−0.001 (0.17)	0.003 (0.08)	0.191 (0.46)	−0.005 (0.73)	−0.719 (1.43)	−0.035 (1.03)	0.440 (1.67)*	0.082 (2.15)**	88	1.86*	0.29	0.07
	High-ownership	−0.010 (0.81)	0.153 (2.09)**	0.004 (1.44)	0.029 (0.73)	−0.287 (0.95)	−0.003 (0.52)	−0.270 (0.55)	0.010 (0.53)	0.148 (1.23)	0.013 (0.34)	85	1.75*	0.31	0.09
DIV2	Low-ownership	−0.001 (0.34)	0.069 (2.74)***	0.003 (1.36)	0.021 (0.70)	0.007 (2.50)**	0.002 (0.30)	0.064 (2.15)**	0.039 (1.74)*	0.490 (3.27)***	−0.005 (0.21)	102	3.57***	0.53	0.41
	High-ownership	0.005 (1.41)	0.045 (1.16)	−0.001 (0.51)	0.115 (1.95)*	−0.003 (1.91)	−0.012 (2.20)**	0.047 (1.25)	0.018 (1.39)	0.088 (1.42)	0.058 (1.82)*	134	3.46***	0.32	0.18

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER 1 equals 1 when firms have been identified as net buyers for all years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high blockholders' ownership and ones with low ownership explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.13: CSA Regressions(2005): The Roles of Corporate Governance Mechanism (Blockholder Ownership).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 1	OVER1* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
Predicted		+	+	+	+/–	+/–	+	+/–	+/–	+ in low-ownership					
LEV	Low-ownership	–0.001 (0.35)	0.059 (2.55)**	–0.005 (1.55)	0.105 (0.38)	0.005 (0.02)	–0.008 (1.15)	–0.011 (0.44)	0.055 (4.59)***	0.195 (4.69)***	0.108 (2.48)**	81	14.67***	0.31	0.08
	High-ownership	–0.002 (0.38)	0.100 (1.82)*	0.003 (0.57)	–0.071 (0.19)	–0.107 (0.34)	–0.010 (2.81)***	0.098 (1.25)	0.002 (0.09)	0.114 (1.07)	0.023 (0.38)	92	3.09***	0.28	0.06
DIV1	Low-ownership	–0.002 (0.71)	0.057 (1.65)	0.004 (0.64)	–0.049 (1.33)	–21.174 (1.23)	0.001 (0.09)	0.010 (0.36)	0.096 (3.15)**	0.702 (5.45)***	0.016 (0.25)	84	5.32***	0.45	0.29
	High-ownership	–0.002 (0.37)	0.088 (1.81)*	–0.001 (0.03)	–0.010 (0.22)	12.651 (1.24)	–0.005 (0.51)	0.091 (1.14)	–0.015 (1.86)*	0.052 (0.45)	0.052 (1.01)	89	4.67***	0.42	0.27
AGE	Low-ownership	0.002 (0.51)	0.092 (2.50)**	0.001 (0.36)	–0.056 (1.42)	–0.035 (0.11)	–0.061 (2.22)**	–0.018 (0.75)	–0.001 (0.04)	0.146 (1.28)	0.182 (2.40)**	89	2.47**	0.30	0.08
	High-ownership	0.002 (0.57)	0.056 (1.55)	0.005 (1.79)*	0.021 (0.32)	–0.232 (0.75)	–0.010 (0.24)	0.051 (1.08)	0.004 (0.21)	0.162 (1.89)*	–0.004 (0.05)	80	3.11***	0.37	0.05
CASH	Low-ownership	–0.014 (1.53)	0.085 (1.33)	–0.002 (0.85)	0.037 (0.96)	0.668 (1.68)*	–0.010 (1.54)	–0.933 (1.53)	–0.029 (1.36)	0.308 (1.71)*	0.125 (2.63)**	88	1.86*	0.27	0.04
	High-ownership	–0.009 (0.87)	0.134 (2.52)**	0.005 (1.85)*	0.028 (0.73)	–0.254 (0.81)	–0.006 (1.02)	–0.456 (1.14)	0.012 (0.67)	0.263 (2.01)**	0.015 (0.50)	85	2.50**	0.39	0.18
DIV2	Low-ownership	–0.002 (0.88)	0.068 (1.69)*	0.002 (0.61)	–0.008 (0.26)	0.004 (1.52)	–0.006 (0.63)	0.019 (1.54)	0.059 (1.86)*	0.586 (3.14)***	0.047 (1.05)	102	2.08**	0.40	0.20
	High-ownership	–0.001 (0.29)	0.079 (1.90)*	0.001 (0.65)	0.032 (0.84)	–0.001 (0.92)	–0.006 (0.90)	0.093 (1.25)	0.017 (1.23)	0.143 (1.58)	0.029 (1.28)	134	2.13**	0.25	0.10

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER 1 equals 1 when firms have been identified as net buyers for all years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high blockholders' ownership and ones with low ownership explained in Section 2.3.2. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.14: Robustness Test 1 : Cash Flow Sensitivity of Investment and Managerial Overconfidence (2006 and OVER2).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 2	OVER2* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
All Firms		0.002 (1.19)	0.079 (4.21)***	−0.001 (0.62)	0.032 (1.73)*	−0.168 (1.54)	0.0007 (0.25)	0.030 (1.51)	0.014 (2.27)*	0.030 (0.59)	0.032 (2.67)***	578	4.03***	0.18	0.15
LEV	Constrained	0.003 (1.47)	0.054 (2.72)***	0.0001 (0.38)	0.027 (0.13)	0.024 (0.19)	−0.005 (1.23)	0.008 (0.40)	0.018 (1.97)**	0.121 (2.64)***	0.046 (2.02)**	173	2.79***	0.35	0.25
	Unconstrained	0.006 (0.93)	0.023 (1.62)	−0.002 (1.11)	0.004 (0.11)	−0.782 (2.66)***	−0.002 (0.41)	0.124 (0.95)	−0.007 (0.62)	0.191 (1.45)	0.080 (2.74)***	173	1.90*	0.28	0.17
DIV1	Constrained	0.0003 (0.13)	0.037 (1.85)*	−0.001 (0.02)	0.067 (1.56)	1.643 (0.36)	−0.005 (0.93)	-0.061 (2.02)**	0.028 (2.55)**	0.162 (2.51)**	0.028 (0.76)	173	2.12**	0.29	0.19
	Unconstrained	−0.006 (1.38)	0.056 (4.25)***	0.0002 (0.15)	−0.002 (0.07)	−0.317 (1.82)*	−0.003 (0.91)	−0.011 (0.33)	0.007 (0.44)	0.066 (0.65)	0.044 (1.71)*	173	3.26***	0.33	0.23
AGE	Constrained	0.002 (0.56)	0.050 (1.96)*	0.001 (0.39)	0.076 (1.39)	−0.293 (1.21)	−0.004 (0.24)	−0.054 (1.64)	0.026 (2.60)**	0.128 (2.51)**	0.011 (0.29)	169	3.63***	0.29	0.19
	Unconstrained	0.010 (2.08)**	0.017 (1.08)	−0.002 (1.02)	0.054 (1.48)	0.394 (1.40)	0.003 (0.03)	0.002 (1.82)*	0.034 (1.65)*	−0.153 (0.68)	0.034 (0.67)	176	2.43**	0.25	0.15
CASH	Constrained	0.001 (0.10)	0.140 (2.87)***	0.001 (0.44)	0.005 (0.21)	−0.392 (1.84)*	−0.002 (0.37)	−0.534 (1.68)*	0.002 (0.19)	0.217 (2.06)**	0.043 (1.74)*	173	3.16***	0.28	0.17
	Unconstrained	0.001 (0.21)	0.041 (1.51)	0.002 (0.54)	0.059 (1.01)	0.075 (0.42)	−0.005 (1.10)	0.043 (1.70)*	0.002 (0.23)	0.043 (1.11)	0.016 (0.44)	173	2.05**	0.25	0.14
DIV2	Constrained	0.002 (0.61)	0.055 (2.49)**	−0.0001 (0.03)	0.083 (2.11)**	−0.0003 (0.12)	−0.006 (1.35)	0.065 (2.32)**	0.016 (2.09)**	0.120 (2.37)**	0.028 (1.55)	236	3.10***	0.26	0.19
	Unconstrained	−0.015 (3.55)***	0.035 (0.80)	−0.001 (0.48)	−0.025 (1.11)	−0.001 (1.31)	−0.001 (0.41)	−0.037 (1.26)	0.006 (0.47)	0.015 (0.13)	0.063 (2.35)**	173	2.54***	0.29	0.19

Notes: This table shows the impact of managerial overconfidence on investment-cash flow sensitivity. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER 2 equals 1 when firms have been identified as net buyers for at 3 least years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. Firms are identified as constrained and unconstrained firms by using their leverage, dividend, age and cash holding as explained in Section 2.3.2.1. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.15: Robustness Test 2 : Cash Flow Sensitivity of Investment and Managerial Overconfidence (2005 and OVER2).

Dependent variable		Independent variables												
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 2	OVER2* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
All Firms		0.001 (0.73)	0.093 (5.20)***	0.0004 (0.40)	0.021 (1.74)*	−0.252 (0.54)	0.001 (0.44)	0.034 (1.41)	0.015 (3.09)***	0.050 (1.76)*	0.040 (2.97)***	578	5.37***	0.18	0.15
LEV	Constrained	0.001 (0.43)	0.082 (3.10)***	0.0004 (0.14)	−0.174 (0.76)	−0.229 (1.40)	−0.009 (1.36)	0.030 (0.80)	0.027 (2.02)**	0.094 (2.23)**	0.063 (2.00)**	173	3.21***	0.24	0.13
	Unconstrained	0.006 (1.11)	0.061 (1.46)	−0.001 (0.43)	0.007 (0.16)	−0.075 (2.56)***	−0.002 (0.53)	0.101 (1.30)	0.008 (0.69)	0.143 (1.11)	0.063 (1.96)*	173	1.90*	0.28	0.17
DIV1	Constrained	0.0003 (0.10)	0.048 (1.65)*	−0.001 (0.27)	0.012 (0.41)	1.976 (0.30)	−0.004 (0.51)	-0.035 (0.84)	0.040 (2.65)**	0.155 (2.65)**	0.053 (1.33)	173	2.54**	0.25	0.14
	Unconstrained	−0.003 (0.72)	0.055 (4.03)***	0.0001 (0.58)	−0.008 (0.44)	−0.385 (1.74)*	−0.003 (1.01)	−0.013 (0.20)	0.026 (1.95)*	0.056 (0.67)	0.032 (1.36)	173	3.43***	0.26	0.15
AGE	Constrained	0.004 (1.45)	0.046 (2.18)**	0.003 (1.32)	−0.028 (0.86)	−0.347 (1.47)	−0.025 (1.04)	−0.007 (0.32)	0.033 (2.89)***	0.113 (2.91)***	0.061 (1.24)	169	4.37***	0.29	0.18
	Unconstrained	0.001 (0.28)	0.037 (1.08)	−0.002 (1.13)	0.060 (1.60)	−0.446 (2.01)**	−0.006 (0.57)	0.056 (0.77)	0.015 (1.46)	0.089 (0.90)	0.075 (1.44)	176	1.74*	0.27	0.17
CASH	Constrained	−0.004 (0.71)	0.118 (2.59)***	0.0003 (0.16)	0.028 (1.13)	−0.165 (0.68)	−0.004 (1.02)	−0.730 (2.16)**	0.007 (0.61)	0.234 (2.48)**	0.064 (2.44)*	173	3.59*	0.30	0.20
	Unconstrained	−0.002 (0.264)	0.070 (1.78)**	0.004 (1.10)	−0.041 (1.34)	−0.065 (0.38)	−0.005 (1.91)*	0.040 (1.02)	0.015 (1.17)	0.032 (0.86)	0.014 (0.42)	173	2.05**	0.25	0.14
DIV2	Constrained	0.001 (0.23)	0.049 (1.69)*	0.001 (0.46)	0.021 (0.71)	0.001 (0.34)	−0.004 (0.83)	0.042 (1.10)	0.027 (2.66)***	0.1920 (2.78)***	0.030 (1.50)	236	3.10***	0.26	0.19
	Unconstrained	−0.009 (2.32)**	0.035 (0.80)	−0.0001 (0.09)	−0.014 (0.64)	−0.001 (2.21)**	−0.0001 (0.06)	−0.070 (2.83)***	0.015 (1.40)	−0.063 (0.76)	0.041 (1.92)*	173	3.04***	0.30	0.20

Notes: This table shows the impact of managerial overconfidence on investment-cash flow sensitivity. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER 2 equals 1 when firms have been identified as net buyers for at least 3 years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. Firms are identified as constrained and unconstrained firms by using their leverage, dividend, age and cash holding as explained in Section 2.3.2.1. All regressions include industry dummies. We use consistent to heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.16: Robustness Test 3 : Cash Flow Sensitivity of Investment and Managerial Overconfidence (2006 and OVER 3).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 3	OVER3* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
All Firms		0.001 (0.84)	0.054 (2.02)**	−0.0002 (0.18)	0.029 (1.54)	−0.159 (1.44)	0.0006 (0.21)	0.029 (1.45)	−0.006 (1.64)	0.103 (3.44)***	0.033 (2.64)***	578	4.84***	0.18	0.15
LEV	Constrained	0.002 (1.18)	0.051 (2.53)**	−0.0001 (0.33)	0.175 (0.78)	0.0008 (0.01)	−0.007 (1.58)	0.011 (0.53)	−0.003 (0.55)	0.096 (2.62)***	0.045 (1.95)*	173	2.73**	0.31	0.21
	Unconstrained	0.005 (0.74)	0.025 (1.41)	−0.002 (1.04)	−0.007 (0.19)	−0.709 (2.64)***	−0.001 (0.24)	0.016 (0.92)	−0.012 (1.24)	0.125 (1.09)	0.078 (2.75)**	173	1.85*	0.26	0.16
DIV1	Constrained	0.0003 (0.11)	0.044 (2.05)**	0.002 (0.60)	0.067 (1.48)	−2.737 (0.56)	−0.004 (0.54)	−0.065 (2.08)**	0.005 (0.45)	0.130 (2.47)**	0.007 (0.17)	173	2.38**	0.26	0.15
	Unconstrained	−0.007 (1.39)	0.043 (1.58)	0.001 (0.41)	−0.002 (0.12)	−0.248 (1.35)	−0.003 (0.87)	0.025 (0.65)	−0.008 (0.64)	0.040 (0.48)	0.044 (1.85)*	173	3.07***	0.30	0.20
AGE	Constrained	0.0004 (0.11)	0.050 (1.87)*	0.001 (0.44)	0.072 (1.28)	−0.338 (1.41)	−0.003 (0.17)	0.057 (1.67)*	0.002 (0.19)	0.101 (2.61)**	0.015 (0.40)	169	3.59***	0.25	0.14
	Unconstrained	0.011 (2.03)**	0.010 (0.07)	−0.001 (0.61)	0.043 (1.09)	−0.332 (1.97)*	0.010 (0.82)	0.001 (0.03)	−0.025 (1.44)	0.199 (1.21)	0.010 (0.21)	173	2.95**	0.28	0.18
CASH	Constrained	0.001 (0.19)	0.114 (2.21)**	0.001 (0.39)	0.004 (0.17)	−0.193 (0.90)	−0.001 (0.19)	−0.303 (0.98)	−0.020 (2.22)**	0.196 (2.39)**	0.042 (1.68)*	173	3.57***	0.24	0.13
	Unconstrained	0.0002 (0.07)	0.042 (1.58)	0.003 (0.45)	0.058 (1.04)	−0.008 (0.04)	−0.006 (1.29)	0.048 (2.83)***	−0.010 (1.40)	0.082 (1.22)	0.012 (0.33)	173	2.56***	0.27	0.17
DIV2	Constrained	0.001 (0.15)	0.085 (2.88)***	−0.0002 (0.08)	0.085 (2.10)**	0.0001 (0.04)	−0.005 (1.11)	0.070 (2.40)**	0.004 (0.57)	0.126 (2.65)***	0.030 (1.55)	236	4.36***	0.25	0.18
	Unconstrained	−0.014 (3.69)***	0.092 (1.12)	−0.001 (0.57)	−0.024 (1.12)	−0.001 (1.26)	−0.001 (0.25)	−0.040 (1.35)	−0.017 (1.51)	0.124 (1.37)	0.070 (2.43)**	173	2.94***	0.30	0.19

Notes: This table shows the impact of managerial overconfidence on investment-cash flow sensitivity. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER3 equals 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise. In DIV 2 group, SIZE 2 and DIV 2 are included. Firms are identified as constrained and unconstrained firms by using their leverage, dividend, age and cash holding as explained in Section 2.3.2.1. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.17: Robustness Test 4 : Cash Flow Sensitivity of Investment and Managerial Overconfidence (2005 and OVER 3).

Dependent variable		Independent variables												
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 3	OVER3* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
All Firms		0.001 (0.43)	0.080 (4.50)**	0.0003 (0.03)	0.020 (1.16)	−0.224 (1.93)*	−0.0009 (0.35)	0.032 (1.28)	0.001 (0.22)	0.062 (2.45)**	0.038 (2.87)***	578	5.30***	0.16	0.13
LEV	Constrained	0.001 (0.28)	0.081 (2.74)***	0.001 (0.27)	−0.091 (0.37)	−0.242 (1.32)	−0.011 (1.76)*	0.028 (0.75)	−0.005 (0.59)	0.061 (1.75)*	0.063 (1.92)*	173	2.73**	0.31	0.21
	Unconstrained	0.005 (0.81)	0.057 (1.29)	−0.001 (1.04)	0.001 (0.03)	−0.647 (2.39)**	−0.001 (0.32)	0.091 (1.21)	−0.004 (0.39)	0.115 (0.93)	0.062 (1.85)**	173	2.30**	0.24	0.13
DIV1	Constrained	−0.001 (0.30)	0.063 (1.92)*	0.002 (0.60)	−0.009 (0.46)	−1.759 (0.28)	−0.002 (0.24)	−0.037 (0.90)	0.006 (0.40)	0.068 (1.32)	0.029 (0.68)	173	1.80*	0.19	0.07
	Unconstrained	−0.002 (0.42)	0.114 (1.68)*	0.001 (0.73)	−0.011 (0.57)	−0.343 (2.73)***	−0.003 (0.90)	0.021 (0.34)	0.0004 (0.03)	−0.009 (0.12)	0.038 (1.61)	173	2.82***	0.23	0.11
AGE	Constrained	0.003 (1.05)	0.040 (1.87)*	0.003 (1.18)	−0.031 (0.89)	−0.369 (1.62)	−0.023 (0.93)	−0.009 (0.41)	0.009 (0.85)	0.085 (2.75)***	0.064 (1.27)	169	3.58***	0.23	0.11
	Unconstrained	0.001 (0.12)	0.152 (1.57)	−0.001 (0.63)	0.056 (1.44)	−0.410 (1.66)*	−0.006 (0.46)	0.044 (2.58)***	−0.002 (0.11)	0.042 (0.28)	0.068 (1.24)	176	1.95*	0.22	0.11
CASH	Constrained	−0.003 (0.54)	0.100 (2.10)**	−0.0004 (0.19)	0.025 (0.98)	0.057 (0.24)	−0.003 (0.75)	−0.526 (1.50)	−0.009 (1.04)	0.152 (2.33)**	0.042 (2.25)**	173	3.11***	0.24	0.13
	Unconstrained	−0.001 (0.49)	0.075 (1.38)	0.006 (1.67)*	−0.041 (1.30)	−0.125 (0.67)	−0.007 (1.29)	0.039 (1.04)	−0.014 (1.55)	0.032 (0.92)	0.009 (0.28)	173	2.33***	0.26	0.15
DIV2	Constrained	−0.001 (0.08)	0.056 (1.99)**	0.001 (0.58)	0.025 (0.76)	0.001 (0.63)	−0.004 (0.64)	0.043 (1.14)	0.010 (1.00)	0.095 (2.13)**	0.032 (1.44)	236	2.57***	0.18	0.09
	Unconstrained	−0.008 (3.69)***	0.042 (1.13)	−0.0003 (0.57)	−0.017 (1.12)	−0.001 (1.26)	0.0001 (0.25)	−0.077 (1.35)	−0.003 (1.51)	0.036 (1.37)	0.048 (2.32)**	173	2.94***	0.30	0.19

Notes: This table shows the impact of managerial overconfidence on investment-cash flow sensitivity. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004.OVER3 equals 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise. Firms are identified as constrained and unconstrained firms by using their leverage, dividend, age and cash holding as explained in Section 2.3.2.1. In DIV 2 group, SIZE 2 and DIV 2 are included. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.18; Robustness Test 5: The Roles of Corporate Governance Mechanism (2006 , OVER 2 and Board Size).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 2	OVER2* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
LEV	Small-size	0.004 (1.39)	0.041 (1.79)*	0.002 (0.41)	0.428 (1.71)*	−0.084 (0.46)	−0.007 (1.38)	0.023 (0.79)	0.013 (1.00)	0.160 (2.28)**	0.009 (0.23)	106	2.10**	0.35	0.21
	Large-size	0.002 (0.14)	0.139 (3.38)***	−0.005 (1.95)*	−0.570 (0.76)	0.021 (0.53)	−0.006 (0.69)	−0.013 (0.19)	0.032 (1.93)*	0.047 (1.86)*	0.109 (3.33)***	67	3.00***	0.59	0.39
DIV1	Small-size	0.002 (0.82)	0.029 (1.20)	0.004 (1.25)	0.020 (0.97)	4.262 (1.03)	−0.004 (0.80)	0.049 (1.51)	0.025 (1.84)*	0.199 (2.27)**	−0.015 (0.47)	122	2.10**	0.25	0.10
	Large-size	−0.013 (1.20)	0.048 (0.71)	−0.019 (1.07)	0.260 (1.74)*	10.678 (0.39)	−0.008 (0.40)	0.119 (1.57)	0.022 (1.88)*	0.084 (0.90)	0.243 (1.32)	51	3.52***	0.51	0.21
AGE	Small-size	0.002 (0.76)	0.049 (1.82)*	0.007 (1.72)*	0.050 (1.26)	−0.419 (1.18)	−0.005 (0.21)	0.062 (2.25)**	0.033 (2.26)**	0.195 (2.58)**	−0.051 (0.97)	97	3.27**	0.44	0.29
	Large-size	0.007 (0.83)	0.041 (0.47)	−0.002 (0.19)	0.118 (1.02)	−0.469 (0.70)	−0.005 (0.18)	0.054 (0.72)	0.025 (1.18)	0.097 (1.13)	0.040 (0.39)	72	1.41	0.34	0.04
CASH	Small-size	0.010 (1.39)	0.015 (0.38)	0.005 (1.23)	0.0005 (0.02)	0.140 (0.31)	0.006 (1.00)	0.060 (0.14)	0.008 (0.61)	0.164 (1.45)	−0.056 (1.26)	74	1.83*	0.42	0.23
	Large-size	0.0002 (0.04)	0.323 (4.06)***	−0.004 (1.55)	0.031 (0.78)	−0.719 (2.66)**	−0.006 (1.10)	−1.095 (2.33)**	0.022 (1.16)	0.087 (0.57)	0.125 (2.97)***	99	3.33**	0.42	0.25
DIV2	Small-size	0.003 (1.39)	0.025 (1.06)	0.004 (2.17)**	0.016 (0.80)	−0.002 (0.43)	−0.006 (1.44)	0.036 (1.22)	0.012 (1.16)	0.123 (2.15)**	0.002 (0.13)	155	2.22**	0.29	0.18
	Large-size	−0.004 (0.73)	0.109 (1.89)*	−0.010 (1.76)*	0.233 (2.71)***	0.001 (0.23)	−0.004 (0.44)	0.091 (1.58)	0.028 (1.92)*	0.034 (0.40)	0.118 (2.04)**	81	2.09**	0.50	0.33

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER 2 equals 1 when firms have been identified as net buyers for at least 3 years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with small board size and one with large board size as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.19: Robustness Test 6: The Roles of Corporate Governance Mechanism (2005, OVER 2 and Board Size).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 2	OVER2* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
LEV	Small-size	0.002 (1.39)	0.089 (1.79)*	0.003 (0.41)	−0.138 (1.71)*	−0.361 (0.46)	−0.014 (1.38)	0.056 (0.79)	0.018 (1.00)	0.112 (2.28)**	0.041 (0.23)	106	1.92*	0.30	0.14
	Large-size	0.001 (0.47)	0.095 (2.55)**	−0.005 (1.62)	−0.318 (0.92)	−0.088 (0.44)	0.004 (0.81)	−0.029 (1.17)	0.035 (2.82)***	0.057 (1.23)	0.074 (2.32)**	67	4.21***	0.48	0.23
DIV1	Small-size	0.001 (0.30)	0.038 (1.98)*	0.002 (0.32)	−0.025 (0.93)	5.857 (0.69)	−0.012 (1.37)	0.038 (0.65)	0.028 (1.51)	0.144 (2.54)**	0.049 (0.92)	122	1.94*	0.20	0.04
	Large-size	−0.011 (1.06)	0.091 (1.99)*	−0.008 (1.15)	0.052 (0.54)	−1.681 (0.06)	−0.010 (0.66)	0.057 (0.89)	0.051 (2.72)**	0.076 (1.00)	0.101 (1.33)	51	1.74	0.58	0.33
AGE	Small-size	0.004 (1.23)	0.028 (0.90)	0.008 (1.29)	−0.066 (1.79)*	−0.561 (1.10)	−0.048 (1.25)	−0.010 (0.31)	0.029 (1.51)	0.126 (2.03)**	0.069 (0.90)	97	2.29**	0.28	0.10
	Large-size	0.012 (1.86)*	0.104 (2.68)**	0.004 (1.64)	0.0004 (1.02)	−0.771 (2.06)**	−0.003 (0.13)	−0.037 (1.03)	0.042 (2.56)**	0.043 (0.88)	−0.021 (0.29)	72	2.72**	0.52	0.30
CASH	Small-size	0.006 (0.67)	0.023 (0.57)	0.006 (1.33)	0.015 (0.47)	0.289 (0.50)	−0.003 (0.43)	−0.389 (0.64)	0.011 (0.63)	0.306 (1.75)*	−0.029 (0.50)	74	1.54	0.34	0.10
	Large-size	−0.006 (0.93)	0.291 (4.11)***	−0.005 (1.89)*	0.068 (1.67)*	−0.411 (1.58)	−0.006 (1.26)	−1.140 (2.43)**	0.020 (1.41)	0.104 (0.83)	0.128 (3.56)***	99	3.93**	0.45	0.29
DIV2	Small-size	0.001 (0.42)	0.030 (0.80)	0.002 (0.80)	−0.022 (0.88)	−0.001 (0.05)	−0.007 (1.04)	0.036 (0.68)	0.020 (1.44)	0.115 (2.55)**	0.031 (1.09)	155	1.72*	0.17	0.03
	Large-size	−0.002 (0.35)	0.092 (1.82)*	−0.001 (0.27)	0.123 (1.88)*	0.012 (1.26)	−0.003 (0.41)	0.034 (0.75)	0.043 (3.24)***	0.067 (0.97)	0.032 (0.90)	81	2.32**	0.52	0.35

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER 2 equals 1 when firms have been identified as net buyers for at least 3 years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with small board size and one with large board size as explained in Section 2.2.3.All regressions include industry dummies. We use consistent to heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.20: Robustness Test 7: The Roles of Corporate Governance Mechanism (2006, OVER 2 and Non-executive Ratio).

Dependent variable		Independent variables												
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 2	OVER2* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
LEV	Low-ratio	0.003 (1.49)	0.022 (0.82)	0.001 (0.41)	0.234 (1.03)	0.197 (1.00)	−0.006 (0.98)	−0.002 (0.09)	0.036 (2.67)***	0.279 (4.10)***	0.022 (0.65)	104	4.02**	0.55	0.44
	High-ratio	0.004 (0.54)	0.073 (2.15)***	−0.004 (1.11)	0.003 (0.01)	−0.070 (0.23)	−0.002 (0.35)	0.022 (0.36)	0.004 (0.33)	0.064 (1.10)	0.071 (1.66)	69	1.99*	0.33	0.03
DIV1	Low-ratio	0.001 (0.26)	0.024 (1.15)	0.004 (1.00)	0.038 (1.15)	1.431 (0.27)	−0.007 (0.89)	0.020 (0.94)	0.032 (1.84)*	0.292 (1.93)**	0.003 (0.07)	101	1.97*	0.37	0.22
	High-ratio	−0.003 (0.55)	0.070 (1.46)	−0.007 (0.96)	0.109 (1.01)	−9.332 (0.53)	−0.007 (0.45)	0.129 (1.76)*	0.032 (1.54)	0.120 (1.49)	0.097 (1.09)	72	1.16	0.34	0.10
AGE	Low-ratio	0.002 (0.80)	0.023 (0.87)	0.007 (2.10)**	0.031 (0.93)	0.112 (0.32)	−0.030 (1.51)	0.031 (1.46)	0.028 (2.04)**	0.200 (2.23)**	0.009 (0.19)	94	3.42***	0.38	0.22
	High-ratio	−0.002 (0.27)	0.077 (0.97)	−0.004 (0.62)	0.178 (1.32)	−0.541 (1.59)	0.010 (0.36)	0.114 (1.07)	0.028 (1.48)	0.110 (1.16)	0.035 (0.34)	75	1.55	0.35	0.10
CASH	Low-ratio	−0.006 (0.55)	0.049 (0.68)	0.003 (1.00)	−0.004 (0.17)	0.661 (1.70)*	0.0002 (0.03)	−0.451 (0.92)	−0.007 (0.33)	0.254 (2.37)**	0.015 (0.39)	77	2.30**	0.37	0.17
	High-ratio	0.013 (1.54)	0.135 (1.76)*	−0.001 (0.39)	0.053 (1.29)	−0.631 (2.30)*	−0.002 (0.39)	−0.225 (0.53)	0.009 (0.60)	0.172 (1.47)	0.038 (1.29)	96	2.19**	0.41	0.23
DIV2	Low-ratio	0.002 (0.56)	0.037 (1.41)	0.002 (0.61)	0.048 (1.36)	−0.004 (3.33)***	−0.006 (0.94)	0.032 (1.45)	0.018 (1.48)	0.197 (2.37)**	0.020 (0.82)	121	6.32***	0.31	0.18
	High-ratio	−0.002 (0.39)	0.093 (2.03)***	−0.002 (0.60)	0.127 (1.07)	0.002 (1.84)*	−0.007 (1.33)	0.112 (2.11)**	0.016 (1.33)	0.077 (1.28)	0.052 (1.38)	115	1.87*	0.33	0.18

Notes: This table shows impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER3 when firms have been identified as net buyers for at least 3 years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high ratio of non-executive directors and ones with low ratio as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.21: Robustness Test 8: The Roles of Corporate Governance Mechanism (2005 , OVER 2 and Non-executive Ratio).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 2	OVER2* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
LEV	Low-ratio	0.002 (0.99)	0.048 (1.60)	0.001 (0.13)	−0.080 (0.24)	0.090 (0.62)	−0.181 (0.67)	−0.003 (0.09)	0.057 (2.29)**	0.255 (2.61)**	0.048 (0.86)	104	3.41***	0.37	0.20
	High-ratio	−0.002 (0.46)	0.111 (2.25)**	−0.004 (0.98)	0.074 (0.19)	−0.063 (0.18)	−0.005 (0.59)	0.089 (0.89)	0.002 (0.10)	0.004 (0.09)	0.079 (1.81)*	69	1.64	0.30	0.04
DIV1	Low-ratio	0.002 (0.65)	0.021 (0.72)	0.001 (0.18)	−0.021 (0.48)	−0.100 (0.01)	−0.008 (0.75)	−0.016 (0.57)	0.048 (1.99)**	0.317 (2.00)**	0.047 (0.66)	101	1.21	0.27	0.10
	High-ratio	−0.007 (1.31)	0.109 (1.56)	−0.008 (1.00)	0.016 (0.40)	14.700 (2.76)***	0.011 (1.01)	0.116 (1.20)	0.045 (2.05)**	0.043 (0.63)	0.078 (1.08)	72	2.74**	0.41	0.19
AGE	Low-ratio	0.009 (0.10)	0.026 (1.28)	0.006 (0.44)	−0.081 (1.42)	−0.217 (0.33)	−0.047 (1.84)*	−0.030 (1.04)	0.033 (0.89)	0.168 (1.14)	0.076 (0.89)	94	1.46	0.32	0.13
	High-ratio	−0.002 (0.67)	0.079 (1.67)*	−0.0001 (0.04)	0.055 (1.00)	−0.588 (1.88)*	0.028 (1.01)	0.019 (0.47)	0.045 (2.98)***	0.040 (0.62)	−0.029 (0.41)	75	3.32**	0.52	0.33
CASH	Low-ratio	−0.003 (0.35)	0.036 (0.69)	0.002 (0.74)	−0.005 (0.22)	0.791 (2.58)**	0.002 (0.49)	−0.862 (1.75)*	−0.007 (0.34)	0.333 (2.19)**	0.015 (0.40)	77	6.65**	0.52	0.36
	High-ratio	0.012 (1.08)	0.168 (2.67)***	−0.005 (1.45)	0.112 (2.69)***	−0.519 (1.66)	−0.006 (1.15)	−0.067 (0.14)	0.028 (1.65)	0.062 (0.52)	0.087 (2.11)**	96	2.03**	0.44	0.27
DIV2	Low-ratio	0.002 (0.56)	0.026 (0.74)	0.001 (0.32)	−0.005 (0.12)	−0.003 (1.61)	0.006 (0.66)	0.001 (0.05)	0.035 (2.00)**	0.269 (1.87)*	0.037 (0.96)	121	2.00**	0.23	0.08
	High-ratio	−0.004 (1.02)	0.106 (1.84)*	−0.0001 (0.02)	0.061 (1.15)	0.005 (2.14)**	−0.001 (0.10)	0.107 (1.27)	0.022 (1.87)*	0.033 (0.65)	0.024 (0.90)	115	3.12***	0.33	0.18

Notes: This table shows impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER2 equals 1 when firms have been identified as net buyers for at least 3 years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high ratio of non-executive directors and ones with low ratio as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.22: Robustness Test 9: The Roles of Corporate Governance Mechanism (2006, OVER2 and Blockholder Ownership).

Dependent variable		Independent variables												
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 2	OVER2* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
Predicted		+	+	+	+/-	+/-	+	+	+/-	+ in low-ownership					
LEV	Low-ownership	0.001 (0.47)	0.041 (1.50)	−0.001 (0.04)	−0.390 (1.74)*	0.175 (1.05)	−0.009 (1.54)	−0.019 (0.76)	0.021 (1.12)	0.109 (2.36)**	0.054 (1.78)*	81	2.52**	0.43	0.25
	High-ownership	0.004 (1.12)	0.025 (0.58)	−0.0002 (0.06)	0.342 (1.12)	0.179 (2.83)***	−0.005 (0.78)	0.023 (0.60)	0.012 (1.00)	0.130 (2.49)**	0.035 (0.74)	92	2.26**	0.46	0.30
DIV1	Low-ownership	0.003 (0.12)	0.025 (1.05)	0.006 (1.44)	0.018 (0.47)	1.214 (0.16)	0.006 (0.60)	0.022 (0.77)	0.041 (2.20)**	0.202 (1.67)*	−0.051 (1.15)	84	2.27**	0.50	0.34
	High-ownership	0.005 (0.89)	0.013 (0.29)	−0.006 (0.76)	0.088 (2.23)**	4.878 (2.50)**	−0.013 (1.37)	0.033 (0.82)	0.016 (1.08)	0.131 (0.91)	0.103 (1.40)	89	2.67**	0.34	0.15
AGE	Low-ownership	0.001 (0.27)	0.049 (1.77)*	0.004 (1.75)*	0.004 (0.11)	−0.168 (0.79)	−0.029 (1.94)*	0.003 (0.13)	0.022 (1.75)*	0.102 (2.37)**	0.051 (1.36)	89	2.97**	0.48	0.32
	High-ownership	0.008 (1.11)	0.038 (0.51)	−0.006 (0.67)	0.188 (1.52)	−0.035 (2.06)**	0.011 (3.33)***	0.061 (0.84)	0.020 (1.10)	0.145 (1.73)*	0.032 (0.36)	80	3.11***	0.36	0.12
CASH	Low-ownership	−0.011 (1.34)	0.058 (0.99)	0.001 (0.07)	−0.009 (0.24)	0.202 (0.60)	−0.005 (0.76)	−0.899 (1.89)*	−0.038 (2.43)**	0.509 (3.51)***	0.089 (2.65)**	88	2.26**	0.39	0.20
	High-ownership	−0.009 (0.78)	0.177 (2.37)**	0.003 (1.04)	0.026 (0.71)	−0.489 (1.83)*	−0.004 (0.59)	−0.313 (0.69)	0.023 (1.47)	0.097 (0.71)	0.024 (0.58)	85	2.27**	0.35	0.14
DIV2	Low-ownership	0.0004 (0.13)	0.041 (1.49)	0.003 (1.46)	0.024 (0.67)	0.012 (2.28)**	0.007 (0.91)	0.049 (1.55)	0.026 (1.95)*	0.167 (1.66)*	−0.025 (1.10)	102	2.47***	0.45	0.31
	High-ownership	0.006 (1.51)	0.018 (0.39)	−0.002 (0.55)	0.109 (1.88)*	−0.003 (1.93)*	−0.011 (2.16)**	0.035 (0.89)	0.014 (1.43)	0.116 (1.42)	0.058 (1.80)*	134	2.48***	0.33	0.19

Notes: This table shows impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER 2 equals 1 when firms have been identified as net buyers for at least 3 years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high blockholders' ownership and ones with low ownership explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.23: Robustness Test 10: The Roles of Corporate Governance Mechanism (2005, OVER2 and Blockholder Ownership).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 2	OVER2* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
Predicted		+	+	+	+/-	+/-	+	+	+/-	+ in low-ownership					
LEV	Low-ownership	−0.002 (0.66)	0.058 (2.27)**	−0.004 (1.18)	−0.256 (0.93)	0.063 (0.26)	−0.009 (0.26)	−0.023 (1.62)	0.046 (1.98)*	0.099 (2.16)**	0.109 (2.51)**	81	2.04**	0.32	0.09
	High-ownership	0.001 (0.17)	0.089 (1.47)	0.004 (0.58)	−0.143 (0.39)	−0.151 (0.50)	−0.007 (0.60)	0.087 (1.07)	0.014 (0.73)	0.087 (1.54)	0.012 (0.19)	92	1.63	0.29	0.08
DIV1	Low-ownership	−0.002 (0.74)	0.037 (1.09)	0.002 (0.32)	−0.023 (0.55)	12.069 (1.05)	0.003 (0.20)	−0.007 (0.25)	0.054 (2.23)**	0.192 (1.61)	0.022 (0.36)	84	1.60	0.35	0.14
	High-ownership	0.001 (0.18)	0.066 (1.12)	−0.002 (0.37)	−0.024 (0.61)	17.760 (1.85)*	−0.006 (0.59)	0.066 (0.75)	0.029 (1.38)	0.109 (1.68)*	0.064 (1.23)	89	1.74*	0.30	0.09
AGE	Low-ownership	−0.001 (0.17)	0.075 (2.25)**	0.0004 (0.15)	−0.049 (1.36)	0.007 (0.02)	−0.062 (2.34)*	−0.022 (1.00)	0.028 (1.92)*	0.089 (1.70)*	0.182 (2.56)**	89	2.89***	0.35	0.14
	High-ownership	0.008 (1.83)*	0.026 (0.58)	0.006 (1.64)	−0.011 (0.17)	−0.333 (0.98)	−0.010 (0.24)	0.006 (0.11)	0.038 (2.26)**	0.134 (2.25)**	−0.019 (0.23)	80	1.86*	0.38	0.15
CASH	Low-ownership	−0.019 (2.29)**	0.047 (0.93)	−0.002 (0.95)	0.031 (0.84)	0.561 (1.65)	−0.009 (1.59)	−1.060 (1.79)*	−0.023 (1.65)	0.429 (3.88)***	0.134 (3.08)***	88	3.27***	0.36	0.16
	High-ownership	−0.008 (0.80)	0.161 (2.63)**	0.003 (1.24)	0.027 (0.71)	−0.459 (1.17)	−0.006 (1.02)	−0.538 (2.43)**	0.022 (1.30)	0.168 (1.07)	0.027 (0.73)	85	2.79**	0.40	0.20
DIV2	Low-ownership	−0.002 (0.67)	0.038 (0.93)	0.001 (0.36)	−0.007 (0.19)	0.012 (2.28)**	0.001 (0.11)	0.008 (0.28)	0.046 (2.40)**	0.188 (1.75)*	0.026 (0.65)	102	2.11**	0.31	0.14
	High-ownership	0.001 (0.19)	0.051 (0.97)	0.001 (2.56)**	0.031 (0.82)	−0.002 (1.33)	−0.005 (0.76)	0.079 (0.99)	0.022 (2.68)***	0.114 (1.37)	0.020 (0.97)	134	2.75***	0.27	0.13

Notes: This table shows impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER 2 equals 1 when firms have been identified as net buyers for at least 3 years over 2003–2006, otherwise equals 0. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high blockholders' ownership and ones with low ownership explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.24: Robustness Test 11: The Roles of Corporate Governance Mechanism (2006 , OVER 3 and Board Size).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 3	OVER3* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
LEV	Small-size	0.003 (1.14)	0.038 (1.40)	0.003 (0.74)	0.516 (1.62)	−0.120 (0.63)	−0.008 (1.53)	0.020 (0.66)	0.004 (0.49)	0.082 (2.02)**	0.013 (0.33)	106	2.10**	0.31	0.19
	Large-size	−0.001 (0.13)	0.114 (3.20)***	−0.004 (0.82)	−0.361 (0.93)	0.167 (0.76)	−0.012 (1.33)	−0.004 (0.13)	−0.005 (0.55)	0.049 (0.94)	0.116 (3.15)***	67	2.58**	0.52	0.29
DIV1	Small-size	0.002 (0.91)	0.028 (1.12)	0.005 (1.34)	0.015 (0.63)	2.585 (0.66)	−0.005 (0.90)	0.042 (1.32)	0.006 (0.56)	0.133 (2.20)**	−0.015 (0.43)	122	2.31**	0.29	0.14
	Large-size	−0.015 (1.60)	0.103 (1.49)	−0.019 (1.06)	0.286 (1.83)*	4.050 (0.14)	−0.008 (0.35)	0.140 (1.85)*	0.003 (0.13)	−0.050 (0.48)	0.250 (1.38)	51	3.52***	0.50	0.20
AGE	Small-size	0.002 (0.53)	0.041 (1.52)	0.008 (1.75)*	0.032 (0.83)	−0.575 (1.43)	−0.005 (0.19)	0.050 (1.59)	0.013 (1.25)	0.139 (2.53)**	−0.047 (0.78)	97	3.20**	0.38	0.21
	Large-size	0.0001 (0.02)	0.033 (0.42)	−0.003 (0.31)	0.123 (1.06)	−0.311 (0.61)	−0.008 (0.29)	0.087 (1.15)	−0.002 (0.14)	0.098 (1.22)	0.070 (0.80)	72	1.41	0.34	0.04
CASH	Small-size	0.007 (1.39)	0.001 (1.01)	0.006 (1.54)	−0.012 (0.41)	0.166 (0.36)	0.005 (1.92)*	0.164 (0.35)	−0.021 (2.06)**	0.084 (1.18)	−0.051 (1.24)	74	2.09*	0.41	0.21
	Large-size	0.005 (0.66)	0.339 (3.38)***	−0.004 (1.51)	0.032 (0.77)	−0.593 (1.89)*	−0.007 (1.15)	−0.880 (1.74)*	−0.009 (0.57)	0.063 (0.42)	0.122 (2.73)***	99	2.99**	0.35	0.16
DIV2	Small-size	0.003 (1.43)	0.026 (1.09)	0.004 (2.22)**	0.014 (0.67)	−0.001 (0.42)	−0.006 (1.39)	0.035 (1.23)	0.004 (0.57)	0.108 (2.15)**	0.004 (0.23)	155	2.76**	0.29	0.17
	Large-size	−0.007 (1.17)	0.100 (1.93)*	−0.010 (1.82)*	0.232 (2.74)***	0.0001 (0.01)	−0.004 (0.37)	0.109 (1.76)*	0.003 (0.23)	0.081 (1.12)	0.122 (2.19)**	81	1.78*	0.48	0.30

Notes: This table shows impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER3 equals 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with small board size and one with large board size as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.25: Robustness Test 12: The Roles of Corporate Governance Mechanism (2005 , OVER 3 and Board Size).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 3	OVER3* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
LEV	Small-size	0.002 (0.48)	0.098 (2.04)**	0.005 (0.82)	−0.110 (0.32)	−0.456 (1.50)	−0.017 (1.90)*	0.054 (1.03)	−0.016 (0.96)	0.050 (1.10)	0.038 (0.60)	106	1.49	0.29	0.13
	Large-size	−0.002 (0.61)	0.079 (2.90)***	−0.004 (0.97)	−0.101 (0.33)	0.046 (0.22)	−0.002 (0.24)	−0.019 (0.76)	0.002 (0.25)	0.050 (1.10)	0.087 (2.57)**	67	2.85***	0.37	0.08
DIV1	Small-size	0.001 (0.18)	0.047 (1.09)	0.004 (0.64)	−0.030 (1.09)	6.020 (0.66)	−0.015 (1.56)	0.031 (0.53)	−0.006 (0.36)	0.040 (0.80)	0.046 (0.85)	122	1.12	0.18	0.01
	Large-size	−0.016 (1.63)	0.101 (1.59)	−0.009 (1.05)	0.061 (0.74)	37.946 (1.10)	0.018 (1.04)	0.082 (1.20)	0.027 (1.27)	0.047 (0.49)	0.101 (1.15)	51	1.16	0.53	0.24
AGE	Small-size	0.004 (1.20)	0.015 (0.46)	0.009 (1.42)	−0.086 (1.83)*	−0.751 (1.42)	−0.047 (1.23)	−0.025 (0.74)	0.009 (0.53)	0.109 (2.16)**	0.065 (0.81)	97	1.99*	0.27	0.08
	Large-size	−0.002 (0.37)	0.032 (0.70)	0.002 (0.63)	0.027 (0.44)	−0.385 (2.28)**	−0.009 (0.35)	0.012 (0.35)	0.022 (1.52)	0.105 (1.94)*	0.023 (0.37)	72	2.27**	0.45	0.21
CASH	Small-size	0.004 (0.40)	0.026 (0.51)	0.006 (1.30)	−0.001 (2.06)**	0.316 (0.54)	−0.002 (0.29)	−0.359 (0.59)	−0.008 (0.69)	0.112 (1.46)	−0.016 (0.29)	74	1.83*	0.26	0.01
	Large-size	−0.002 (0.23)	0.314 (3.57)***	−0.005 (1.81)*	0.065 (1.47)	−0.281 (0.98)	−0.007 (1.23)	−0.899 (1.83)*	0.002 (0.17)	0.012 (0.10)	0.124 (3.13)***	99	3.13**	0.38	0.20
DIV2	Small-size	0.001 (0.27)	0.033 (0.84)	0.003 (0.96)	−0.025 (0.99)	−0.0001 (0.04)	−0.007 (1.07)	0.031 (0.60)	0.004 (0.34)	0.063 (1.49)	0.036 (1.19)	155	1.31	0.14	0.01
	Large-size	−0.005 (1.01)	0.089 (2.13)**	−0.001 (0.26)	0.129 (1.92)*	0.010 (1.29)	−0.001 (0.07)	0.057 (1.09)	0.017 (1.26)	0.090 (1.33)	0.034 (1.01)	81	1.73*	0.46	0.27

Notes: This table shows impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER3 equals 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with small board size and one with large board size as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.26: Robustness Test 13: The Roles of Corporate Governance Mechanism (2006 , OVER 3 and Non-executive Ratio).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 3	OVER3* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
LEV	Low-ratio	0.002 (0.84)	0.044 (1.45)	0.003 (0.84)	0.255 (0.85)	−0.072 (0.31)	−0.010 (1.57)	0.018 (0.77)	0.009 (1.04)	0.127 (2.86)***	0.025 (0.67)	104	4.02**	0.40	0.25
	High-ratio	0.002 (0.26)	0.073 (2.25)***	−0.004 (1.00)	0.029 (0.06)	−0.012 (0.05)	−0.003 (0.54)	0.024 (0.38)	0.005 (0.65)	0.035 (0.65)	0.070 (1.58)	69	1.47	0.30	0.01
DIV1	Low-ratio	0.001 (0.51)	0.011 (0.50)	0.007 (1.52)	0.034 (0.83)	−1.048 (0.17)	−0.004 (0.45)	0.026 (1.20)	0.013 (1.02)	0.203 (3.10)***	0.035 (0.63)	101	1.77*	0.35	0.20
	High-ratio	−0.003 (0.52)	0.102 (2.33)*	−0.003 (0.46)	0.118 (1.06)	−1.433 (0.06)	−0.009 (0.63)	0.135 (1.84)*	−0.009 (0.51)	0.049 (0.59)	0.081 (0.85)	72	1.05	0.31	0.06
AGE	Low-ratio	0.002 (0.82)	0.030 (1.08)	0.009 (2.44)**	0.010 (0.23)	−0.207 (0.54)	−0.025 (1.15)	0.028 (1.08)	−0.009 (2.02)**	0.106 (1.76)*	−0.009 (0.19)	94	2.60***	0.32	0.14
	High-ratio	−0.004 (0.58)	0.094 (1.06)	−0.008 (1.41)	0.205 (1.63)	−0.542 (1.59)	0.015 (0.48)	0.140 (1.22)	0.016 (0.86)	0.132 (1.38)	0.060 (0.56)	75	1.42	0.34	0.08
CASH	Low-ratio	−0.009 (0.75)	0.047 (0.64)	0.003 (0.87)	−0.011 (2.40)**	0.656 (1.69)*	−0.002 (0.26)	−0.420 (0.79)	−0.033 (1.46)	0.253 (1.32)	0.031 (0.73)	77	2.69**	0.36	0.15
	High-ratio	0.017 (1.89)*	0.097 (1.10)	−0.001 (0.49)	0.058 (1.41)	−0.449 (1.47)	−0.001 (0.27)	0.108 (0.27)	−0.014 (1.17)	0.150 (1.68)*	0.035 (1.11)	96	2.97***	0.36	0.17
DIV2	Low-ratio	0.001 (0.45)	0.024 (0.99)	0.001 (0.39)	0.053 (1.22)	−0.001 (2.75)***	−0.005 (0.70)	0.035 (1.52)	0.009 (0.92)	0.141 (2.58)**	0.021 (0.79)	121	6.05***	0.31	0.17
	High-ratio	−0.002 (0.28)	0.112 (2.89)***	−0.002 (0.53)	0.134 (1.68)*	0.001 (0.36)	−0.008 (1.29)	0.120 (1.90)*	−0.001 (0.11)	0.088 (1.05)	0.056 (1.49)	115	1.83*	0.32	0.17

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER3 equals 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high ratio of non-executive directors and ones with low ratio as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.27: Robustness Test 14: The Roles of Corporate Governance Mechanism (2005 , OVER 3 and Non-executive Ratio).

Dependent variable		Independent variables												
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 3	OVER3* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
LEV	Low-ratio	0.0004 (0.15)	0.072 (1.90)*	0.003 (0.44)	−0.129 (0.33)	−0.420 (1.26)	−0.014 (1.27)	0.008 (0.22)	−0.006 (0.42)	0.090 (1.86)*	0.064 (1.10)	104	1.29	0.23	0.03
	High-ratio	−0.001 (0.17)	0.113 (1.89)*	−0.004 (0.87)	0.076 (0.19)	0.027 (0.08)	−0.005 (0.70)	0.087 (0.84)	−0.009 (0.74)	0.009 (0.14)	0.080 (1.67)	69	1.62	0.26	0.01
DIV1	Low-ratio	0.002 (0.56)	0.022 (0.68)	0.004 (0.54)	−0.021 (0.43)	−0.387 (0.04)	−0.004 (0.34)	−0.008 (0.28)	0.020 (1.06)*	0.147 (2.02)**	0.003 (0.12)	101	1.07	0.39	0.19
	High-ratio	−0.006 (1.09)	0.129 (1.85)*	−0.002 (0.29)	0.013 (0.31)	36.626 (1.49)	0.004 (0.41)	0.114 (1.22)	−0.012 (0.64)	−0.035 (0.44)	0.058 (0.74)	72	1.62	0.35	0.11
AGE	Low-ratio	0.008 (2.16)**	0.026 (0.77)	0.006 (1.17)	−0.094 (2.10)**	−0.438 (1.00)	−0.044 (1.38)	−0.032 (1.03)	0.005 (0.38)**	0.082 (1.53)**	0.073 (1.12)	94	2.12**	0.26	0.06
	High-ratio	−0.005 (1.44)	0.083 (1.72)*	−0.003 (0.69)	0.086 (1.24)	−0.460 (1.37)	0.025 (1.84)*	0.024 (0.63)	0.024 (1.73)*	0.038 (0.57)	0.012 (0.16)	75	2.09**	0.42	0.19
CASH	Low-ratio	−0.004 (0.35)	0.063 (1.05)	0.0003 (0.08)	−0.013 (0.55)	0.981 (3.06)***	0.001 (0.15)	−1.052 (1.92)*	−0.003 (0.15)	0.055 (0.37)	0.043 (0.90)	77	4.44***	0.44	0.25
	High-ratio	0.016 (1.40)	0.110 (1.98)*	−0.005 (1.47)	0.108 (2.41)**	−0.394 (1.08)	−0.006 (1.03)	0.160 (0.33)	−0.007 (0.66)	0.151 (2.46)**	0.082 (1.95)*	96	2.27**	0.38	0.20
DIV2	Low-ratio	0.001 (0.17)	0.018 (0.54)	0.001 (0.17)	0.002 (0.03)	0.002 (0.13)	−0.004 (0.37)	0.002 (0.08)	0.020 (1.30)	0.133 (2.08)**	0.038 (0.84)	121	1.79*	0.18	0.02
	High-ratio	−0.004 (0.91)	0.118 (2.22)**	0.001 (0.50)	0.069 (1.19)	0.004 (1.49)	−0.006 (0.85)	0.107 (1.31)	−0.008 (0.55)	0.006 (0.09)	0.036 (1.25)	115	2.54*	0.31	0.15

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER3 equals 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high ratio of non-executive directors and ones with low ratio as explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.28: Robustness Test 15: The Roles of Corporate Governance Mechanism (2006, OVER 3 and Blockholder Ownership).

Dependent variable		Independent variables													
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 3	OVER3* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
Predicted		+	+	+	+/-	+/-	+	+	+/-	+ in low-ownership					
LEV	Low-ownership	0.001 (0.64)	0.046 (1.78)*	0.001 (0.27)	−0.290 (0.98)	0.216 (1.24)	−0.014 (1.58)	−0.027 (0.96)	−0.001 (0.22)	0.062 (1.27)	0.059 (2.03)**	81	1.09	0.38	0.18
	High-ownership	0.002 (0.70)	0.012 (0.29)	−0.001 (0.15)	0.514 (1.53)	0.151 (0.68)	−0.003 (0.41)	0.041 (1.16)	0.005 (0.47)	0.129 (2.44)**	0.027 (0.59)	92	2.09**	0.46	0.30
DIV1	Low-ownership	0.001 (0.23)	0.029 (1.18)	0.010 (1.92)*	−0.009 (0.21)	−9.878 (0.95)	0.014 (1.25)	0.013 (0.36)	0.024 (1.43)	0.219 (2.46)**	−0.096 (1.79)*	84	1.61	0.47	0.31
	High-ownership	0.005 (1.03)	0.019 (0.37)	−0.004 (0.56)	0.100 (1.32)	6.081 (0.66)	−0.015 (1.58)	0.037 (0.91)	−0.017 (1.20)	0.119 (1.53)	0.099 (1.42)	89	0.97	0.36	0.18
AGE	Low-ownership	0.001 (0.12)	0.035 (1.44)	0.003 (1.27)	−0.015 (0.34)	−0.246 (1.26)	−0.031 (2.11)**	−0.002 (0.08)	0.012 (1.53)	0.132 (2.91)***	0.064 (1.67)*	89	5.05***	0.50	0.34
	High-ownership	0.007 (0.95)	0.075 (1.14)	−0.007 (0.89)	0.216 (1.91)*	−0.188 (0.37)	0.015 (0.45)	0.081 (1.17)	−0.027 (1.32)	0.094 (1.30)	0.052 (0.58)	80	1.06	0.37	0.15
CASH	Low-ownership	−0.005 (0.65)	0.059 (0.88)	−0.001 (0.36)	−0.006 (0.15)	0.162 (0.41)	−0.001 (0.14)	−0.446 (1.90)*	−0.044 (2.61)**	0.473 (3.55)***	0.074 (2.35)**	88	2.75**	0.38	0.18
	High-ownership	−0.006 (0.54)	0.173 (2.02)**	0.003 (1.27)	0.031 (0.74)	−0.234 (0.76)	−0.002 (0.34)	−0.161 (0.33)	−0.008 (0.70)	0.001 (0.01)	0.011 (0.30)	85	2.03*	0.28	0.05
DIV2	Low-ownership	−0.0001 (0.02)	0.051 (2.11)**	0.003 (1.01)	0.025 (0.62)	0.006 (1.62)	0.009 (1.07)	0.049 (1.25)	0.016 (1.30)*	0.156 (2.09)*	−0.023 (0.93)	102	2.18**	0.41	0.27
	High-ownership	0.007 (1.73)*	0.023 (0.53)	−0.002 (0.63)	0.112 (1.90)*	−0.012 (1.29)	0.034 (2.19)**	0.035 (0.94)	−0.007 (0.71)	0.133 (1.91)*	0.066 (1.99)*	134	4.25***	0.33	0.19

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. OVER3 equals 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high blockholders' ownership and ones with low ownership explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 2.29: Robustness Test 16: The Roles of Corporate Governance Mechanism (2005, OVER 3 and Blockholder Ownership).

Dependent variable		Independent variables												
INVESTMENT		MTB	CFLOW	SIZE	LEV	DIV	AGE	CASH	OVER 3	OVER3* CFLOW	Constant	Obs	F-test	R^2	Adj. R^2
Predicted		+	+	+	+/-	+/-	+	+	+/-	+ in low-ownership					
LEV	Low-ownership	0.001 (0.39)	0.056 (2.24)**	0.002 (0.59)	−0.077 (0.22)	0.060 (0.27)	−0.014 (1.60)	−0.026 (1.06)	−0.004 (0.28)	0.023 (0.48)	0.106 (2.49)**	81	1.90*	0.22	0.02
	High-ownership	0.001 (0.20)	0.087 (1.38)	0.004 (0.61)	−0.143 (0.36)	−0.263 (0.71)	−0.007 (0.62)	0.091 (1.22)	−0.008 (0.42)	0.108 (1.90)*	0.017 (0.26)	92	1.56	0.29	0.08
DIV1	Low-ownership	−0.002 (0.71)	0.044 (1.19)	0.006 (0.94)	−0.047 (1.07)	−20.793 (1.64)	0.012 (0.72)	0.012 (0.49)	−0.016 (0.90)	0.024 (1.34)	0.131 (0.41)	84	1.23	0.27	0.04
	High-ownership	0.0004 (0.01)	0.080 (1.12)	0.0004 (0.07)	0.009 (0.22)	15.902 (1.39)	−0.008 (0.77)	0.079 (0.93)	−0.011 (0.50)	0.046 (0.63)	0.054 (1.00)	89	1.37	0.28	0.06
AGE	Low-ownership	−0.001 (0.34)	0.062 (1.77)*	−0.001 (0.16)	−0.068 (1.75)*	−0.017 (0.06)	−0.063 (2.31)**	−0.031 (1.28)	0.017 (1.32)	0.082 (1.76)*	0.196 (2.50)**	89	2.88***	0.32	0.11
	High-ownership	0.004 (0.83)	0.024 (0.69)	0.006 (1.65)	0.032 (0.47)	−0.397 (1.28)	−0.006 (0.14)	0.047 (1.03)	0.008 (0.40)	0.114 (2.23)**	−0.025 (0.28)	80	1.46	0.32	0.07
CASH	Low-ownership	−0.012 (1.45)	0.053 (1.04)	−0.004 (1.24)	0.039 (0.95)	0.548 (1.46)	−0.006 (0.87)	−0.751 (1.31)	−0.020 (1.13)	0.353 (2.86)***	0.118 (2.52)**	88	2.20**	0.34	0.13
	High-ownership	−0.009 (0.68)	0.165 (2.01)**	0.004 (1.43)	0.023 (0.54)	−0.139 (0.39)	−0.005 (0.81)	−0.329 (0.74)	−0.001 (0.06)	0.027 (0.30)	0.020 (0.65)	85	1.99*	0.31	0.08
DIV2	Low-ownership	−0.002 (0.80)	0.051 (1.89)*	0.001 (0.26)	−0.002 (0.04)	0.005 (1.87)*	0.003 (0.30)	0.004 (0.12)	0.027 (1.50)	0.137 (1.77)*	0.028 (0.63)	102	2.35**	0.24	0.06
	High-ownership	0.0004 (0.08)	0.064 (1.16)	0.001 (2.72)***	0.037 (0.90)	−0.0004 (2.28)**	−0.005 (0.74)	0.087 (1.15)	0.003 (0.20)	0.082 (1.63)	0.024 (1.05)	134	2.37**	0.24	0.10

Notes: This table shows the impact of corporate governance on the relationship between managerial overconfidence and cash flow sensitivity of investment in financially constrained firms. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. OVER3 equals 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise. In DIV 2 group, SIZE 2 and DIV 2 are included. The sample is divided into two subgroups: firms with high blockholders' ownership and ones with low ownership explained in Section 2.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Chapter 3

How Does Investment Affect Cash Flow Sensitivity of Cash: An Empirical Study of UK Firms

3.1 Introduction

There is an extensive literature that attempts to explain firms' motives for holding cash. One of the explanations is based on transaction costs (Meltzer, 1963; Miller and Orr, 1966), that is, firms with lower transaction costs tend to accumulate less cash. Moreover, departing from capital market perfection, asymmetric information (Myers and Majluf, 1984) and agency problems (Jensen and Meckling, 1976; Myers, 1977) provide further grounds to explain another precautionary motivation for holding cash. That is, when the costs of external financing increase, firms needing external funds to invest will have to pass up some positive NPV projects. Therefore, investment expenditure is not only subject to their growth opportunity but also subject to the availability of internal funds. Under such conditions, holding cash can avoid the costs of cash shortfalls and facilitate future investment ability. Dittmar *et al.* (2003), on the other hand, suggest that holding cash can be indicative of managerial discretion. For example, entrenched managers would rather hold more cash to pursue their private benefits than distribute it to shareholders. Previous empirical research also provides detailed evidence on the determinants of cash holding (e.g. Kim *et al.*, 1998; Opler *et al.*, 1999) incorporating firms' specific characteristics such as size, growth opportunity, cash flow, etc.

Another strand of the cash holding literature links financial constraints with cash flow sensitivity of cash. A notable study is by Almeida *et al.* (2004), who emphasize that financial constraints can create a demand for hoarding cash to facilitate future investment. Their results suggest that cash flow sensitivity of cash is positive in financially constrained firms, while there is no systematic relationship between cash holdings and cash flow in financially unconstrained firms. This is an alternative explanation for the effects of financial constraints emphasizing the linkage between financial constraints and liquidity demand rather than the linkage between financial constraints and corporate investment demand in other previous papers (e.g. Fazzari *et al.*, 1998; Hoshi *et al.*, 1991; Whited, 1992, etc). However, their argument still do not provide a clear account about how financial constraints can be related to both cash flow sensitivity of

cash and cash flow sensitivity of investment within one framework. One hypothesis, for example, is that financially constrained firms should increase their investment with cash flow, which may also lead firms to save more cash out of cash flow. The main objective of this chapter is, therefore, to provide more insights into this relationship by providing a detailed analysis of the impact of investment on cash flow sensitivity of cash in the presence of financial constraints.

This chapter consists of three stages.

In the first stage, we simply discuss the determinants of cash holding relating to several firm-specific characteristics such as size, leverage, dividend, cash flow, investment and managerial ownership.

In the second stage, we emphasize the importance of financial constraints in determining cash holdings. In line with Almeida *et al.* (2004), we acknowledge that there exists a positive relationship between cash flow sensitivity of cash and financial constraints. In particular, we evaluate the extent to which investment influences cash flow sensitivity of cash by emphasizing the importance of financial constraints. A possible scenario is that financially constrained firms are those firms that have limited internal funds and lower capacity to raise funds externally for investment. They, therefore, have higher preferences for saving cash out of cash flow than other unconstrained firms. Owing to insufficient internal cash flow in financially constrained firms, not all profitable investment projects can be achieved to a first-best level. When cash flow increases, firms distribute additional cash flow into dividend payouts, debt payoff, investment and cash holding. However, financially constrained firms are unlikely to choose dividend payouts (a zero NPV project) rather than pass up other positive NPV investment projects. Meanwhile, cash plays an important role in hedging future cash shortfalls in these constrained firms. As a result, an increase in cash flow would lead to an increase in investment and an increase in cash holding in the first stage. However, more investment expenditure may limit the source available for cash and increase cash flow fluctuations in the future. Then, an increase in investment expenditure can finally induce financially constrained firms to save

more cash out of cash flow. In contrast, financially unconstrained firms have higher capacity to raise either internal or external funds and are expected to undertake all profitable investment projects to the first-best level. Hence, cash holding policy is independent of cash flow and investment policy. Empirically, we hypothesize that investment can increase firms' propensity to save cash in financially constrained firms, with reference to cash flow sensitivity of cash. In contrast, we do not expect to find a determinant impact of investment policy on cash flow sensitivity of cash in financially unconstrained firms.

In the third stage, we further test whether investment decisions by overconfident managers can affect cash flow sensitivity of cash, especially in financially constrained firms. The underlying notion is that that agents/managers may act in a manner deviating from the behaviour we would expect of fully rationality. In particular, behavioural researchers have argued that overconfident managers tend to make biased corporate decisions (Camerer and Lovallo, 1999; Roll, 1986; Malmendier and Tate, 2005; Malmendier and Tate, 2008; Malmendier *et al.*, 2007). These studies attribute managerial overconfidence to a stylish fact that overconfident managers tend to overestimate the future returns of investment projects under their control. In Chapter 2, we have analyzed the issue of how managerial overconfidence affects investment decisions in financially constrained firms. A natural extension would be whether this impact can further affect firms' cash holding policy. In this chapter, we focus on this clue aiming to provide a more comprehensive analysis on the association between investment decisions and cash policy in the presence of managerial overconfidence.

Our hypothesis is as follows: although cash is an important tool for hedging cash flow shortfalls in the future and avoiding transaction costs, financially constrained firms with overconfident managers might still persist in investing in their perceived profitable projects as many as possible rather than save more cash out of cash flow. This is because overconfident managers believe the benefits of their desired projects should be higher than the benefits of accumulating cash. In other words, the positive relationship between investment and cash flow sensitivity of cash may not be held in financially constrained firms with

overconfident managers. We, therefore, hypothesize that the positive association between cash flow sensitivity of cash and investment expenditure becomes weaker in financially constrained firms with managerial overconfidence than those firms without managerial overconfidence.

To empirically investigate these hypotheses, we use a large sample of UK listed firms over the period 1996–2006 and collect various firm-specific characteristics (e.g. market to book value ratio, cash flow, size, leverage, etc.) in order to analyse the determinants of cash holding. In line with the prediction of the non-linear relationship between managerial ownership and cash holding (Ozkan and Ozkan, 2004), we also include managerial ownership and its squared and cubic values in our estimation. We then interact investment expenditure with cash flow as an essential factor in our regression. Doing so enables us to test the existence of the impact of investment on cash flow sensitivity of cash. Moreover, we identify firms as the financially constrained and unconstrained firms according to their single indicators, such as dividend payouts, size, leverage and age. Finally, to test the role of managerial overconfidence on cash holding policy, we split firms into those with managerial overconfidence and those with managerial non-overconfidence by using our managerial measurement (OVER 1). This is a dummy variable, which equals 1 when firms have been identified as net buyers in the open stock market for at least three years between 2003 and 2006, otherwise it equals 0. To give more evidence, we also use press portrayal as an alternative measurement (OVER 2).

With respect to estimation methods, we initially employ an average cross-sectional technique developed by Rajan and Zingales (1995), in which the averaged value of explanatory variables are used to allow for annual adjustment rather than fixed adjustment over the entire sample period in GMM and lagged explanatory variables (one year lag) are used to reduce endogeneity. We execute our CSA regressions over two time periods: one, the dependent variable is measured in year 2006; two, the dependent variable is measured in year 2005. And the independent variables are average-past values over 2002-2005 and 2001-2004 respectively. In addition, the first-difference GMM and the system GMM

estimations (Arellano and Bond, 1991; Arellano and Bover, 1995) are used to present target adjustment models. This enables us to explain a firm's cash holding in terms of its cash holding in the previous period and its target level. Also, the dynamic models can control for unobservable firm-specific effects and firm-constant time-specific effects. And their instrument variables can be used to deal with endogeneity. Moreover, our dynamic analysis is conducted in financially constrained and unconstrained firms, respectively. We predict that there exist different adjustment speeds between financially constrained and unconstrained firms, that is financially constrained firms are expected to have lower adjustment speeds with regard to their target cash level. We argue that it is easier for financially unconstrained firms to change their cash holding level and investment level by choosing among several alternative sources of financing. In contrast, financially constrained firms are more likely to face future cash shortfalls and their target cash levels are relatively higher. In order to adjust to the target levels, they have to pass up some positive NPV projects and accumulate cash out of cash flow. Hence, it would take longer for financially constrained firms to adjust to their target cash levels.

Our average cross-sectional estimation shows that firms with higher growth opportunity, lower investment, lower dividend payouts and lower leverage tend to hold more cash. Our results also find a non-linear relationship between managerial ownership and cash holding. When managerial ownership is at a low level, we find a negative and significant relationship between ownership and cash holding (*alignment effect*). This implies that an increase in managerial ownership can help to align the conflicts between managers and shareholders and thus managers tend to use less cash to pursue their private benefits. However, when managerial ownership exceeds a certain level, the benefits of alignment effect can be replaced by the private benefits of holding cash (*entrenchment effect*). Then, an increase in managerial ownership can result in higher cash holding. Finally, the negative coefficient of the cubic value of managerial ownership means that the positive relationship between cash holding and ownership will change back to a negative one. This indicates that the interests of managers can converge to the interests of shareholders when managerial ownership is substantially high.

More importantly, our average cross-sectional estimation implies a significant and positive relationship between the interaction term of investment and cash flow and cash holding in financially constrained firms with lower leverage ratio or lower dividend payouts. Contrarily, in financially unconstrained firms, we cannot find such a significant relationship. This supports our prediction that investment expenditure can increase cash flow sensitivity of cash in financially constrained firms, but cannot affect cash flow sensitivity of cash in financially unconstrained firms. In addition, we also find that cash flow has a significant and positive impact on cash in constrained firms, identified by leverage and dividend, which is in line with the arguments of Almeida *et al.* (2004).

In terms of the role of managerial overconfidence, we especially analyse its impact on cash flow sensitivity of cash in financially constrained firms. The cross-sectional regression demonstrates that financially constrained firms with managerial overconfidence have an insignificant relationship between the interaction term of investment and cash flow and cash holding. However, in dividend, leverage and age groups, financially constrained firms without managerial overconfidence retain a significant positive relationship between the interaction term of cash flow and investment and cash holding. This implies that overconfident managers tend to believe the benefits of their projects should be larger than the benefits of accumulating cash. Hence they would rather invest than retain cash out of cash flow. Therefore, we can conclude that managerial overconfidence can weaken the positive relationship between investment and cash flow sensitivity of cash in younger firms with lower leverage and dividend payouts.

Furthermore, our first-difference GMM and system GMM estimations provide consistent evidence that there exists a significant and positive relationship between investment and cash flow sensitivity of cash in financially constrained firms in leverage and dividend groups. In contrast, in financially unconstrained firms, investment cannot lead to any significant impact on the cash flow sensitivity of cash.

Finally, both dynamic GMM estimations show that financially constrained and unconstrained firms tend to adjust their cash holding to a target level. Our results reveal that this adjustment is slower in financially constrained firms, except for dividend group. This implies that financially unconstrained firms are able to quickly change their cash holding level and investment level by choosing among several alternative sources of financing. However, it would take longer for financially constrained firms to adjust to their target cash levels — either because of the higher target levels or the costs of adjustment they entail.

The remainder of the chapter is organized as follows. Section 3.2 reviews the determinants of cash holding. We argue the different roles of investment on cash flow sensitivity of cash in financially constrained and unconstrained firms. Then, we discuss the impact of investment by overconfident managers on cash flow sensitivity of cash, especially in financially constrained firms. Section 3.3 presents data and our estimation techniques. Our empirical results are provided in Section 3.4. Finally, in Section 3.5 conclusions are drawn.

3.2 Theoretical Background and Empirical Hypotheses

In the presence of perfect capital markets, cash holdings are irrelevant. However, holding cash can be relevant when firms are facing capital market imperfection. In what follows, we present the main reasons why cash holdings can be relevant.

3.2.1 Transaction Costs

There are two major motives associated with this framework: (1) the transaction costs motive and (2) the precautionary motive. The transaction motive is based on the costs of transferring cash from other non-cash substitutes (Keynes, 1936). Referring to the transaction costs, a value-maximizing firm balances the marginal costs and benefits of cash holding to hold an optimal amount of cash. Thus, those firms who can more cheaply convert their non-liquid assets into cash will hold

less cash. The precautionary motive is that firms need to accumulate cash to hedge their future cash shortfalls and so those firms who are more likely to face financial constraints in the future tend to hold more cash.

Nevertheless, holding cash also has costs. In fact, there are three feasible ways for firms to obtain cash promptly: cutting dividends, external funds from capital market or cutting off investment in production; however, each of them is costly. For example, assuming that managers aim to maximize their firms' value, then the costs of holding cash lie in their lower expected return relative to other investments with the same risk. Moreover, a large shortage of cash implies decreasing investment or raising more costly external funds. A study from Kim *et al.* (1998) emphasize that firms' optimal level of cash holding is the result of a trade-off between investment in production and investment in cash. Namely, there must be a critical level of external financing costs, above which firms would invest in cash. Meanwhile, due to potential financial constraints in the future, they may pass up some current positive growth opportunities to retain earnings on cash. Therefore, we can predict a positive relationship between cash holding and transaction costs.

Firms with sufficient cash flow have lower transaction costs and fewer incentives to hold large amounts of cash (Kim *et al.*, 1998, Opler *et al.*, 1999). Therefore, a negative relationship between cash and cash flow can be predicted. We define cash holding (CH) as the ratio of total cash and equivalents to total assets, while cash flow (CFLOW) is pre-tax profits plus depreciation over total assets. To the extent that investment can limit the internal source of cash holding, we could expect a negative relationship between investment expenditure and cash holdings. However, investment expenditure could also be regarded as a proxy for investment opportunities or costs of financial distress, in which investment can be positively related to cash (Hartzell *et al.*, 2006). Firms with better investment opportunities value cash more and accumulate more cash to satisfy higher future investment, the reason being that it is more costly for these firms to be financially constrained.We use the ratio of capital expenditure in fixed assets to total assets to measure investment expenditure (I).

Moreover, leverage ratio and dividend payouts can be related to the transaction costs. On one hand, firms having access to debt markets can use debt as a substitute for maintaining cash holdings. Larger amounts of debt imply firms' greater ability to raise funds from an external capital market (John, 1993). Moreover, Baskin (1987) argues that when the firms' debt ratio increases, the cost of funds used to invest in liquidity increases, and this can decrease the need for cash holding. Acharya *et al.* (2007) argue that debt can be regarded as negative cash only when financially constrained firms are facing lower hedging needs. As far as leverage can act as a proxy for firms' ability to issue debt, we predict that there would be a negative relationship between debt and cash holding and use LEVERAGE (LEV) to measure debt which is the ratio of total debt to total assets.

On the other hand, it is reasonable to predict that dividend paying firms are facing lower transaction costs than non-dividend paying firms, because they can gain cash relatively cheaper by cutting their payouts. This leads to a negative relationship between dividend and cash holdings. However, firms have incentives to stick to their dividend payout plan (Brav *et al.*, 2005) and they may have to accumulate cash to avoid future cash shortfalls. If this is the case, then we could expect a positive relationship between cash and dividend payouts. Nonetheless, if we regard dividend payouts and leverage as alternative substitutes for cash, we can expect cash holding to be positively related to them (Opler *et al.*, 1999; Kalcheva and Lins, 2007). We define dividend as the ratio of total cash dividend payouts to total assets (DIV1) and as the ratio of dividend payouts to earnings before dividend (DIV2).

Finally, Mulligan (1997) argues that the transaction cost motive for cash holding can be associated with firms' activity, technological sophistication and opportunity costs. In other words, larger firms are believed to have with lower transaction costs. Hence, we can expect a negative relationship between firms' size and cash holding in that those larger firms tend to hold less cash. Here, we use the natural logarithm of total assets to measure firms' size (SIZE) in 1996 prices.

3.2.2 Asymmetric Information

As mentioned above, external funds from the capital market can be one of the feasible ways for firms to obtain cash. In other words, if external funds are costly, more cash will be needed to facilitate future investment opportunities. This precautionary motive is based on capital market frictions due to asymmetric information and agency costs.

It has been acknowledged that asymmetric information between managers and investors can induce costly external financing. On the one hand, outside lenders realize it may be difficult to distinguish a risky debt from a safe one because of the asymmetric information between firms and themselves. They tend to limit their supply of loans by raising interest rates. As a result, firms are simply unable to access any loans they would like at a prevailing market interest rate (Stiglitz and Weiss, 1981). Moreover, this credit rationing induces adverse selection (Akerlof, 1970) in that all low-risk borrowers will be withdrawn from the market. Finally, only risky borrowers with higher returns will be ready to take up the higher interest rate debt contracts. On the other hand, Myers and Majluf (1984) propose the signalling role of equity issuance when asymmetric information exists between managers and the equity market. Assuming that managers know the future prospects of their firms while investors do not, managers in firms in good shape but with limited internal funds may be reluctant to issue stocks and pass up valuable investment projects, because they believe their stocks are undervalued.

Therefore, we can primarily predict that firms facing higher asymmetric information costs tend to hold more cash to avoid costly external funds. Empirically, firms with greater growth opportunities are more likely to incur higher bankruptcy costs or shortfalls of cash (Williamson, 1988; Harris and Raviv, 1990; Shleifer and Vishny, 1992), and then tend to have larger cash reserves. We predict a positive relationship between growth opportunity and cash holding. To proxy for investment opportunity (MTB), we also use the ratio of book value of total assets minus book value of equity plus market value of equity to book value of total assets. In addition, smaller firms exhibit less information

asymmetries (Collins *et al.*, 1981; Brennan and Hughes, 1991) and lower costs of external financing (Whited, 1992; Fazzari and Petersen, 1993) than larger firms, who tend to hold lower cash. In this respect, we can expect a negative relationship between firms' size and cash holding.

3.2.3 Agency Costs of Debt

The standard agency model examines the relationship between the principal and the agent within a firm. The agency costs arise when the interest of shareholders differ from those of bondholders. Two main kinds of agency costs have been frequently debated: asset substitution (Jensen and Meckling, 1976; Barnea *et al.*, 1980) and underinvestment problem (Myers, 1977). In the first case, incentive effects associated with debts can induce managers to undertake risky but higher return projects and transfer wealth from bondholders to themselves. To avoid this asset substitution, bondholders may have to pay higher monitoring and audit costs to oversee agents' behaviour. In the second case, if debt matures after the expired date of investment, then issuing debt can induce an underinvestment problem. The reason for this is because shareholders may not receive all net benefits from future investment opportunities, and part of them could be transferred to bondholders such that shareholders prefer not to invest, even though the projects are valuable. Although such costs are initially borne by the principals (bondholders), they are finally transferred to managers (shareholders) through contracting.

In both cases, firms may face costly external funds and have to pass up some current profitable investment opportunities. Firms with higher agency costs tend to hold more cash to hedge future cash shortfalls and avoid raising costly external funds. Firms with higher leverage level are expected to face higher agency costs and bankruptcy costs and hold more cash. Hence, we can predict that leverage is positively related to cash holding. However, firms can use leverage as a substitute for holding cash because leverage can act as a proxy for firms' ability to borrow debts (John, 1993). If this is the case, we predict a negative relationship between leverage and cash holding.

3.2.4 Agency Costs of Managerial Discretion

Besides the low return of cash holding, another cost of holding cash is its agency costs of managerial discretion. Jensen (1986) proposes a free cash flow theory to identify another agency cost arising from conflicts between managers and shareholders, in which managers with more cash have greater flexibility to pursue their own private interests at shareholders' expense. Cash as free cash flow should be paid back to shareholders, but these payouts can reduce managers' control over firms' resources. Hence, the less cash managers pay back, the more self-interest can be retained. We expect that the agency cost of managerial discretion is positively related to cash holding. In other words, increasing cash may reduce firms' value but increase managers' private benefits.

Agency costs arising from the conflicts between managers and shareholders could be eliminated by managerial ownership. Jensen and Meckling (1976) formalized a relationship between firms' value and managerial ownership. They suggest that firms' value depends on the fraction of shares owned by managers. So, more managerial shareholdings can result in less agency costs and higher firm value. However, some empirical studies indicate that this relationship can be non-monotonic (e.g. Stulz, 1988; Morck *et al.*, 1988; McConnel and Serveas, 1990, 1995; Short and Keasey, 1999). For example, in a takeover market (Stulz, 1988), when managerial ownership increases, the possibility of hostile takeover will be lower. But this possibility will be zero when managerial ownership rises to 50%. Morck *et al.* (1988) proposed a trade-off of two opposing forces arising from managerial shareholdings: managerial tendency to pursue their own interests (*entrenchment effects*) and greater coincidence between managers and outsiders (*incentive alignment effects*). McConnel and Serveas (1990, 1995) document a significant curvilinear relation between Tobin's Q and managerial ownership: Q first increases according to the fraction of shares held by corporate insiders, and then declines as insider ownership increases beyond the 40–50% range. Using UK data, Short and Keasey (1999) show that the performance of firms as measured by RSE is positively related with managers' ownership in the 0–15.58% range, negatively related in the 15.58–41.84% range and positively related when managers' ownership exceeds 41.84%. The turning points change

to 12.99 and 41.99%, respectively when VAL is used to measure the performance.

In the context of cash holding decisions, the evidence of the relationship between cash holding and managerial ownership is mixed. Opler *et al.* (1999) report neither strong evidence of a linear association between insider shareholding and cash in the US nor any evidence of their non-linear relationship. However, Ozkan and Ozkan (2004) document a cubic relationship between managerial ownership and cash holding due to the opposing impacts of incentive alignment effects and entrenchment effects. That is, an increase in managerial ownership can help to align the interests of managers and shareholders and thus managers tend to use less cash to pursue their private benefits (*alignment effects*). Also, there exists a negative relationship between cash holding and managerial ownership. However, when managerial ownership exceeds a certain level, the benefits from alignment effects cannot be greater than the private benefits by holding more cash. In this case the conflicts will not be aligned and managers tend to hold more cash (*entrenchment effects*). Thus, managerial ownership is predicted to be negatively related to the amount of cash reserves.

Therefore, a preliminary investigation about the relationship between managerial ownership and cash holding is carried out. Figure 3.1 presents the way in which the two variables are associated. It seems that at low levels of managerial ownership, managerial ownership is negatively related to cash holding. The appearance of Figure 3.1 is similar as the one provided by Ozkan and Ozkan (2004). But the turning point is quite different from theirs. Cash holdings first decrease with managerial ownership. When firms have managerial ownership between 9 and 15%, cash holdings fall to the lowest level of. Once managerial ownership exceeds 15%, the negative relationship between managerial ownership and cash holdings changes to be a positive one. Finally, cash holding decreases to a lower level when managerial ownership exceeds 70%. This indicates that the interests of managers can converge to the interests of shareholders when managerial ownership is high enough.

In general, the figure reveals that the relationship between cash holding and

managerial ownership is non-monotonic. To control for the non-linear aspect of managerial ownership, in our empirical model we include the level of managerial ownership (OWN), the square value of managerial ownership (OWN^2) and the cubic value of managerial ownership (OWN^3). Doing so, we capture the possibility that the relationship between managerial ownership and cash holding has two turning points. Managerial ownership (OWN) is measured as the percentage of shares held by all executive directors.

3.2.5 The Role of Financial Constraints

Another strand of cash holding literature is to link financial constraints with cash holding. In fact, based on the above analysis, firms with limited internal funds and higher costs of external funds to invest are more likely to be financially constrained and tend to retain more cash holdings out of cash flow. Hence, we can expect a positive relationship between the costs of external funds and cash holdings. In the following section, we present a brief review of related research in this respect.

The role of financial constraints has been widely acknowledged by the investment literature. They argue that financially constrained firms should rely more heavily on internal cash flows to finance investment. And investment is more sensitive to the fluctuations of cash flow in firms with lower dividend payouts. These conclusions, however, have been challenged on theoretical and empirical grounds (see, Kaplan and Zingales, 1997; Cleary 1999 etc) that firms classified as less financially constrained actually exhibit higher investment-cash flow sensitivity.

Despite these controversies concerning investment-cash flow sensitivity, Almeida *et al.* (2004) propose an alternative model of corporate demand for liquid assets. They argue that financial constraints should be related to firms' propensity to save cash out of cash flow, which they refer to as "cash flow sensitivity of cash". Their notion originates from Keynes' (1936) research, which proposes that the importance of corporate cash policy is influenced by firms'

capacity to raise external finance (financial constraints). It is beneficial for financially constrained firms to retain cash to avoid transaction costs and future cash shortfalls arising from agency problems and asymmetric information. In contrast, financially unconstrained firms have unrestricted access to external capital markets, so internal funds and cash holding is irrelevant. Therefore, they believe that cash flow sensitivity of cash should be increased in financially constrained firms, while such a systematic relationship between cash flow and cash holding does not exist in financially unconstrained firms. Thus, we expect that financially constrained firms display a positive cash flow sensitivity of cash, while financially unconstrained firms do no have such a positive sensitivity.

Finally, we use the following four alternative criteria to identify financially constrained and unconstrained firms: SIZE, LEV, DIV1, DIV2 and AGE. Specifically, we assign to the category of financially constrained firms those firms that are in the bottom three deciles (smaller) of the distribution (the distribution of size leverage, age or dividend). And those firms that are in the top three deciles (larger) of the distribution are assigned to the category of financially unconstrained firms.

3.2.6 Interaction of Investment and Cash Flow

Provided that cash flow is positively related to investment (e.g. Fazarri *et al.*, 1988; Devereux and Shiantarelli, 1990; Bond and Meghir, 1994; Hoshi *et al.*, 1991) and cash holding (Almeida *et al.*, 2004), especially in financially constrained firms, cash holding and investment in these firms can both increase with cash flow. A following question could be whether the interaction of cash and investment could be used to further explain the positive cash flow sensitivity of cash and the positive cash flow sensitivity of investment in financially constrained firms.

In the following section, we discuss this question in two respects. The possible framework is that, on the one hand, cash policy should affect investment-cash flow sensitivity. The lower the capacity of raising external funds is, the higher the cash holdings are required, which may hamper firms' current investment but

facilitate their ability to invest in the future. In this regard, we will provide some related literature later. On the other hand, investment decisions can also affect cash flow sensitivity of cash. Since investment and cash holding are both determined by the availability of internal funds (cash flow) in financially constrained firms, more investment can limit the source available for cash and increase cash flow fluctuations in the future. Therefore, from the hedging perspective, more cash will be required. In our study, we aim to centres on this respect whether investment can affect cash holding policy.

The issue of cash policy influencing investment-cash flow sensitivity has been studied by Arslan *et al.*, (2006) and Marchica and Mura (2007). Both sets of authors emphasize the hedging role of cash affecting investment-cash flow sensitivity by comparing cash-poor and cash-rich firms. The work of Arslan *et al.* (2006) investigates the role of cash holding in influencing the relationship between financing constraints and investment-cash flow sensitivity. Authors not only use traditional methods to classify the firms into financially constrained and financially unconstrained firms, such as size, age, business groups and dividend, but also use cash holding to check whether cash holding is valid acting as a proxy for financial constraint. In order to set up the cash holding classification scheme, they use median value as a benchmark. Financially constrained firms are those firms with below median value of cash holdings, while financially unconstrained firms are those firms with above median value of cash holdings. In addition, they consider target cash level as another benchmark. And financially constrained firms (cash-poor) are those cash holdings lower than their estimated target levels, and vice versa. They argue that investment is much more sensitive to cash flow in those cash-poor firms. Since their empirical study focuses on a developing country—Turkey, they also consider the role of cash on investment decisions in a period of financial crisis. They find that investment-cash flow sensitivity is greater in those cash-poor firms, especially in the period of crisis.

Another work from Marchica and Mura (2007) investigates how persistent cash policy affects investment decisions. They focus on investment-cash flow sensitivity in the UK listed firms using target cash holding as a benchmark to classify firms into high cash holding firms and low cash holding firms. In line

with the persistent cash holding policy proposed by Mikkelson and Partch (2003), they consider high (low) cash holding firms as those persistently holding higher (lower) cash than the estimated target level for at least three consecutive years. Meanwhile, they use GMM to reduce endogenous and heterogeneous problems in the panel and average cross-sectional regression to deal with annual adjustment of explanatory variables. Their findings show that those firms with persistently low cash invest less in investment expenditure, while firms with persistently high cash invest significantly more and their cash policy seems to decrease investment-cash flow sensitivity.

Unlike Arslan *et al.* (2006) and Marchica and Mura (2007), we investigate a reverse part of the interaction of investment and cash holding, which is how investment affects cash flow sensitivity of cash. In addition, we emphasize the importance of financial constraints in influencing this relationship.

The 'irrelevance of liquidity' theory deems (Almeida *et al.*, 2004) that a financially unconstrained firm is able to invest at the first-best and holds cash regardless of cash flow, which is still the case for the financially unconstrained firms in our hypothesis. That is because financially unconstrained firms are those either facing low costs of external financing or having sufficient internal funds for their present and future investment. Financially unconstrained firms can invest to their first-best investment levels, which are independent of other corporate financial policies including cash holding policy. The first-best investment in each period is determined at the point where firms can maximize their profits so that the (expected) marginal return on investments is equal to the marginal cost of capital. Consequently, the cash holding level is irrelevant of internal funds. In line with this, we predict that investment is independent of the cash flow sensitivity of cash in financially unconstrained firms.

On the contrary, financially constrained firms are unable to undertake all their positive NPV investment projects owing to limited internal funds and costly external financing. First, these firms prefer to use internal funds to invest as external financing is costly for them. When the firms are with limited internal funds for investment, their investment cannot be achieved at the first-best levels.

Second, the firms need cash holdings in the presence of asymmetric information, agency costs and transaction costs to facilitate future investment. Any increase in cash holdings will result in the sacrifice of some current profitable investments. Thus, we can predict that financially constrained firms might have a propensity to save more cash out of cash flow. Third, when cash flow increases, firms can choose dividend payout, debt payoff, investment and cash holding to distribute additional cash flow. However, financially constrained firms are unlikely to choose a zero NPV project (such as dividend payout) rather than pass up other valuable investments. Moreover, cash is a very important tool for avoiding transaction costs and cash flow shortfalls. As a result, constrained firms choose to increase investment and cash in the first stage. However, an increase in investment expenditure will limit the source of saving cash and increase cash flow fluctuations in the future. Then, an increase in investment expenditure can eventually induce constrained firms to save more cash out of cash flow. Empirically, we predict that investment can increase firms' propensity to save cash in constrained firms, which is called "cash flow sensitivity of cash".

3.2.7 The Role of Managerial Overconfidence

In the second chapter, we have already discussed the impact of managerial overconfidence on investment decisions. The premise behind this is that corporate decisions can also be affected when managers are irrational. Managerial overconfidence, as a particular irrationality, has been recently emphasized that overconfident managers tend to overestimate the outcomes of the investment under their control (see, Roll, 1986; Heaton, 2002; Malmendier and Tate, 2005; Malmendier and Tate, 2008; Malmendier *et al.*, 2007).

Building on this, we further explore whether investment undertaken by overconfident managers can exert an impact on cash flow sensitivity of cash. The analysis in this section is conducted especially in financially constrained firms rather than in financially unconstrained firms. That is because, for financially unconstrained firms, the 'irrelevance of liquidity' theory (see Almeida *et al.*, 2004) is also applicable even for firms with overconfident managers. With easier

access to capital, overconfident managers can invest at their desired first-best levels. Although they may invest more than non-overconfident managers, their investment decision is still irrelevant of cash flow sensitivity of cash.

In regard to financially constrained firms, we develop our hypothesis in two stages. First, we acknowledge that investments undertaken by overconfident managers increase with cash flow in financially constrained firms. The underlying notion is that overconfident managers are those who overestimate the return of investment projects and tend to invest more aggressively. In addition, managers' preference for internal funds over external funds to invest is still held for overconfident managers. The reason for this is that overconfident managers tend to believe capital markets undervalue their firms. Then, the cost of external financing in their perspective is much higher than that in the perspective of non-overconfident managers such that overconfident managers are reluctant to raise funds externally to invest. As a result, overconfident managers' overinvestment tendency and their financing preference induce positive investment-cash flow sensitivity in financially constrained firms with overconfident managers. In summary, an increase in cash flow can increase investment undertaken by overconfident managers in financially constrained firms.

Second, we apply the managerial view into the linkage between cash holding policy and investment and argue that a biased balance between cash holding and investment should exist. We focus on one of the drawbacks of investing liquid asset, which is the low return of holding cash. For instance, if firms expect to experience high costs of external financing, firms tend to save more cash out of cash flow. However, hoarding cash today means passing up current investment projects. Meanwhile, overconfident managers think the benefits of their desired investment should be larger than the benefits of accumulating cash. Hence, firms with overconfident managers tend to increase their investment with internal funds, but are reluctant to increase their cash holding. In other words, for financially constrained firms, when cash flow increases, overconfident managers would rather invest in production than invest in cash. Their propensity for saving more cash out of cash flow is less sensitive to cash flow than those with non-

overconfident managers. We predict that this managerial investment decision can eliminate the positive relationship between investment and cash flow sensitivity of cash holding in financially constrained firms.

Our main overconfidence dummy variable is organized as follows. That is we consider stock dealing decisions by all executive directors during the period 2003–2006. In a firm, when the amount of shares purchased by executive directors in a sample year is larger than the amount of shares sold by executive directors, the firm will be classified as a net buyer in this sample year. Moreover, we identify firms with managerial overconfidence based on their persistent share dealing behaviour. That is, we identify those firms who have been classified as net buyers (overconfident) for at least three years over the period 2003–2006 as those with managerial overconfidence (OVER1); otherwise those firms are without managerial overconfidence. To give more evidence, we also measure managerial confidence (OVER 2) using outsiders' perception of the executive directors as captured by press. When the total number of articles over the period 2003-2006 describing executive directors as the optimistic or confident is higher than the total number of articles describing executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident, this firm will be classified as a firm with managerial overconfidence and OVER2 equals one, otherwise zero. We predict that investment by non-overconfident managers can positively and significantly affect the cash flow sensitivity of cash in constrained firms, while investment by overconfident managers tend to insignificantly affect the cash flow sensitivity of cash in constrained firms.

3.3 Data and Methodology

3.3.1 Data

In our estimation, we use a sample of non-financial UK listed firms during the period 1996–2006, using two data sources for the compilation of the sample:

Datastream and Hemscott. First, financial firms are excluded from our sample. Second, the dataset was cleared of outliers by excluding the values of each variable that lie outside the 1st and 99th percentile range. Third, we chose those firms that had no missing data in the period 1996–2006. In order to carry out the GMM estimations we included in the sample only those firms with a minimum of five consecutive years of observations. Taking these factors into account resulted in an unbalanced panel of 648 firms. Data on corporate managerial ownership (2003–2005) and managerial overconfidence (2003–2006) are collected from Hemscott. Table 3.1 presents a definition of all variables used in our analysis, Table 3.2 A shows descriptive statistics for the main variables and Table 3.2 B shows the panel data structure.

Table 3.2 A shows that all firms have 11 % of total assets investing in cash holdings (*CH*) during the period 1996–2006. This is higher than the 9.9% reported by Ozkan and Ozkan (2004) in the period 1995–1999 and the 10.4% reported by Marchica and Mura (2007) in the period 1989–2002, but is close to that reported by Guney *et al.* (2007), of 11% in the period 1996–2000. Different mean values of cash holdings are probably the result of different sample periods. For example, in our sample, the mean value of cash holding is around 10.6% over 1996–2000, but increases to about 12% during 2001–2006. We use capital expenditure in fixed assets to calculate investment (I) and report an average value of 0.057. This is in line with Guney *et al.* (2007), who report an average value of 0.06 during 1996–2000. In addition, cash flow (CFLOW) is around 8% from 1996 to 2006. This closes to the reports from Ozkan and Ozkan (2004) and Guney *et al.* (2007), who report 8.8% in the period 1995–1999 and 8% in the period 1996–2000, respectively. In addition, average firm size (SIZE) is around 11.376, average leverage ratio (LEV) is 0.176 and average market to book value (MTB) is 1.851. These are in line with Ozkan and Ozkan (2004) and Guney *et al.* (2007).

As far as managerial ownership is concerned, average executive ownership is 8.20%, which is lower than the 8.98% reported by Florackis and Ozkan (2007). Finally, we report our managerial overconfidence variable (OVER1), which is a dummy variable, and about 23.6% of firms appeared to be net buyers for at least

three years in the stock market over the period 2003–2006. And about 37.3% of firms have been perceived by press as overconfidence (OVER2).

In Table 3.3, we present the Pearson's correlation matrix. The results are generally in line with our prediction. The negative correlation between cash holding and cash flow means that firms with sufficient cash flow have lower transaction costs and fewer incentives to hold large amount of cash. It also indicates that smaller-size firms with younger age, lower leverage ratio and lower dividend payouts tends to hold more cash, which is in line with the transaction costs theory. Firms with higher growth opportunity also tend to hold more cash, which is in line with the asymmetric information theory. Moreover, we find that managerial ownership displays a negative relationship with cash holding, which is in line with the alignment effect of managerial ownership. That is an increase in managerial ownership can help to align the interests of managers and shareholders and thus managers tend to use less cash to pursue their private benefits. Finally, our managerial overconfidence measures (OVER1 and OVER2) are significantly and negatively correlated with cash holding. It also indicates that firms with managerial overconfidence tend to invest more rather than retain cash. However, such findings do not lead to concrete inferences for the potential interaction effect of managerial overconfidence and cash flow sensitivity of cash.

3.3.2 Methodology

We firstly perform our average cross-sectional (CSA) regression using the following specification:

$$(1)\ CH_i = \alpha_{0i} + \alpha_{1i}CFLOW_i + \alpha_{2i}I_i + \alpha_{3i}CFLOW_i * I_i + \sum_{k=4}^{n}\alpha_{ki}x_{ki} + \varepsilon_i$$

We conduct our initial estimation to discuss the determinants of cash holdings using our subsample over the period 2001–2006 in the UK listed firms. Following Rajan and Zingales (1995), two average cross-sectional regressions are executed. They are: one: the dependent variable (*CH*) is measured in year 2006 and two: the dependent variable is measured in year 2005. And independent variables are measured as average-past values over the period 2002-2005 with 550 firms and the period 2001-2004 with 562 firms respectively.

Averaged values of independent variables can mitigate annual adjustment and extreme values for each firm, and lagged values can deal with endogenous problems. We mainly focus on whether investment can affect cash flow sensitivity of cash. To do so, we use an interaction term CFLOW * I, which represents the impact of investment on cash flow sensitivity of cash. If investment decisions can increase the sensitivity of cash to cash flow, then the coefficient α_3 of this term should be a positive one. We also use $\sum_{k=4}^{n}\alpha_{ki}x_{ki}$ to control for variables relating to the transaction costs and precautionary motives for holding cash such as size, market to book value, leverage, and dividend and managerial ownership to investigate their roles in determining cash holding. Finally, in order to test the non-linear relationship between managerial ownership and cash holding, we include the squared and cubic values of managerial ownership in $\sum_{k=4}^{n}\alpha_{ki}x_{ki}$.

According to our prediction that investment has different impacts on cash flow sensitivity of cash with financial constraints, we also identify firms as being either financially constrained or unconstrained as discussed in Section 3.2.5. We are especially interested in the sign and significance level of the coefficient (α_3) and expect it is positive in financially constrained firms.

In addition, we use a panel data set over the period 1996–2006 with 648 UK listed firms to provide more evidence. Panel data sets that combine time series and cross sections are common in the existing cash holding literature. Heterogeneity and endogeneity arising from panel data require various estimation techniques. For example, cross-sectional and pooled cross-sectional regressions are used by Kim *et al.* (1998) and Dittmar *et al.* (2003). Opler *et al.* (1999) emphasizing the persistence of cash holding and the target cash levels. They use the Fama-Macbeth methodology (Fama and Macbeth, 1973), a cross-sectional regression is estimated for each year, which can eliminate the problem of serial correlation in the residuals. They also use OLS and fixed effect estimations. In these estimations, White's (1980) correction has been used for

testing heteroskedasticity.

These static cash holding models used in the cash holding research implicitly assume that firms can instantaneously adjust towards the target cash level following changes in firm-specific characteristics and/or random shocks (Ozkan and Ozkan, 2004). However, real adjustment process of cash holding always involves a lag, which changes specification (1) as follows:

Let the optimal cash holding of firm i in period t, denoted as CH_{it}^{*}, be a function of cash holding determinants (X^{a}) and lagged explanatory variables (X^{b}) and write:

$$(2) \qquad CH_{it}^{*} = \sum_{j} \alpha_{j} X^{a}{}_{jit} + \sum_{j} \xi_{j} X^{b}{}_{ji(t-1)} + \varepsilon_{it}.$$

i: firm, j:determinants, t:time

This set-up implies that the optimal cash holding may vary both across firms and over time. In the presence of capital market imperfection, the observed cash holding of firm i at time t, CH_{it}, should be equal to the optimal cash holding, i.e. $CH_{it} = CH_{it}^{*}$. However, if capital market imperfection makes adjustment costly, firms may not fully adjust their cash holding level from a previous period to a current one. This leads to a partial adjustment mechanism as follows:

$$(3) \qquad CH_{it} - CH_{i,t-1} = \beta(CH_{it}^{*} - CH_{i,t-1}).$$

where β is the adjustment parameter capturing the extent of desired adjustment of the optimal cash holding from the previous to the current period. The value of β varies between 0 and 1. If β=1, the entire adjustment is made immediately and a firm's cash holding is at the target. If β=0, no adjustment of cash holding is made to its target due to high adjustment costs.

Rewriting equation (3) using equation (2) yields:

$$(4) \qquad \begin{aligned} CH_{it} &= CH_{i,t-1} + \beta(CH_{it}^{*} - CH_{i,t-1}) \\ &= (1-\beta)CH_{i,t-1} + \beta\sum_{j} \alpha_{j} X^{a}{}_{jit} + \beta\sum_{j} \xi_{j} X^{b}{}_{ji(t-1)} + \varepsilon_{it} \end{aligned}$$

We, in turn, can obtain an empirical specification as follows:

$$(5) \qquad CH_{it} = \gamma_o CH_{i,t-1} + \sum_{k=1} \gamma_k X^a{}_{kit} + \sum_{k=1} \lambda_k X^b{}_{ki(t-1)} + \upsilon_i + \upsilon_t + \mu_{it}.$$

Unobservable characteristics of a firm that have a significant impact on the firm's cash holding are captured by υ_i. The fixed effects υ_i represent firm-specific effects which are unobservable and differ across firms but are fixed for a given firm through time. These characteristics include an ownership variable which can be assumed to be constant over the years. Hence, X^a includes firm-specific characteristics determining cash holding such as cash flow, size, etc., apart from managerial ownership and X^b includes all lagged explanatory variables. This time-invariant industry-specific effect can also capture industry-specific effects. υ_t captures time effects that are kept the same for all firms at a given point in time but vary across time. The time effects include macroeconomic factors such as prices and interest rates.

In addition, $\beta = 1 - \gamma_0$ represents the speed of adjustment. Hence, a higher value of β denotes a higher speed of adjustment. In other words, the higher value of $\gamma_0 = 1 - \beta$ in equation (5) represents a lower speed of adjustment on cash holding.

We argue that the adjustment speeds vary with financial constraints. It is easier for financially unconstrained firms to change their cash holding level and investment level by choosing among several alternative sources of financing. However, financially constrained firms are more likely to face future cash shortfalls and their target cash levels are relatively higher. In order to adjust to the target levels, they have to pass up some positive NPV projects and accumulate cash out of cash flow. Hence, it would take longer for financially constrained firms to adjust to their target cash levels. Hence, we expect the adjustment speed will be lower in financially constrained firms. Accordingly, γ_0 in equation (5) will be higher in financially constrained firms.

Furthermore, comparing with other estimation methods, the dynamic GMM model (equation (5)) has unique advantages for dealing with several econometric problems (Hsiao, 1985). First, the fixed effects υ_i may be correlated with

explanatory variables. Second, firm-specific variables may be endogenous so that the causality affecting cash holding may also affect some regressors and these regressors may also be correlated with error term μ_{it}. Third, the lagged dependent variable $CH_{i,t-1}$ gives rise to autocorrelation with the error term.

If we use OLS in equation (5), dynamic panel bias can arise. OLS regression cannot consistently estimate the parameters because ($CH_{it-1} - CH_{it-2}$) and ($\mu_{it} - \mu_{it-1}$) are correlated through CH_{it-1} and μ_{it-1}. Moreover, fixed-effect (FE) and random-effect (RE) estimations are neither consistent nor eliminate this bias (see Nickell, 1981; Bond, 2002). In a simulation, Judson and Owen (1999) find a high bias of 20% when time period equals 30.

Moreover, if the errors cannot be considered to be independent on the regressors, then instrumental variables (IV) are called for. Therefore, Kiviet (1995) suggested a corrected FE estimator to eliminate this bias. However, this approach only works for the balanced data and without considering the endogeneity of some regressors. Another solution is the application of the IV estimator, proposed by Anderson and Hsiao (1982). They introduce instruments by using $\Delta CH_{it-2} = (CH_{it-2} - CH_{it-3})$ or CH_{it-2} for the first difference of the lagged dependent variable where both are correlated with ($CH_{it-1} - CH_{it-2}$) but uncorrelated with ($\mu_{it} - \mu_{it-1}$). This instrumental variable estimation can provide inconsistent estimators if the error term μ_{it} is not serially correlated. However, this approach cannot provide good improvement in its efficiency by using deeper lags of dependent variable as instruments since more observations with unavailable lagged observations are dropped which makes the sample much smaller[10].

Consequently, Arellano and Bond (1991) suggested a new approach of first-differencing GMM-DIF. It has asymptotic properties and can be performed in a few time periods with many firms' cases, as Monte-Carlo evidence is able to

[10] More details about OLS and IV techniques can be found in Appendix B. And more details about OLS and Fama-Macbeth techniques can be found in Appendix C.

show. Its advantages are the ways to solve the above three problems faced by dynamic models.

In order to deal with the first problem, Arellano and Bond (1991) derive a first-differencing (Δ) model, which can be transformed from equation (5) as follows:

$$\Delta CH_{it} = \gamma_o \Delta CH_{i,t-1} + \sum_{k=1} \gamma_k \Delta X^a{}_{kit} + \sum_{k=1} \lambda_k \Delta X^b{}_{ki(t-1)} + \Delta \upsilon_t + \Delta \mu_{it} . \quad (6)$$

As can be seen, the individually fixed effect, such as ownership variable has been removed from our model. In addition, GMM-DIF is concerned with not only the endogenous problem between lagged dependent variables and firm-specific effects but also the endogenous problem between lagged dependent variables and other firm-specific variables. This is because the first lagged dependent variable may be correlated with firm-fixed effects or with firm-specific variables. For the second and third problems, they use instrumental variables in the presence of heteroskedasticity, where lagged dependent variable and endogenous regressors are instrumented. Therefore, the selection of instrumental variables is very important. GMM-DIF employs additional instruments obtained by the orthogonal conditions that exist between the error term μ_{it} and the lagged dependent variables. Therefore, the GMM-DIF optimally exploits all the linear moment restrictions specified by the model. To obtain consistent GMM-DIF estimators, $E(\mu_{it}\mu_{it-1})$ is not necessarily zero but $E(\mu_{it}\mu_{it-2})$ should be zero. If the error terms are not correlated, then $\Delta\mu_{it}$ is orthogonal to the past variables X and CH so that $(X_{it-2}, X_{it-3} \cdots CH_{it-2}, CH_{it-3} \cdots)$ can be used as instruments for $\Delta\mu_{it}$. If μ_{it} follows a MA(1) process, then the instrument set will be $X_{it-3}, X_{it-4} \cdots CH_{it-3}, CH_{it-4} \cdots$. That is the first valid instruments start form the third lag not from the second because the differenced distribution follows an MA(2) process. Therefore, it is important that there is no higher-order serial correlation to have a valid instrument set. Empirically, it is reported by Sargan's test of overidentifying restrictions, which indicates the validity of instruments whether instruments and residual are independent. We also test the null hypothesis of no first and second order serial correlation in the residuals separately (denoted as M1 and M2). Finally, we compute and report the two-step GMM results using the small variance correction (Windmeijer, 2000).

The disadvantage of the first-difference GMM estimation is its dealing with missing data in the unbalanced data set. If CH_{it} is missing for some companies, then $\Delta CH_{it} = CH_{it} - CH_{i,t-1}$ and $\Delta CH_{i,t+1} = CH_{i,t+1} - CH_{it}$ will be missing in the transformed equation. Arellano and Bover (1995) argue that the absence of information with respect to the parameters in the level variables causes substantial loss of efficiently in models estimated in first-differences using instruments in levels. Therefore, they use 'forward orthogonal deviations' for transformation into a differencing equation, which is called system GMM (GMM-SYS). Blundell and Bond (1998) show that GMM-SYS has dramatic efficient gain when GMM-DIF estimator performs poorly especial for short sample period and persistent data. For example, the coefficient estimator of lagged dependent variable can be downward-biased when the coefficient estimate of lagged dependent variable approaches unity and the ratio of (variance(υ_i)/variance(μ_i)) increase. Moreover, once lagged first differenced and lagged levels instruments are used into the instrument set, the finite sample biases can be reduced considerable by exploiting the additional moment conditions coming from level equations. That is, instead of subtracting $CH_{i,t-1}$ in ΔCH_{it}, we can subtract the average of all future available observations of CH which minimizes the data loss. Also, lagged observations are used as instruments. We use GMM-SYS as our robustness test.

Finally, the long-term relationship between the cash holding and its determinants may differ from the short-term effect. Any difference in the sign of the coefficient of the contemporaneous and lagged values of explanatory variable reveals its possibility (Blundell and Bond, 1998). We finally examine the long-run relationship (Antoniou *et al.*, 2006) by using the following equation (7).

$$CH_{it}^{*} = (\frac{\gamma_1 + \lambda_1}{1-\gamma_0})MTB^{*} + (\frac{\gamma_2 + \lambda_2}{1-\gamma_0})CFLOW^{*} + (\frac{\gamma_3 + \lambda_3}{1-\gamma_0})I^{*} +$$
$$(\frac{\gamma_4 + \lambda_4}{1-\gamma_0})LEV^{*} + (\frac{\gamma_5 + \lambda_5}{1-\gamma_0})DIV^{*} + (\frac{\gamma_6 + \lambda_6}{1-\gamma_0})SIZE^{*} +$$
$$(\frac{\gamma_7 + \lambda_7}{1-\gamma_0})AGE^{*} + (\frac{\gamma_8 + \lambda_8}{1-\gamma_0})I^{*} * CFLOW^{*}$$

The parameters used in the above ($\gamma_0 \cdots \gamma_8, \lambda_1 \cdots \lambda_8$) and obtained using a dynamic estimation of equation (5).

3.4 Empirical Results

This section contains the empirical results of our regressions. Section 3.4.1 presents a univariate analysis of mean-comparison of key independent variables by different cash holding quartiles. We then present multivariate analysis in Section 3.4.2. In this section, we first use averaged cross-sectional regression to show determinants of cash holding and how investment has different impacts on cash holding policy between financially constrained and unconstrained firms. We then use average cross-sectional regression to show how managerial investment influences cash holding policy in financially constrained firms by splitting firms into those with managerial overconfidence and those with managerial non-overconfidence. In Section 3.4.3, we use panel data estimates to show further robustness results.

3.4.1 Univariate Analysis

We report univariate mean-comparisons of key independent variables in different cash holding quartiles of our sample in Table 3.4. The quartiles are based on annual data of cash holding. Then, we use a t-test to see whether the firms' characteristics (e.g. investment, cash flow, MTB, size, leverage and dividend) in the first quartile firms are significantly different from those in the fourth quartile.

As expected, mean values of investment in the four quartiles monotonically decrease with the cash holding quartiles and firms with the highest cash holding in the fourth quartile generally have least investment expenditure. This is consistent with our starting point, that firms can reduce the reserve of cash holding in order to make necessary investment. In other words, when firms have to save more cash out of cash flow, they may have to reduce their investment.

The results also indicate that MTB, as a proxy for investment opportunity, has been found monotonically to increase with cash holdings from the first quartile to the fourth quartile. This is in line with the argument that cash holding can facilitate firms' investment ability in the future. It also implies that more investment opportunities can increase bankruptcy costs and then more cash is required. Moreover, the youngest firms with the lowest leverage and the lowest dividend payouts tend to hold the highest level of cash. In addition, firms' size in the first two quartiles is relatively larger than in the last two quartiles. These also suggest that the youngest firms or those with the lowest leverage, the lowest dividend payouts or smaller size can be identified as financially constrained firms, who are facing limited internal cash flow and have a propensity for saving more cash out of cash flow. Finally, firm-specific variables such as investment, MTB, leverage, age and size in the first and fourth quartiles differ significantly.

Finally, evidence about the relationship between cash flow and cash holding is mixed. Cash flow is lowest in the first quartile, which is consistent with the view of Arslan *et al.* (2006) that the most financially constrained firms tend to hold the lowest level of cash holdings. Cash flow is decreasing with cashing holding from the second quartile to the fourth quartile. It suggests that firms with sufficient cash flow facing lower transaction costs do not need retain cash holding. Hence, cash flow is negatively related to cash holdings.

3.4.2 Cross-Sectional Regression Analysis

In this section, we test several predictions as follows. First, we use an average cross-sectional (CSA) regression to test the roles of firm-specific characteristics and managerial ownership in determining the optimal cash holding. Second, we use the CSA regression to compare the different impacts of investment on cash holding between financially constrained and unconstrained firms. Finally, we use the CSA regression to test the roles of investment by overconfident managers on firms' cash holding in financially constrained firms.

In Table 3.5, we use the average cross-sectional regression in which dependent variable cash holding (*CH*) is measured in 2006, while other independent variables are averaged over 2002–2005, apart from managerial ownership which is averaged over 2003–2004. After matching two datasets, the subsample falls to 550. We first analyze the determinants of cash holding for all firms and then explore the different roles of investment in cash flow sensitivity of cash in both financially constrained and financially unconstrained firms.

The determinants of cash holding: for all firms, we find a significantly positive relationship between cash holding (*CH*) and market to book value (MTB). This is in line with our arguments that firms with higher growth opportunities are more likely to face bankruptcy costs and cash shortfall and hold more cash. Cash flow (CFLOW) is negative but insignificant. Similar results were also found in Opler *et al.* (1999). A significant negative relationship between leverage (LEV) and cash (*CH*) has been shown in our result. This is consistent with our prediction that leverage as a proxy for firms' ability to raise funds from external market can act as a substitute for holding cash. Less cash holding can be associated with higher leverage. Another negative relationship can also be found between dividend payouts (DIV1) and cash holding. This implies that firms with dividend payouts are facing lower transaction costs than those firms with no dividend payout. In addition, firms' size (SIZE) is negatively related to cash holding and this relationship is statistically significant. It seems that larger firms are less likely to face asymmetric information and tend to hold less cash.

As far as investment expenditure (I) is concerned, we find a negative and significant relationship between investment and cash holding. This is in line with our prediction that investment expenditure as a consuming aspect of internal funds can decrease firms' investment in cash holdings. More importantly, investment can also affect firms' cash flow sensitivity of cash. In our regression, we find a positive coefficient of the interaction term of investment and cash flow (I*CFLOW). It gives a hint that the relationship between investment and cash flow sensitivity of cash might be related to the financial constraints.

Finally, to allow for the potential non-linear relationship between managerial ownership and cash holding, in our empirical model we include the level of managerial ownership (OWN), the squared value of managerial ownership (OWN^2) and the cubic value of managerial ownership (OWN^3). In line with our hypothesis, we find a negative and significant relationship between ownership (OWN) and cash holding. When managerial ownership is at a low level, an increase in managerial ownership can eliminate the conflicts between managers and shareholders (*alignment effect*), leading to relatively lower cash holding. However, when the level of managerial ownership exceeds a certain level, this alignment effect can be replaced by *entrenchment effect*. This happens when the benefits to managers from low cash holdings are lower than private benefit. Then, an increase in managerial ownership can lead to higher cash holding. Our finding of a significant positive coefficient of OWN^2 suggests a turning point of managerial ownership at 11.8%, in that cash holding decreases as ownership increases up to 11.8% and then increases for managerial ownership levels above 11.8%, which is in line with Figure 3.1. Finally, the significant negative coefficient of OWN^3 suggests that this positive relationship between ownership and cash holding may also turn into a negative one, with the turning point being around 60%. This indicates that the interests of managers can converge to the interests of shareholders when managerial ownership is substantially high. In summary, it suggests a non-linear relationship between managerial ownership and cash holding, which is in line with the findings of Ozkan and Ozkan (2004).

The interaction of investment and cash flow: Another objective in Table 3.5 focuses on whether investment decisions have different impacts on cash flow sensitivity of cash in financially constrained and unconstrained firms. We identify firms to be financially constrained or financially unconstrained firms based on firms age and average values of size, leverage and dividend over 2002–2005.

The most important finding is that we observe a positive coefficient of interaction term (*I*CFLOW*) in financially constrained firms. And it is statistically significant in leverage and dividend groups. This supports our prediction that investment diverts some cash flow from cash saving, increases

cash flow fluctuation and makes firms' cash holding to be more sensitive to cash flow. Meanwhile, we find that coefficients of cash flow are also positive and significant in constrained firms identified by leverage and dividend (DIV1 and DIV2) which are consistent with the study by Almeida *et al.* (2004). It implies that financial constraints should be related to firms' propensity to save cash out of cash flow. In addition, we find a negative relationship between investment and cash holding, which is significant in unconstrained groups identified by age, dividend and leverage. It seems that investment as a consuming part of cash flow can decrease cash holdings especially in financially unconstrained firms.

For other explanatory variables, we find the constrained firms in leverage, dividend and age groups display a significant and positive relationship between MTB and cash holding, which is in line with the findings by Almeida *et al.* (2004). This suggests that future investment opportunity is important, especially in financially constrained firms. Moreover, we find that leverage and dividend are both negatively related to cash holding, although the statistically significant level is mixed. We also cannot find any strong evidence to demonstrate different roles of firms' size in cash holding between constrained and unconstrained firms. Finally, with respect to managerial discretion, we include OWN, OWN^2 and OWN^3 to control for non-linear association between managerial ownership and cash holding. Our findings suggest that the non-linear relationship between managerial ownership and cash holding dose not vary with the status of financial constraints.

All these results are robust when we use our second average cross-sectional regression in which dependent variable cash holding (*CH*) is measured in 2005, while other independent variables are averaged over 2001–2004, apart from managerial ownership which is averaged over 2003–2004. The results are given in Table 3.6. Similarly, investment can increase cash flow sensitivity of cash in financially constrained firms identified by leverage, dividend and age. Meanwhile, the cash flow sensitivity of cash is found to be statistically significant in financially constrained firms in these groups.

The role of managerial overconfidence: We now turn to test whether investment undertaken by overconfident managers can affect the cash flow sensitivity of cash in financially constrained firms. Owing to the persistent behaviour of overconfidence, we measure managerial overconfidence from 2003 to 2006. And we identify those firms with managerial overconfidence (OVER 1) as those being net buyers between 2003 and 2006 for at least three years. The results are given in Table 3.7.

In Table 3.7, we split financially constrained firms into firms with overconfident managers and firms with non-overconfident managers using OVER1. The most interesting finding is that coefficient of interaction term (I*CFLOW) becomes statistically insignificant in all constrained firms with managerial overconfidence while it remains significantly positive in constrained firms without managerial overconfidence in leverage and dividend (DIV1 and DIV2) groups. This result supports our hypothesis that managerial overconfidence can eliminate the positive impact of investment on cash flow sensitivity of cash in financially constrained firms. That is because overconfident managers overestimate payoff of investment, they tend to believe the benefits of their project should be larger than the benefits of accumulating cash and thus would rather invest than save cash out of cash flow, even if their firms are facing financial constraints. In Table 3.8, we use another CSA regression in which dependent variable is measured in year 2005 and all other independent variables are the average past values over the period 2001-2004. And we find consistent results.

In Table 3.9 and 3.10, we try our alternative measurement of managerial overconfidence (OVER 2) to test whether investment undertaken by overconfident managers can affect the cash flow sensitivity of cash in financially constrained firms. And we find that that coefficients of interaction term (I*CFLOW), are insignificant in all constrained firms with managerial overconfidence while they remain significantly positive in constrained firms without managerial overconfidence in leverage, dividend(DIV1 and DIV2) and age groups. In sum, the consistent results indicate that overconfident managers would rather increase investment with cash flow than save cash out of cash flow, even if their firms are facing financial constraints. Therefore, investment by

overconfident managers in constrained firms cannot generate greater cash flow sensitivity of cash.

3.4.3 Dynamic Estimation and Robustness

3.4.3.1 Alternative estimator procedures and Diagnostics

We turn to use GMM to estimate the baseline cash model to give further evidence. Since GMM will drop fixed effects by differencing and ownership variables are relatively stable over a certain period of time, our GMM test will not include managerial ownership. Before that, we first conduct a number of different methods to find which approach is proper for our equation (5).

In Table 3.11, we present the OLS estimates in Model 1. In Model 2, we give the results of the Anderson-Hsiao (AH) estimate, which use CH_{it-2} as instruments. In Model 3, we present the results of the Within Groups estimate. In order to find a consistent GMM estimate, we particularly discuss the validity of instrument set and the relationship between regressors and error term. For example, if one regressor x_{it} is correlated with the fixed effects and μ_{it} is serially uncorrelated, we need to consider whether x_{it} is predetermined or strictly exogenous with respect to μ_{it}. We include all regressors dated $x_{i,t-1}$ ($x_{i,t-2}$ for the lagged explanatory variables) to investigate the potential biases which arise from the correlation between $x_{i,t-1}$ and the first-differenced error term μ_{it}. Hence, in Model 4, we start with the GMM estimate in levels (GMM-LEV1), where all explanatory variables, except CH_{it-1}, are treated as strictly exogenous. Accordingly, GMM-DIF1 estimate in differences in Model 6 is used to test whether all explanatory variables, except CH_{it-1}, are strictly exogenous by including all current values of each variable $x_{i,t}$ ($x_{i,t-1}$ for the lagged explanatory variables). In Model 5, we use the GMM estimate in levels (GMM-LEV2), where all explanatory variables are treated as endogenous, to test whether

variables are predetermined. And in Model 7, we use the GMM-DIF2 estimate in differences to test whether variables are predetermined[11].

First, correlation test reveals that OLS (Model 1) and GMM-level specifications (Models 4 and 5) violate the assumption that there is no serial correlation in error terms. It seems that lagged dependent variable (CH_{it-1}) is correlated with some unobservable and firm-specific fixed effects. Comparing with GMM-Differences (Models 6 and 7) the estimated coefficient of CH_{it-1} in OLS estimate (Model 1) is too higher. The same problem can also be found in GMM-Levels (Models 4 and 5), in which the estimated coefficient of CH_{it-1} is even higher. Moreover, the Sargan Test in Model 4 reveals that instruments used are invalid. This implies that the explanatory variables cannot be treated as strictly exogenous. Also, the Sargan Test in Model 5 reveals instruments used are still invalid. This implies that the explanatory variables are not predetermined. Therefore, we can conclude that OLS and GMM-Levels estimates are not appropriate for a study of dynamic cash structure models.

To solve these problems, we use the first-difference to transform the variables. We use AH-type (Model 2) and GMM-Differences (Models 6 and 7). It seems that AH-type estimates (Model 2) still suffers from the serial correlation problems. This is because two correlation tests for the first and the second order autocorrelation of error terms reject the null hypothesis of no serial correlation as the results are significant. Hence, the AH-type cannot provide consistent estimates and has a downward bias. However, some standard deviations of the coefficients is this model are larger that the ones in GMM-Differences models. To some extent, it reveals that AH instrumental variable technique does not use all available moments, which may cause efficiency loss (Arellano and Bond, 1991). As for GMM-Differences (Models 6 and 7), Sargan tests indicates that the instruments used are not valid. It rejects two assumptions: one is to assume that all explanatory variables except the lagged dependent variable are strictly exogenous (Model 6); two is to assume that all explanatory variables are predetermined (Model 7).

[11] A similar discussion can be found in Blundell *et al.* (1992).

We also report Within Groups estimate (Model 3; deviation from individual means). It seems that the first correlation test is insignificant but the second correlation test is significant. However, the standard deviations of the coefficients in this model are much higher that the ones in GMM models. It seems that the Within Groups estimate is not so efficient comparing with GMM methodology.

Thus, the specifications of OLS, AH, GMM-Levels and GMM-Differences assuming that variables are predetermined or strictly exogenous are not appropriate methods of estimation for our dynamic cash holding models. As a result, we introduce GMM-DIF3 which might be a proper estimate for our panel date. That is GMM in first difference and instruments are all variables dated (*t-2*).

3.4.3.2 GMM Estimation

We present the results of GMM-DIF3 in Table 3.12. The first regression in this table provides the evidence on the determinants of cash holding with the whole sample. Consistent with the dynamic cash holding hypothesis, it suggests that firms partially adjust towards an optimal cash holding, with a positive adjustment value of 0.500. In line with our cross-sectional regression, dynamic panel data regression also shows that dividend and investment remain as important determinants of cash holding, in that firms with more growth opportunities, less dividend payouts and lower investment expenditure tend to hold more cash. Their coefficients are statistically significant at 10%.

In order to investigate the different role of investment on cash flow sensitivity of cash, we identify firms to be financially constrained and unconstrained firms. Based on annual values of size, dividend, leverage and age, we include those firms whose have been regarded as constrained (unconstrained) for at least half of their duration in our sample as financially constrained (unconstrained) firms in our regression. A potential problem arising from our identification is that it makes our sample size smaller relative to the number of instruments. For example, in year 1998, our GMM-DIF3 can generate only one instrument per instrumented variable. However, when year rises, the number of instruments will

grow large relative to our sample size in financially constrained (unconstrained) groups. Then, two types of problems can be caused by numerous instruments (Roodman, 2007). First, too many instruments can overfit endogenous variables, failing to remove their endogenous components. Second, in two-step GMM, a weighting matrix, which is the inverse of the covariance of the moments, is used to make two-step GMM asymptotically efficient. However, limited sample size and numerous instruments can make this matrix become singular. In order to avoid these two problems, we use only certain lags instead of all available lags and in our regression in that we cap the maximum number of instruments per period at three.

In addition to GMM-DIF3 estimation, we also provide further results from system GMM (GMM-SYS) estimation. We present their results in Table 3.13. In Tables 3.12 and 3.13, we find consistent results from these two GMM estimates (GMM-DIF3 and GMM-SYS). They reveal that firms with lower investment and lower dividend tend to hold more cash. More importantly, we find positive and significant coefficients of interaction of investment and cash flow in constrained firms identified by leverage (LEV) and dividend (DIV1 and DIV2). This supports our prediction that investment can increase cash flow sensitivity of cash, especially in financially constrained firms. Meanwhile, financially constrained firms in these groups display positive sensitivities of cash to cash flow, which is also in line with the argument of Almeida *et al.* (2004) that financially constrained firms are more likely to save more cash out of cash flow.

Finally, both dynamic GMM estimations also provide evidence of adjustment speed of cash holding. Tables 3.12 and 3.13 reveal that the coefficient (γ_0) of lagged cash holding is significantly positive both in financially constrained and unconstrained firms. It means both constrained and unconstrained firms are trying to adjust their cash holding to the target level. This coefficient is much higher in younger firms with smaller-size and lower leverage ratio, which means that cash adjustment speed in financially constrained firms is much slower than unconstrained firms owing to costly external finance. This implies that financially unconstrained firms are able to change their cash holding level and

investment level by choosing among several alternative sources of financing. Therefore, financially unconstrained firms can quickly correct deviation from the optimal cash holding, and γ_0 will be lower in financially unconstrained firms. However, it would take longer for financially constrained firms to adjust to their target cash levels — either because of their higher target levels or the costs of adjustment they entail. Hence, we expect the adjustment speed will be lower in financially constrained groups. Accordingly, γ_0 in equation (5) will be higher in financially constrained groups.

3.4.3.3 Long-term Relation

The long-term static model assumes that target cash holdings are instantaneously adjusted as a reaction to random changes in the business and firms' condition. We provide static cashing holding model using GMM-SYS estimates to give more evidence in Table 3.14. As for the determinants of cash holding, we find that firms with lower investment and lower dividend tend to hold more cash, which is in line with our previous findings. However, we only find that investment can generate greater cash flow sensitivity of cash in financially constrained firms identified by dividend (DIV2).

Finally, two correlation tests reveal that our estimates violate the assumption that there is no serial correlation in error terms. And Wald Test (joint significance) statistics are much lower than the dynamic models. It shows that it is better to use dynamic models to analyze our panel data in cash holding model.

3.5 Conclusion

This chapter investigates how investment decision influences cash holding by using a large sample of UK non-financial listed firms between 1996 and 2006. We believe that financial constraints play an important role in determining this linkage. We first argue that investment decisions can affect cash flow sensitivity of cash especially in financially constrained firms. That is, more investment expenditure may limit the source available for cash savings, increase cash flow

fluctuations in the future and lead cash to be more sensitive to cash flow in financially constrained firms, while investment decisions cannot have a positive impact upon cash flow sensitivity of cash in financially unconstrained firms. In addition, we discuss the role of managerial overconfidence affecting this linkage that investment decisions by overconfident managers can eliminate cash flow sensitivity of cash in financially constrained firms. This is because overconfident managers believe the benefits of their desired investments are much larger than the benefits of saving cash. They would rather invest in their projects than invest in cash. Finally, our analysis incorporates the dynamic nature of firms in adjusting their cash holding. We argue that financially constrained and unconstrained firms can adjust to their target cash level at different speeds. In particular, owing to costly external funds, financially constrained firms should adjust to their target cash level much slower than do financially unconstrained firms.

We adopt two estimation techniques, average cross-sectional regression and dynamic GMM, to mitigate any possible econometric problems. In cross-sectional regression, we use average explanatory variables to deal with firms' annual adjustment and lagged explanatory variables to deal with endogeneity. In GMM, we account for unobservable firm-specific effects and firm-invariant time-effects and choose more efficient instruments to control for endogeneity.

Both GMM (GMM-DIF3 and GMM-SYS) and cross-sectional regressions suggest that firms with less dividend payouts and lower investment expenditure tend to hold more cash. More importantly, investment can increase cash flow sensitivity of cash in financially constrained firms. The results are consistently significant in constrained firms identified by their leverage and dividend payouts. By contrast, in unconstrained firms, we cannot find such a positive relationship. However, our static model provides limited evidence on this aspect.

In addition, our CSA estimates suggest that the relationship between ownership and cash holding is non-monotonic. When managerial ownership is at a low level, an increase in managerial ownership can eliminate the conflicts between managers and shareholders. However, when the level of managerial ownership

exceeds a certain level, an increase in managerial ownership can lead to higher cash holding. Finally, this positive relationship between ownership and cash holding may also turn into a negative one when managerial ownership exceeds a higher level.

Moreover, the CSA results also reveal that managerial overconfidence can eliminate the positive impact of investment on cash flow sensitivity of cash. The results show that investment can still increase cash flow sensitivity of cash in constrained firms without overconfident managers. They are statistically significant in constrained firms identified by leverage, dividend and age. In contrast, this positive relationship becomes insignificant in constrained firms with overconfident managers. The results are robust when we use two alternative measures of managerial overconfidence.

Finally, we use first-difference GMM and system GMM estimates to show that firms tend to adjust their cash holding to the target level and this adjustment speed is much slower in constrained firms. This implies that financially unconstrained firms are able to change their cash holding level and investment level by choosing among several alternative sources of financing quickly. However, it would take longer for financially constrained firms to adjust to their target cash levels — either because of the relatively higher target level or the costs of adjustment they entails.

Table 3.1: Variables, Definitions and Sources.

Variable	Definition	Sources
CH	Cash holding: The ratio of cash and cash equivalents to total assets.	Datastream
MTB	The ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of total assets	Datastream
CFLOW	The ratio of pretax profits plus depreciation to total assets.	Datastream
LEV	The ratio of total debt to the total assets.	Datastream
SIZE	Total assets (in natural logarithm).	Datastream
DIV1	The ratio of ordinary dividends to total assets.	Datastream
DIV2	The ratio of ordinary dividends to earnings before dividend.	Datastream
I	Investment: The ratio of payments to fixed assets to total assets.	Datastream
AGE	The number of years that a firm has been incorporated in each year plus one in natural logarithm.	Datastream
OWN	The total percentage of shareholding by the executive directors.	Hemscott
OVER 1	Managerial overconfidence: a dummy variable, which takes the value of 1 if the firm is identified as a net buyer for at least 3 years over 2003–2006, and 0 otherwise.	Hemscott
OVER 2	A dummy variable, which takes the value of 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise.	Nexis UK

Notes: Datastream database provides accounting and market data. Hemscott Guru Academic database provides financial data for the UK's top 300,000 companies and detailed data on all directors of UK listed companies. Nexis UK is a single most powerful global news and business information service.

Figure 3.1: The Relationship between Cash Holding and Managerial Ownership.

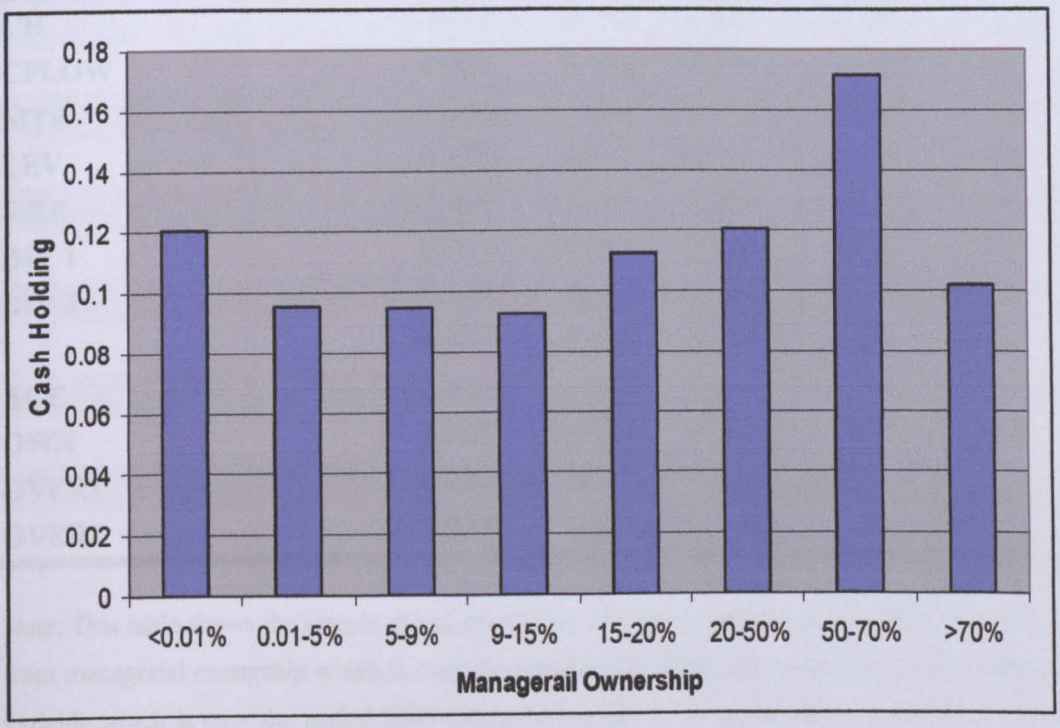


Table 3.2 A: Descriptive statistics. (N=648)

Variables	Mean	S.D.	25%	Median	75%
CH	0.110	0.136	0.020	0.061	0.147
CFLOW	0.080	0.161	0.039	0.102	0.166
MTB	1.836	1.561	1.032	1.391	2.053
LEV	0.176	0.161	0.031	0.148	0.274
SIZE	11.416	2.125	9.883	11.183	12.740
DIV 1	0.023	0.031	0.000	0.018	0.033
DIV 2	0.349	2.819	0.000	0.246	0.460
I	0.057	0.066	0.019	0.039	0.072
AGE	3.113	1.072	2.303	3.045	4.043
OWN	8.203	14.559	0.148	1.090	9.831
OVER1	0.236	0.425	0	0	0
OVER2	0.373	0.484	0	0	1

Note: This table shows the sample characteristics for 648 firms over the period 1996–2006, apart from managerial ownership which is over the period 2003–2004 and managerial overconfidence variable which is over the period 2003–2006. Definitions of all variables are provided in Table 4.1.

Table 3.2 B: Panel Data Structure.

a) Number of records on each firms		b) Number of firms in each year	
5	21	1996	357
6	76	1997	381
7	75	1998	485
8	39	1999	517
9	101	2000	590
10	25	2001	643
11	311	2002	629
		2003	622
		2004	615
		2005	602
		2006	585

Table 3.3: Correlation Matrix.

	CH	CFLOW	MTB	SIZE	I	LEV	DIV 1	DIV 2	AGE	OWN	OVER1	OVER
CH	1											
CFLOW	-0.090***	1										
MTB	0.245***	0.092***	1									
SIZE	-0.287***	0.247***	-0.085***	1								
I	-0.106***	0.166***	0.066***	0.083***	1							
LEV	-0.347***	-0.045***	-0.103***	0.291***	0.112***	1						
DIV 1	-0.019***	0.381***	0.132***	0.127***	0.059***	-0.084***	1					
DIV 2	-0.039***	0.049***	-0.018	0.038***	0.004	0.014	0.057***	1				
AGE	-0.222***	0.143***	-0.204***	0.221***	-0.030**	0.130***	0.119***	0.019	1			
OWN	-0.140***	-0.043	0.043	-0.392***	0.008	-0.099***	-0.075**	-0.002	-0.209***	1		
OVER1	-0.052*	0.009	-0.036	0.156***	0.070**	0.038	0.062**	-0.023	0.054*	-0.147***	1	
OVER2	-0.020	0.055*	0.092***	0.098***	0.022	-0.016	-0.004	0.042	-0.105***	0.011	0.067**	1

Notes: This table presents the Pearson's Correlation matrix for the main variables used in our analysis. Definitions of all the variables are provided in Table 2.1. *** indicates coefficient is significant at 1%.

Table 3.4: Firm Characteristics by Cash Quartiles.

CASH quartiles	First quartile	Second quartile	Third quartile	Fourth quartile	*t*-test
CFLOW	0.069	0.093	0.085	0.074	-0.79
	0.146	0.130	0.153	0.203	
MTB	1.455	1.676	1.836	2.376	-15.34***
	1.058	1.259	1.546	2.047	
SIZE	11.579	12.143	11.488	10.455	14.93***
	2.271	2.159	1.892	1.785	
I	0.066	0.062	0.052	0.047	7.14**
	0.082	0.064	0.054	0.056	
LEV	0.238	0.211	0.163	0.089	26.66***
	0.163	0.152	0.148	0.138	
DIV 1	0.025	0.024	0.022	0.021	-1.88*
	0.039	0.029	0.025	0.024	
AGE	3.280	3.252	3.138	2.780	12.88***
	1.050	1.072	1.030	1.059	

Notes: This table provides univariate mean comparisons of firm-specific characteristics by cash holding quartiles. It also provides standard deviation. We use cash holding measured over 1996–2005, and split the sample into four quartiles. The t-statistic is for the difference of means between the first and the fourth quartiles. *** , **and * indicate the coefficient is significant at 1 5% and 10 %, respectively. Definitions of all variables are provided in Table 4.1.

Table 3.5: CSA (2006): Different Roles of Investment on Cash Flow Sensitivity of Cash in Financially Constrained/Unconstrained Firms.

Dependent variable		Independent variables														
CH		MTB	CFLOW	I	LEV	DIV 1	SIZE	AGE	OWN	OWN^2	OWN^3	I* CFLOW	Obs	F-test	R^2	Adj. R^2
Predicted		+	+ in constrained	–	+/–	–	–	–	–	+	+/–	+ in constrained				
All firms		0.040 (4.66)***	0.044 (0.60)	–0.299 (2.56)**	–0.197 (4.19)***	–1.045 (3.49)***	–0.006 (1.97)**	–0.008 (1.54)	–0.003 (1.65)*	1.52e-04 (2.34)**	–1.41e-06 (2.78)***	0.935 (1.50)	550	10.59***	0.27	0.23
SIZE	Constrained	0.051 (3.39)***	0.062 (0.52)	–0.487 (1.59)	–0.258 (1.92)*	–1.131 (1.63)	–0.032 (1.56)	0.012 (0.88)	–0.0003 (0.09)	9.24e-05 (0.94)	–1.11-06 (1.46)	1.215 (0.87)	165	4.49***	0.29	0.17
	Unconstrained	0.031 (2.56)**	–0.014 (0.07)	0.201 (0.44)	–0.139 (2.79)***	–0.604 (1.05)	–0.002 (0.44)	–0.012 (1.50)	–0.005 (0.91)	2.52e-04 (0.72)	–4.02e-06 (0.76)	–1.389 (0.76)	165	3.40**	0.22	0.09
LEV	Constrained	0.043 (4.56)***	0.199 (1.75)*	–0.333 (1.12)	–1.392 (3.27)***	–2.726 (5.82)***	–0.016 (1.97)*	–0.002 (0.20)	–0.005 (0.39)	1.98e-04 (0.83)	–1.90e-06 (0.65)	2.366 (1.70)*	165	7.47***	0.44	0.35
	Unconstrained	0.030 (1.97)*	0.200 (1.64)	–0.223 (2.34)**	–0.123 (1.15)	–0.235 (0.52)	0.006 (1.37)	0.001 (0.15)	–0.005 (1.23)	1.99e-05 (1.07)	–2.45e-06 (1.10)	0.087 (0.15)	165	2.97***	0.31	0.19
DIV 1	Constrained	0.015 (1.02)	0.150 (1.69)*	–0.218 (1.38)	–0.2051 (1.74)*	11.480 (1.29)	–0.006 (0.83)	–0.004 (0.35)	–0.005 (1.41)	2.18e-04 (1.76)*	–1.93e-06 (1.94)*	1.710 (1.88)*	165	3.50***	0.29	0.17
	Unconstrained	0.013 (1.18)	0.131 (1.22)	–0.959 (2.11)**	–0.091 (0.45)	–0.807 (1.67)*	–0.005 (1.38)	–0.013 (1.25)	–0.005 (1.06)	2.44e-04 (0.97)	–2.94e-06 (0.85)	2.559 (1.35)	165	4.03***	0.26	0.13
AGE	Constrained	0.040 (2.40)**	0.015 (0.13)	–0.265 (1.52)	–0.331 (3.12)***	–1.399 (2.11)**	–0.001 (0.14)	–0.031 (0.93)	–0.007 (1.56)	2.66e-04 (1.78)*	–2.14e-06 (1.94)*	1.781 (1.48)	165	7.07***	0.39	0.29
	Unconstrained	0.026 (2.05)**	–0.078 (0.79)	–0.378 (1.69)*	–0.156 (3.02)***	–0.183 (0.38)	–0.007 (1.43)	0.033 (1.31)	0.003 (0.58)	1.96e-04 (0.70)	–3.32e-06 (0.86)	0.949 (0.90)	162	2.18**	0.20	0.06
DIV 2	Constrained	0.041 (2.81)***	0.032 (1.72)*	–0.187 (1.24)	–0.173 (1.95)*	–0.007 (1.77)*	–0.001 (0.20)	–0.013 (1.33)	–0.007 (2.42)**	3.03e-04 (2.75)***	–2.64e-06 (2.91)***	1.647 (1.72)*	216	3.64***	0.33	0.24
	Unconstrained	0.015 (1.27)	–0.095 (0.53)	–0.857 (1.47)	–0.138 (2.56)**	–0.001 (0.37)	–0.005 (1.19)	–0.005 (0.68)	0.002 (0.34)	5.10e-06 (2.02)**	–2.50e-08 (0.01)	1.164 (0.35)	165	2.86***	0.29	0.17

Notes: This table provides results for the different roles of investment on cash flow sensitivity of cash. Dependent variable is measured in year 2006, while other explanatory variables are average-past value over the period 2002-2005. All regressions include industry dummies. T-statistic values are reported in parentheses. Firms are identified as constrained and unconstrained firms by using their age, dividend, leverage, size and cash holding as explained in Section 3.2.5. In DIV2 group, DIV 2 is included in the regression. We use consistent heteroscedaticity standard errors. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 3.6: CSA (2005): Different Roles of Investment on Cash Flow Sensitivity of Cash in Financially Constrained/Unconstrained Firms.

Dependent variable		Independent variables														
CH		MTB	CFLOW	I	LEV	DIV 1	SIZE	AGE	OWN	OWN^2	OWN^3	I* CFLOW	Obs	F-test	R^2	Adj. R^2
Predicted		+	+ in constrained	−	+/−	−	−	−	−	+	+/−	+ in constrained				
All firms		0.026 (4.17)***	-0.041 (0.63)	−0.238 (2.90)***	−0.215 (7.74)***	−0.590 (2.07)**	−0.003 (0.98)	−0.004 (0.78)	−0.003 (1.66)*	1.04e-04 (1.95)*	−8.98e-07 (2.23)**	1.453 (2.93)***	562	10.36***	0.24	0.21
SIZE	Constrained	0.022 (2.18)**	−0.053 (0.34)	−0.198 (1.13)	−0.396 (6.43)***	−0.797 (1.27)	−0.016 (0.81)	−0.014 (1.15)	−0.002 (0.95)	1.09e-04 (1.34)	−9.94-07 (1.66)*	0.833 (0.55)	167	6.35***	0.30	0.19
	Unconstrained	0.026 (2.40)**	−0.318 (1.66)*	−0.052 (0.20)	−0.080 (1.73)*	0.340 (0.60)	−0.006 (1.55)	−0.007 (1.19)	−0.009 (2.13)**	6.20e-04 (2.04)**	−9.73e-06 (2.01)**	−0.385 (0.26)	167	3.19***	0.24	0.11
LEV	Constrained	0.011 (1.38)	0.220 (1.83)*	0.054 (0.20)	−1.107 (2.83)***	−1.550 (3.32)***	−0.024 (2.98)***	−0.012 (0.99)	−0.002 (0.52)	−1.29e-05 (0.06)	7.95e-07 (0.33)	1.745 (1.82)*	167	3.58**	0.29	0.17
	Unconstrained	0.037 (4.46)***	−0.141 (1.61)	−0.317 (1.75)*	−0.036 (0.99)	0.079 (0.18)	0.007 (2.60)***	0.004 (0.73)	−0.001 (0.73)	4.56e-05 (0.55)	−4.33e-07 (0.51)	1.709 (1.61)	167	6.69***	0.40	0.30
DIV 1	Constrained	0.029 (2.70)***	0.152 (2.05)**	−0.115 (1.18)	−0.299 (5.96)***	−8.167 (1.14)	−0.008 (1.12)	−0.001 (0.05)	−0.004 (1.08)	1.41e-04 (1.29)	−1.16e-06 (1.45)	1.022 (2.09)**	167	5.71***	0.38	0.28
	Unconstrained	0.007 (0.67)	−0.231 (1.07)	−1.491 (2.85)***	−0.044 (0.69)	−0.317 (0.75)	0.0004 (0.09)	−0.012 (1.36)	0.005 (1.21)	−2.58e-04 (1.14)	3.28e-06 (1.10)	1.925 (1.56)	167	2.95***	0.27	0.15
AGE	Constrained	0.024 (2.74)***	−0.051 (0.54)	−0.132 (1.18)	−0.274 (4.22)***	−0.001 (1.93)*	−0.006 (1.06)	−0.014 (0.40)	−0.006 (1.61)	2.13e-04 (1.70)*	−1.67e-06 (1.78)*	1.569 (2.15)**	167	6.79***	0.38	0.27
	Unconstrained	0.021 (1.49)	−0.280 (2.35)**	−0.657 (2.23)***	−0.171 (3.29)***	−0.001 (0.01)	−0.003 (0.45)	−0.002 (0.07)	−0.003 (0.79)	1.76e-04 (0.72)	−1.68e-06 (0.53)	1.037 (1.11)	170	2.58*	0.18	0.04
DIV 2	Constrained	0.023 (2.36)**	0.063 (0.91)	−0.125 (1.34)	−0.290 (6.48)***	−0.0005 (1.06)	−0.002 (0.47)	−0.006 (0.56)	−0.004 (1.28)	0.0002 (1.53)	−1.24e-06 (1.70)*	1.058 (2.28)**	220	6.45***	0.30	0.22
	Unconstrained	0.019 (2.28)**	−0.107 (0.61)	−0.579 (1.72)*	−0.037 (0.69)	0.0007 (0.62)	−0.001 (0.27)	−0.001 (0.14)	−0.002 (0.48)	0.0001 (0.71)	−1.38e-06 (0.73)	1.812 (0.96)	166	3.32***	0.24	0.11

Notes: This table provides results for the different roles of investment on cash flow sensitivity of cash. Dependent variable is measured in year 2005, while other explanatory variables are average-past value over the period 2001-2004. All regressions include industry dummies. T-statistic values are reported in parentheses. Firms are identified as constrained and unconstrained firms by using their age, dividend, leverage, size and cash holding as explained in Section 3.2.5. In DIV2 group, DIV 2 is included in the regression. We use consistent heteroscedaticity standard errors. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 3.7:CSA(2006): Different Roles of Managerial Overconfidence in Financially Constrained Firms (OVER1).

Dependent variable		Independent variables														
CH		MTB	CFLOW	I	LEV	DIV	SIZE	AGE	OWN	OWN^2	OWN^3	I* CFLOW	Obs	F-test	R^2	Adj. R^2
Predicted		+	+ in non-over	–	+/–	–	–	+	–	+	+/–	+ in non-over				
SIZE	Overconfident	0.015 (0.25)	−0.619 (1.53)	−3.103 (2.02)*	−1.338 (1.82)*	−0.101 (0.11)	−0.146 (1.50)	0.047 (0.90)	−0.015 (0.62)	0.001 (0.81)	−2.43-05 (0.84)	9.534 (1.52)	28	11.37**	0.87	0.62
	Non-overconfident	0.050 (3.16)***	0.019 (1.14)	−0.347 (1.15)	−0.220 (1.62)	−1.147 (1.58)	−0.030 (1.23)	0.006 (0.39)	−0.001 (0.38)	1.26e-04 (1.22)	−1.39e-06 (1.74)*	1.548 (1.03)	137	3.67***	0.31	0.16
LEV	Overconfident	0.043 (0.53)	0.862 (1.79)*	−1.012 (0.50)	−0.478 (0.34)	−0.905 (0.35)	0.004 (0.10)	0.005 (0.10)	−0.002 (0.05)	1.94e-04 (0.08)	−8.22e-08 (0.23)	−0.486 (0.04)	28	2.50*	0.67	0.01
	Non-overconfident	0.041 (4.03)***	0.142 (1.20)	−0.205 (0.62)	−1.486 (3.07)***	−2.842 (5.56)***	−0.015 (1.65)	−0.004 (0.29)	−0.003 (0.53)	2.23e-04 (0.85)	−2.01e-06 (0.63)	2.717 (1.89)*	137	3.45***	0.49	0.38
DIV 1	Overconfident	0.049 (0.82)	0.175 (0.41)	0.027 (0.06)	−0.249 (0.93)	−41.926 (1.29)	−0.029 (0.77)	−0.022 (0.53)	−0.064 (1.23)	0.003 (1.21)	−4.71e-05 (1.12)	1.761 (0.27)	34	13.96***	0.68	0.20
	Non-overconfident	0.018 (1.14)	0.152 (1.51)	−0.324 (1.84)*	−0.156 (1.19)	−9.443 (0.97)	0.004 (0.49)	0.001 (0.02)	0.003 (0.74)	−1.61e-04 (1.21)	1.52e-06 (1.44)	1.994 (2.42)**	131	3.55***	0.31	0.16
AGE	Overconfident	0.043 (0.87)	0.252 (0.78)	−0.050 (0.16)	−0.486 (3.24)***	−0.813 (0.66)	−0.0002 (0.06)	−0.036 (0.57)	−0.036 (1.90)*	0.002 (1.73)*	−2.52e-05 (1.56)	0.603 (0.17)	34	9.08**	0.81	0.42
	Non-overconfident	0.037 (2.04)**	0.066 (0.46)	−0.336 (1.53)	−0.287 (2.09)**	−1.573 (1.74)*	−0.004 (0.51)	−0.061 (1.37)	−0.007 (1.37)	2.78e-04 (1.56)	−2.25e-06 (1.70)*	1.480 (1.10)	128	6.51***	0.42	0.28
DIV 2	Overconfident	0.016 (0.46)	0.198 (0.61)	−0.012 (0.03)	−0.314 (2.29)**	0.018 (1.89)*	−0.010 (0.63)	−0.002 (0.07)	−0.022 (2.02)*	0.001 (1.64)	1.06e-05 (1.16)	2.547 (0.78)	57	13.49***	0.48	0.15
	Non-overconfident	0.040 (2.58)**	0.062 (0.53)	−0.273 (1.56)	−0.128 (1.28)	0.001 (0.39)	0.003 (0.49)	−0.021 (1.75)*	−0.006 (1.85)*	2.76e-04 (2.30)**	−2.47e-06 (2.53)**	1.873 (1.82)*	159	2.89***	0.36	0.24

Notes: This table provides results for the prediction whether managerial overconfidence can eliminate the positive role of investment on cash flow sensitivity of cash. Dependent variable is measured in year 2006, while other explanatory variables are average-past value over the period 2002-2005.We split financially constrained firms into those with managerial overconfidence and those with non-overconfidence by using OVER 1. All regressions include industry dummies. t-statistic values are reported in parentheses. We use consistent heteroscedaticity standard errors. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 3.8:CSA(2005): Different Roles of Managerial Overconfidence in Financially Constrained Firms (OVER1).

Dependent variable		Independent variables														
CH		MTB	CFLOW	I	LEV	DIV	SIZE	AGE	OWN	OWN^2	OWN^3	I* CFLOW	Obs	F-test	R^2	Adj. R^2
Predicted		+	+ in non-over	–	+/–	–	–	+	–	+	+/–	+ in non-over				
SIZE	Overconfident	0.019 (0.30)	0.575 (0.52)	−1.324 (1.43)	−0.837 (1.88)*	−2.497 (1.99)*	0.113 (1.40)	0.014 (0.26)	−0.016 (0.48)	5.56e-04 (0.28)	−2.80-06 (1.10)	6.647 (0.45)	26	2.12**	0.45	0.28
	Non-overconfident	0.022 (1.97)*	−0.071 (0.46)	−0.136 (0.76)	−0.372 (5.92)***	−0.155 (0.75)	−0.021 (0.98)	0.009 (0.66)	−0.003 (1.03)	1.32e-04 (1.58)	−1.23e-06 (2.03)**	1.175 (0.76)	141	6.68***	0.37	0.25
LEV	Overconfident	−0.033 (0.66)	0.356 (0.61)	−1.353 (1.19)	−1.406 (1.09)	−0.197 (0.09)	0.046 (1.80)*	−0.079 (1.64)	−0.007 (0.23)	2.03e-04 (0.10)	−7.47e-06 (0.24)	1.813 (0.33)	31	4.06**	0.68	0.12
	Non-overconfident	0.013 (1.40)	0.228 (1.75)*	0.071 (0.35)	−0.745 (1.50)	−1.645 (3.15)***	−0.031 (3.37)***	−0.006 (0.45)	−0.003 (0.63)	5.48e-05 (0.25)	3.47e-07 (0.13)	1.758 (1.77)*	136	4.45***	0.31	0.16
DIV 1	Overconfident	0.092 (1.37)	−0.032 (0.07)	−0.108 (0.33)	−0.135 (0.46)	20.699 (1.72)*	0.022 (0.58)	−0.003 (1.88)*	−0.027 (0.44)	0.002 (0.47)	−3.43e-05 (0.44)	6.203 (0.97)	33	2.26*	0.54	0.04
	Non-overconfident	0.028 (2.41)**	0.176 (2.19)**	−0.119 (0.96)	−0.288 (5.36)***	−6.745 (0.80)	−0.014 (1.91)*	−0.0004 (0.03)	0.003 (0.94)	−1.32e-04 (1.13)	1.10e-06 (1.29)	1.051 (1.88)*	134	5.31***	0.43	0.31
AGE	Overconfident	0.055 (1.76)*	0.198 (0.62)	−0.168 (0.45)	−0.460 (2.88)**	−0.050 (1.23)	0.006 (0.28)	0.090 (0.86)	−0.041 (1.65)	0.003 (1.72)*	−3.81e-05 (1.74)*	0.243 (0.07)	35	4.43**	0.68	0.10
	Non-overconfident	0.022 (2.09)**	0.063 (2.18)**	−0.268 (1.83)*	−0.220 (3.08)***	−0.0002 (0.35)	−0.010 (1.57)	−0.031 (0.69)	−0.007 (1.64)	2.47e-04 (1.76)*	−1.95e-06 (1.87)*	2.003 (2.42)**	132	5.77***	0.43	0.30
DIV 2	Overconfident	0.056 (1.58)	0.223 (0.63)	−0.078 (0.29)	−0.191 (2.23)**	0.001 (0.62)	0.001 (0.08)	−0.020 (0.82)	−0.023 (1.88)*	0.001 (1.92)*	−1.74e-05 (1.84)*	−1.241 (0.30)	58	4.11***	0.45	0.34
	Non-overconfident	0.021 (1.97)*	0.062 (0.76)	−0.146 (1.24)	−0291 (5.80)***	0.001 (1.02)	−0.004 (0.62)	−0.003 (0.23)	−0.003 (1.06)	1.48e-04 (1.33)	−1.23e-06 (1.53)	1.230 (2.36)**	162	5.66***	0.34	0.22

Notes: This table provides results for the prediction whether managerial overconfidence can eliminate the positive role of investment on cash flow sensitivity of cash. Dependent variable is measured in year 2005, while other explanatory variables are average-past value over the period 2001-2004.We split financially constrained firms into those with managerial overconfidence and those with non-overconfidence by using OVER 1. All regressions include industry dummies. t-statistic values are reported in parentheses. We use consistent heteroscedaticity standard errors. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 3.9:CSA(2006): Different Roles of Managerial Overconfidence in Financially Constrained Firms (OVER2).

Dependent variable		Independent variables														
Investment		MTB	CFLOW	I	LEV	DIV	SIZE	AGE	OWN	OWN^2	OWN^3	I* CFLOW	Obs	F-test	R^2	Adj. R^2
CH		+	+ in non-over	−	+/−	−	−	+	−	+	+/−	+ in non-over				
SIZE	Overconfident	0.109 (5.59)***	0.024 (0.11)	−0.439 (0.58)	−0.323 (2.13)**	−2.534 (1.47)	−0.008 (0.24)	0.006 (0.24)	−0.016 (2.34)**	6.59e-04 (2.15)**	−6.39-06 (1.82)*	4.497 (0.66)	54	5.04***	0.65	0.40
	Non-overconfident	0.031 (1.97)*	0.139 (0.96)	−0.362 (0.94)	−0.258 (1.49)	−0.730 (0.85)	−0.060 (2.25)**	0.015 (0.83)	−0.0003 (0.08)	9.03e-05 (0.74)	−1.10e-06 (1.18)	−0.648 (0.40)	111	3.33***	0.34	0.18
LEV	Overconfident	0.034 (2.32)**	0.387 (2.08)**	0.253 (0.34)	−1.954 (3.69)***	−3.005 (4.80)***	−0.020 (2.50)**	−0.033 (2.19)**	−0.013 (1.97)*	6.55e-04 (1.84)*	−7.14e-06 (1.63)	−5.014 (1.23)	65	5.43***	0.73	0.60
	Non-overconfident	0.055 (3.73)***	0.200 (1.22)	−0.297 (0.91)	−1.026 (1.36)	−3.058 (4.53)***	−0.015 (1.24)	0.017 (0.98)	0.0001 (0.08)	1.24e-04 (0.43)	−6.84e-07 (1.21)	2.949 (1.81)*	100	5.21***	0.44	0.27
DIV1	Overconfident	0.011 (0.48)	0.279 (1.67)*	0.541 (0.88)	−0.389 (3.28)***	−0.253 (0.02)	−0.006 (0.63)	−0.023 (1.02)	−0.014 (1.59)	5.47e-04 (1.41)	−4.90e-06 (1.18)	−2.956 (0.87)	56	2.42**	0.68	0.42
	Non-overconfident	0.010 (0.48)	0.116 (0.93)	−0.403 (2.84)***	−0.125 (0.85)	−5.016 (2.01)*	0.009 (0.78)	0.001 (0.05)	0.003 (0.85)	1.92e-04 (1.23)	−1.76e-06 (1.40)	2.423 (2.61)**	109	2.77***	0.43	0.34
AGE	Overconfident	0.060 (3.54)***	0.203 (1.27)	−0.531 (0.93)	−0.233 (1.94)*	−2.439 (2.00)*	0.001 (0.22)	−0.086 (2.31)**	−0.012 (1.70)*	3.95e-04 (1.47)	−3.34e-06 (1.19)	1.266 (0.46)	72	3.04***	0.69	0.54
	Non-overconfident	0.013 (0.56)	0.246 (2.28)**	−0.230 (1.11)	−0.476 (3.65)***	−1.264 (1.08)	0.001 (0.09)	0.032 (0.62)	−0.006 (1.10)	3.41e-04 (1.63)	−2.92e-06 (1.86)*	1.967 (1.23)	90	3.69***	0.39	0.18
DIV2	Overconfident	0.080 (4.08)***	−0.010 (0.07)	−0.023 (0.05)	−0.304 (2.92)***	0.002 (0.49)	0.002 (0.28)	−0.032 (1.55)	−0.017 (2.76)***	5.54e-04 (1.75)*	−3.93e-06 (0.96)	1.126 (0.42)	74	6.74***	0.63	0.47
	Non-overconfident	0.029 (1.87)*	−0.039 (0.29)	−0.226 (1.36)	−0.128 (1.10)	−0.014 (1.66)*	−0.002 (0.15)	−0.008 (0.64)	−0.004 (1.12)	2.00e-04 (1.49)	−1.90e-06 (1.71)*	1.841 (1.69)*	142	1.85*	0.30	0.16

Notes: This table provides results for the prediction whether managerial overconfidence can eliminate the positive role of investment on cash flow sensitivity of cash. Dependent variable is measured in year 2006, while other explanatory variables are average-past value over the period 2002-2005.We split financially constrained firms into those with managerial overconfidence and those with non-overconfidence by using OVER 2. All regressions include industry dummies. t-statistic values are reported in parentheses. We use consistent heteroscedaticity standard errors. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 3.10:CSA(2005): Different Roles of Managerial Overconfidence in Financially Constrained Firms (OVER2).

Dependent variable		Independent variables														
CH		MTB	CFLOW	I	LEV	DIV	SIZE	AGE	OWN	OWN^2	OWN^3	I* CFLOW	Obs	F-test	R^2	Adj. R^2
Predicted		+	+ in non-over	−	+/−	−	−	+	−	+	+/−	+ in non-over				
SIZE	Overconfident	0.055 (1.22)	−0.182 (0.85)	−0.773 (1.04)	−0.443 (2.27)**	−1.799 (0.65)	0.011 (0.23)	0.023 (0.64)	−0.001 (0.14)	1.57e-05 (0.04)	−3.09-07 (0.08)	1.624 (0.31)	57	2.34**	0.34	0.09
	Non-overconfident	0.021 (2.05)**	0.106 (0.77)	0.041 (0.18)	−0.423 (5.28)***	−1.047 (1.84)*	−0.030 (1.32)	0.021 (1.43)	−0.003 (0.93)	1.18e-04 (1.24)	−1.04e-05 (1.51)	−0.128 (0.08)	110	6.04***	0.38	0.22
LEV	Overconfident	−0.008 (0.31)	0.132 (0.57)	0.053 (0.07)	−2.098 (2.88)***	−1.285 (1.30)	−0.024 (1.92)*	−0.037 (1.74)*	−0.006 (0.76)	2.35e-04 (0.63)	−2.10e-06 (0.49)	1.366 (0.38)	67	2.15**	0.42	0.13
	Non-overconfident	0.018 (1.57)	0.333 (1.82)*	0.098 (0.41)	−0.507 (0.87)	−2.091 (3.35)***	−0.034 (2.82)***	0.007 (0.44)	−0.002 (0.37)	4.17e-05 (0.17)	−1.89e-06 (0.66)	2.121 (1.98)*	100	3.93***	0.37	0.18
DIV 1	Overconfident	0.050 (1.96)*	0.132 (0.60)	0.355 (0.62)	−0.349 (2.94)***	−18.185 (1.12)	−0.003 (0.21)	−0.018 (0.79)	0.005 (0.39)	3.15e-04 (0.61)	−4.24e-06 (0.76)	−0.091 (0.02)	58	2.20**	0.55	0.28
	Non-overconfident	0.031 (2.78)***	0.122 (1.26)	−0.138 (1.47)	−0.295 (4.34)***	−1.655 (0.20)	−0.007 (0.85)	0.006 (0.45)	0.003 (0.79)	1.55e-04 (1.12)	1.36e-06 (1.33)	1.255 (2.69)***	109	5.18***	0.42	0.27
AGE	Overconfident	0.039 (2.61)**	−0.231 (1.83)*	0.306 (0.65)	−0.301 (2.86)***	0.001 (0.94)	0.002 (0.30)	−0.042 (0.76)	0.006 (0.83)	−3.05e-04 (1.02)	3.84e-06 (1.20)	0.246 (0.10)	74	5.28***	0.53	0.33
	Non-overconfident	0.028 (3.46)***	0.096 (1.06)	−0.136 (1.53)	−0.262 (3.19)***	−0.001 (3.27)***	−0.007 (0.87)	0.029 (0.70)	−0.006 (0.97)	2.37e-04 (1.08)	1.92e-06 (1.16)	1.307 (2.74)***	93	4.71***	0.49	0.32
DIV 2	Overconfident	0.051 (1.95)*	−0.082 (0.48)	0.334 (0.83)	−0.269 (3.51)***	−0.001 (0.21)	−0.003 (0.33)	−0.030 (1.48)	−0.001 (0.23)	9.29e-05 (0.29)	2.45e-06 (0.61)	2.441 (0.91)	73	3.19***	0.49	0.26
	Non-overconfident	0.025 (2.40)**	0.062 (0.68)	−0.157 (1.88)*	−0.268 (4.84)***	0.001 (0.88)	0.001 (0.14)	0.007 (0.58)	−0.001 (0.38)	8.92e-05 (0.70)	−8.28e-07 (0.90)	1.139 (2.76)***	147	4.37***	0.30	0.17

Notes: This table provides results for the prediction whether managerial overconfidence can eliminate the positive role of investment on cash flow sensitivity of cash. . Dependent variable is measured in year 2005, while other explanatory variables are average-past value over the period 2001-2004.We split financially constrained firms into those with managerial overconfidence and those with non-overconfidence by using OVER 2. All regressions include industry dummies. t-statistic values are reported in parentheses. We use consistent to heteroscedaticity standard errors. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 3.11: Panel Data Estimation by Using Different Methods.

Independent Variables	Dependent Variable: CH_{it}						
	1 OLS	2 AII	3 WITIIIN	4 GMM -LEV1	5 GMM- LEV2	6 GMM- DIF1	7 GMM- DIF2
CH_{it-1}	0.654 (0.020) (33.2)***	0.373 (0.054) (2.16)**	0.338 (0.078) (4.33)***	0.744 (0.078) (26.7)***	0.759 (0.028) (26.8)***	0.444 (0.048) (9.35)***	0.505 (0.046) (11.1)***
MTB_{it}	0.002 (0.002) (0.92)	−0.071 (0.018) (2.50)**	0.007 (0.006) (1.05)	0.004 (0.004) (0.98)	0.004 (0.005) (0.88)	0.002 (0.003) (0.85)	0.003 (0.003) (0.85)
MTB_{it-1}	0.004 (0.002) (2.12)**	−0.042 (0.028) (1.80)*	0.005 (0.006) (0.90)	0.004 (0.002) (1.22)	−0.002 (0.004) (0.37)	0.005 (0.002) (2.18)**	0.002 (0.002) (0.98)
$CFLOW_{it}$	0.060 (0.012) (3.12)***	0.028 (0.012) (2.22)**	0.050 (0.132) (0.38)	−0.016 (0.053) (1.30)	0.043 (0.101) (0.42)	0.042 (0.023) (1.82)*	0.054 (0.033) (1.63)
$CFLOW_{it\ 1}$	−0.043 (0.019) (2.27)**	0.037 (0.017) (2.18)**	−0.104 (0.113) (0.92)	0.004 (0.030) (0.12)	−0.076 (0.075) (1.01)	0.012 (0.020) (0.60)	−0.010 (0.024) (0.41)
I_{it}	−0.162 (0.037) (4.33)***	−0.008 (0.074) (2.09)**	−0.312 (0.215) (1.45)	−0.170 (0.126) (1.34)	−0.325 (0.283) (1.15)	−0.213 (0.056) (3.80)***	−0.092 (0.064) (1.44)
I_{it-1}	0.063 (0.030) (2.14)**	−0.016 (0.077) (2.17)**	−0.063 (0.022) (0.29)	0.019 (0.071) (0.27)	0.285 (0.293) (0.98)	−0.091 (0.045) (2.04)**	−0.031 (0.046) (1.66)*
LEV_{it}	−0.113 (0.019) (5.87)***	0.001 (0.031) (0.67)	0.090 (0.134) (0.67)	−0.147 (0.081) (1.82)*	−0.093 (0.582) (0.16)	−0.044 (0.026) (1.70)*	−0.063 (0.041) (1.57)
LEV_{it-1}	0.052 (0.019) (2.58)***	0.014 (0.037) (2.15)**	−0.078 (0.067) (1.17)	0.090 (0.070) (1.29)	0.085 (0.110) (0.77)	0.058 (0.023) (2.50)**	0.087 (0.025) (3.45)***
DIV_{it}	−0.133 (0.089) (1.49)	0.003 (0.002) (2.04)**	−0.180 (0.614) (0.29)	−0.220 (0.161) (1.37)	0.093 (0.582) (0.16)	−0.196 (0.119) (1.64)	0.002 (0.106) (0.21)
DIV_{it-1}	0.041 (0.064) (0.66)	−0.012 (0.005) (2.17)**	−0.677 (0.609) (1.11)	0.069 (0.087) (0.79)	−0.201 (0.496) (0.41)	−0.065 (0.001) (1.29)	0.023 (0.036) (0.65)
$SIZE_{it}$	−0.011 (0.006) (1.68)*	0.082 (0.039) (2.10)**	−0.031 (0.028) (1.08)	−0.025 (0.022) (1.15)	−0.006 (0.026) (0.24)	−0.009 (0.008) (1.18)	-0.012 (0.015) (0.81)
$SIZE_{it-1}$	0.008 (0.006) (1.21)	−0.002 (0.006) (0.34)	0.051 (0.024) (2.15)**	0.024 (0.022) (1.08)	0.005 (0.026) (0.20)	−0.008 (0.006) (1.23)	−0.012 (0.006) (1.84)*
AGE_{it-1}	−0.034 (0.029) (1.16)	0.014 (0.007) (2.15)**	0.065 (0.233) (0.28)	−0.045 (0.039) (1.16)	−0.020 (0.079) (0.26)	−0.040 (0.084) (0.47)	−0.088 (0.079) (1.12)
AGE_{it-1}	0.030 (0.028) (1.09)	0.019 (0.009) (2.15)**	−0.068 (0.186) (1.52)	0.042 (0.037) (1.14)	0.019 (0.074) (0.26)	0.028 (0.063) (0.44)	0.064 (0.058) (1.11)
I_{it}*$CFLOW_{it}$	0.146 (0.194) (0.75)	0.0004 (0.0001) (2.48)**	−0.199 (0.233) (0.28)	1.731 (0.524) (3.30)***	1.384 (1.101) (1.26)	0.167 (0.250) (0.67)	−0.142 (0.266) (0.46)
I_{it-1} *$CFLOW_{it-1}$	−0.163 (0.176) (0.93)	0.0003 (0.0002) (2.03)**	1.241 (1.261) (0.98)	−0.832 (0.263) (3.16)***	−0.539 (0.720) (0.75)	0.069 (0.205) (0.33)	−0.050 (0.271) (0.19)
M1	−2.327**	−4.508**	−1.022	−3.882***	−3.508***	−8.118***	−8.612***
M2	−1.753*	−1.957**	−2.519**	1.368	1.064	1.377	1.553
Sargan Test	-	-	-	187.5***	90.34***	251.2**	244.1**
Wald Test (joint)	2108***	25.33*	39.12***	1954***	1583***	197***	207.9***

Table 3.12: Dynamic Panel Data Estimation (GMM-DIF3).

Dependent variable		Independent variables													
CH_{it}		CH_{it-1}	MTB_{it}	$CFLOW_{it}$	I_{it}	LEV_{it}	DIV_{it}	$SIZE_{it}$	AGE_{it}	I_{it}* $CFLOW_{it}$	M1	M2	Wald (Joint)	Wald (Time)	Sargan	Firms
All firms		0.500 (10.4)***	0.002 (0.33)	0.011 (0.14)	−0.278 (1.77)*	0.001 (0.01)	−0.356 (1.73)*	−0.017 (0.88)	−0.002 (1.01)	1.473 (1.89)*	−8.56***	1.05	154.7***	37.49**	120.1	632
SIZE	Constrained	0.532 (4.98)***	0.008 (0.90)	0.066 (0.77)	−0.363 (1.71)*	−0.065 (0.78)	−0.671 (1.55)	−0.013 (0.53)	−0.201 (0.99)	0.295 (0.37)	−5.24***	1.19	115.7***	14.99*	142.9	192
	Unconstrained	0.374 (3.98)***	0.011 (1.63)	0.036 (0.55)	−0.290 (1.95)*	−0.041 (0.85)	0.016 (0.05)	−0.045 (2.48)**	0.079 (0.58)	0.178 (0.25)	−3.73***	−0.81	74.37***	16.26*	129.7	162
LEV	Constrained	0.492 (7.48)***	0.002 (0.30)	0.191 (2.26)**	−0.245 (0.75)	0.148 (1.04)	−0.743 (1.66)*	−0.057 (2.16)**	0.002 (0.16)	1.982 (1.94)*	−5.85***	0.61	141.4***	22.89**	133.0	177
	Unconstrained	0.249 (2.90)***	−0.002 (0.26)	−0.011 (0.23)	−0.042 (0.88)	0.060 (1.01)	0.257 (1.11)	0.001 (0.16)	−0.042 (0.58)	−0.042 (1.11)	−3.52***	−0.85	79.78***	14.79*	114.3	162
DIV 1	Constrained	0.383 (6.12)***	0.003 (0.43)	0.112 (1.72)*	−0.193 (1.37)	0.008 (0.07)	0.036 (0.05)	−0.011 (0.71)	−0.384 (1.06)	1.071 (1.98)*	−5.45***	1.04	99.65***	31.18**	125.1	208
	Unconstrained	0.610 (7.05)***	−0.008 (0.99)	−0.047 (0.44)	−0.145 (0.29)	−0.191 (1.65)*	−0.001 (0.31)	−0.032 (0.86)	0.243 (1.03)	0.264 (0.17)	−4.31***	−0.45	88.12***	47.62***	118.3	154
AGE	Constrained	0.402 (6.27)***	0.001 (0.09)	0.027 (0.34)	−0.192 (1.53)	0.095 (0.72)	−0.619 (1.19)	−0.018 (1.02)	0.222 (0.63)	0.197 (0.36)	−4.99***	0.77	117.8***	29.99**	138.9	193
	Unconstrained	0.362 (5.87)***	−0.002 (0.30)	−0.060 (0.62)	−0.285 (1.24)	−0.032 (0.54)	0.148 (0.61)	−0.070 (1.57)	−0.067 (1.20)	0.847 (0.84)	−4.13***	1.04	92.26***	17.86*	145.8	182
DIV 2	Constrained	0.393 (6.00)***	−0.002 (0.27)	0.033 (1.74)*	−0.297 (1.48)	−0.026 (0.20)	0.002 (0.68)	−0.030 (1.08)	−0.041 (0.14)	1.596 (1.69)*	−5.89***	1.20	143.1***	31.96***	130.7	252
	Unconstrained	0.525 (4.74)***	−0.009 (0.90)	0.127 (1.39)	−0.043 (0.15)	0.090 (1.27)	0.002 (1.14)	−0.055 (1.50)	0.057 (0.16)	−0.659 (0.57)	−3.67**	1.14	104.0***	19.36*	105.9	144

Notes: Firms are identified as constrained and unconstrained firms by using their age, dividend, leverage, size and cash holding as explained in Section 3.2.5. In particular, we regards constrained(unconstrained) firms in GMM are those who have been identified as constrained(unconstrained) firms for at least half of their duration, therefore the numbers of observation are different across four groups. For the estimation, levels dated t-2 and further lags of each regressor are used as instruments. Time dummies were used in all specifications. We use asymptotic standard errors robust to heteroscedasticity. We report the Sargan test, which is a test of over-identifying restrictions, asymptotically distributed as χ^2 under the null of valid instruments. M1 and M2 are tests for the absence of first order and second order correlation in the residuals. These test statistics are asymptotically distributed as N(0,1) under the null of no serial correlation. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 3.13: Dynamic Panel Data Estimation (GMM-SYS).

Dependent variable		Independent variables													
$CASH_{it}$		$CASH_{it-1}$	MTB_{it}	$CFLOW_{it}$	I_{it}	LEV_{it}	DIV_{it}	$SIZE_{it}$	AGE_{it}	I_{it}* $CFLOW_{it}$	M1	M2	Wald (Joint)	Wald (Time)	Sargan	Firms
All firms		0.659 (26.8)***	0.001 (0.28)	−0.031 (0.61)	−0.191 (1.72)*	−0.108 (1.52)	−0.178 (1.74)*	−0.017 (0.93)	−0.054 (1.35)	1.729 (3.19)***	−7.11***	0.94	1659***	15.65*	264.4	632
SIZE	Constrained	0.615 (16.0)***	0.005 (0.77)	0.054 (0.81)	−0.203 (1.24)	−0.167 (1.94)*	−0.610 (2.37)**	−0.027 (1.00)	0.084 (0.92)	0.839 (1.24)	−6.59***	1.91	611.3***	42.8***	151.7	192
	Unconstrained	0.604 (10.2)***	−0.012 (2.04)**	0.117 (1.68)*	−0.257 (1.31)	−0.038 (0.67)	−0.145 (0.62)	−0.042 (2.69)**	−0.062 (1.20)	0.077 (0.09)	−4.78***	0.90	436.3***	22.1***	119.0	162
LEV	Constrained	0.609 (16.6)***	0.003 (0.56)	0.104 (2.37)**	−0.169 (0.72)	0.101 (0.90)	−0.949 (3.43)***	−0.045 (2.00)**	0.002 (0.13)	1.820 (2.09)**	−6.69***	0.54	545.3***	73.4***	141.4	177
	Unconstrained	0.594 (11.1)***	0.001 (0.11)	0.054 (0.93)	−0.121 (1.68)*	−0.078 (1.42)	0.028 (0.12)	−0.001 (0.12)	0.022 (0.60)	0.204 (0.41)	−4.63***	0.13	402.5***	39.17**	120.5	162
DIV 1	Constrained	0.550 (15.1)***	0.006 (1.70)*	0.053 (1.08)	−0.126 (0.88)	−0.145 (1.32)	−0.080 (0.11)	−0.002 (0.12)	−0.052 (0.57)	1.366 (2.82)***	−6.41***	0.98	513.0***	30.19**	168.4	208
	Unconstrained	0.796 (22.3)***	−0.005 (0.71)	0.034 (1.48)	0.604 (1.47)	−0.087 (0.92)	−0.001 (0.37)	0.001 (0.06)	0.034 (0.54)	−2.829 (1.89)*	−5.09***	0.01	842.7***	20.05	116.7	154
AGE	Constrained	0.697 (15.7)***	0.001 (0.02)	0.094 (1.48)	−0.165 (1.31)	−0.081 (1.90)*	−0.499 (1.56)	−0.009 (0.51)	−0.064 (0.68)	0.513 (0.94)	−5.94***	0.80	699.4***	37.5***	156.7	193
	Unconstrained	0.604 (11.9)***	0.005 (0.60)	−0.064 (0.59)	−0.174 (0.70)	−0.041 (0.80)	0.066 (0.31)	−0.040 (1.44)	−0.504 (1.30)	0.768 (0.66)	−4.41***	1.63	357.0***	16.81	145.8	182
DIV 2	Constrained	0.556 (16.4)***	0.004 (0.73)	0.027 (1.77)*	−0.309 (1.49)	−0.194 (1.99)**	0.002 (0.78)	−0.029 (1.33)	−0.026 (0.35)	2.859 (3.78)***	−7.05***	1.15	611.4***	45.1***	215.8	252
	Unconstrained	0.778 (18.5)***	−0.006 (0.57)	0.105 (1.18)	−0.026 (1.10)	−0.008 (0.10)	0.001 (1.05)	−0.003 (0.12)	−0.066 (1.10)	0.704 (0.56)	−4.44***	1.65	730.7***	15.99	105.9	144

Note: Firms are identified as constrained and unconstrained firms by using their age, dividend, leverage, size and cash holding as explained in Section 3.2.5. In particular, we regards constrained (unconstrained) firms in GMM are those who have been identified as constrained (unconstrained) firms for at least half of their duration, therefore the numbers of observation are different across four groups. For all estimations, levels dated t-2 of each regressor are used as instruments whereas the equation in levels, first differences dated t-1 are used as instruments. Time dummies were used in all specifications. We use asymptotic standard errors robust to heteroscedasticity. We report the Sargan test, which is a test of over-identifying restrictions, asymptotically distributed as χ^2 under the null of valid instruments. M1 and M2 are tests for the absence of first order and second order correlation in the residuals. These test statistics are asymptotically distributed as N(0,1) under the null of no serial correlation. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 3.14: Static Model using system-GMM estimations.

Dependent variable		Independent variables													
$CASH_{it}$		MTB_{it}	$CFLOW_{it}$	I_{it}	LEV_{it}	DIV_{it}	$SIZE_{it}$	AGE_{it}	I_{it}* $CFLOW_{it}$	M1	M2	Wald (Joint)	Wald (Time)	Sargan	Firms
All firms		0.760 (3.75)***	0.556 (1.26)	−0.579 (−2.71)***	0.507 (0.19)	−0.179 (8.26)***	1.569 (4.42)***	0.918 (2.71)***	0.136 (0.84)	−7.56***	−3.70***	179.3***	24.62***	238.6	632
SIZE	Constrained	0.447 (2.10)**	−0.253 (0.48)	0.860 (0.93)	1.135 (7.51)***	0.252 (0.76)	0.793 (2.42)**	2.580 (0.54)	1.025 (0.81)	−5.20***	−2.30***	80.4***	20.1**	163.9	192
	Unconstrained	0.849 (1.89)*	−0.571 (2.13)**	4.529 (0.65)	1.063 (3.44)***	1.924 (1.52)	0.871 (1.72)*	0.446 (1.76)*	0.432 (0.62)	−2.97***	−2.97***	35.6***	22.1**	141.6	162
LEV	Constrained	0.667 (2.58)***	0.399 (1.43)	0.523 (2.59)***	−0.798 (2.51)**	0.329 (2.10)**	0.864 (4.16)***	−2.805 (1.60)	0.376 (1.29)	−5.27***	−3.02***	59.8***	14.8*	156.3	177
	Unconstrained	0.051 (0.10)	2.384 (1.49)	0.531 (1.56)	−0.190 (0.05)	−0.0003 (0.37)	0.474 (0.30)	−0.830 (0.54)	0.363 (0.70)	−4.52***	−1.92	43.5***	10.3	62.29	162
DIV 1	Constrained	0.682 (3.27)***	0.558 (0.55)	0.408 (1.32)	1.435 (5.36)***	−2.922 (0.23)	−1.442 (1.89)*	1.248 (2.60)***	0.263 (1.03)	−5.22***	−2.30***	77.6***	25.7*	177.5	208
	Unconstrained	−0.964 (1.91)*	0.167 (1.36)	−0.627 (2.08)**	1.100 (0.72)	−2.166 (1.59)	0.999 (3.28)***	0.0002 (1.05)	0.065 (0.41)	−3.33***	−2.81***	49.1***	33.4***	97.23	154
AGE	Constrained	0937 (3.93)***	1.278 (1.25)	0.568 (1.63)	1.444 (4.32)***	−0.332 (0.98)	1.096 (1.53)	1.511 (0.60)	0.423 (0.49)	−4.92***	−2.62***	69.4***	22.2***	175.4	193
	Unconstrained	0.317 (0.94)	2.211 (1.76)*	1.636 (3.11)***	0.880 (4.00)***	1.571 (1.24)	0.907 (1.81)*	0.021 (0.35)	−0.066 (0.46)	−3.92***	−1.56	48.3***	22.2***	143.2	182
DIV 2	Constrained	1.001 (3.86)***	0.667 (1.07)	0.601 (1.64)	1.201 (6.61)***	−0.455 (0.60)	0.815 (2.39)**	5.233 (2.55)**	0.267 (1.76)*	−6.45***	−2.64***	118.9***	19.4**	118.9	252
	Unconstrained	−1.370 (1.67)*	0.132 (0.13)	1.191 (2.92)***	1.578 (0.99)	−0.002 (0.01)	1.727 (2.21)**	0.089 (0.30)	−2.524 (1.26)	−3.74***	−1.70	24.9***	17.3*	120.5	144

Note: Firms are identified as constrained and unconstrained firms by using their age, dividend, leverage, size and cash holding as explained in Section 3.2.5. In particular, we regards constrained (unconstrained) firms in GMM are those who have been identified as constrained (unconstrained) firms for at least half of their duration, therefore the numbers of observation are different across four groups. For all estimations, levels dated t-2 of each regressor are used as instruments whereas the equation in levels, first differences dated t-1 are used as instruments. Time dummies were used in all specifications. We use asymptotic standard errors robust to heteroscedasticity. We report the Sargan test, which is a test of over-identifying restrictions, asymptotically distributed as χ^2 under the null of valid instruments. M1 and M2 are tests for the absence of first order and second order correlation in the residuals. These test statistics are asymptotically distributed as N(0,1) under the null of no serial correlation. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Chapter 4

The Impact of Managerial Overconfidence on Debt Maturity: Empirical Evidence from the UK

4.1 Introduction

Four main hypotheses are presented by the existing literature as the determinants of debt maturity structure. These include: 1) *the agency cost of debt hypothesis* that short-term debt is more effective than long-term debt in reducing agency costs arising from debt financing (Myers, 1977; Barnea *et al.*, 1980; Hart and Moore, 1995); 2) *the asymmetric information hypothesis* that short-term debt can act as a signalling role of firms' quality (Flannery, 1986), and long-term debt will be preferred by firms when liquidity risk increases over time (Diamond, 1991); 3) *the taxation hypothesis* that optimal debt maturity depends on the tax advantage of debt (Brick and Ravid, 1985); 4) *the managerial discretion hypothesis* that long-term debt will be preferred when managers' self-interests are weakly aligned with shareholders'(Datta *et al.*, 2005; Guney and Ozkan, 2005).

Although the empirical literature has been successfully in providing evidence of the significant roles played by firm-specific characteristics such as size, growth opportunity, firm's quality, tax rates, managerial ownership in determining debt maturity (Barclay and Smith, 1995; Stohs and Mauer, 1996; Datta *et al.*, 2005 etc.), little is known about the extent to which the personal characteristics such as managerial overconfidence may affect this policy. Managerial overconfidence as a particular form of cognitive bias focuses on a stylized fact that some managers are less than completely rational and tend to overestimate the prospects of their projects. Hence they are more likely to believe their firms being undervalued by the market. This tendency can potentially lead overconfident managers to adopt a biased debt maturity, which is a choice between short-term debt and long-term debt. A possible scenario, for example, is that overconfident managers have more incentives to use short-term debt to signal their perceived quality to the market. Moreover, this can happen even if overconfident managers believe they run the best interests of shareholders and maximize shareholders' wealth, although they are not doing so. Thus, the impact of managerial overconfidence on debt maturity should be irrelevant of the impact of managerial discretion on debt maturity for private benefits. The main objective of this chapter is therefore to provide more

insight into the potential role of managerial overconfidence in determining debt maturity structure.

The empirical analysis of this chapter is presented in three stages. First, based on traditional theories of asymmetric information and agency costs, we simply investigate the direct impacts of firm-specific characteristics on debt maturity (long-term debt ratio). Specifically, we investigate the non-linear impact of managerial ownership on debt maturity. It has been argued that managerial ownership is a potential incentive mechanism which can alleviate managerial discretion related to conflicts between managers and shareholders. When managerial ownership is at a low level, an increase in managerial ownership can help to align the different interests between managers and shareholders. Thus firms tend to increase short-term debt with managerial ownership to facilitate more external monitoring (*alignment effect*). However, when managerial ownership exceeds a certain level, the alignment benefits for managers from short-term debt are no longer higher than their private benefits from long-term debt and thus the conflicts can no longer be aligned. Instead, firms tend to lengthen their maturity of debt to avoid external monitoring (*entrenchment effect*). We expect to observe a negative relationship between managerial ownership and long-term debt ratio and a positive relationship between the squared value of managerial ownership and long-term debt ratio.

Second, we test whether managerial overconfidence can affect firms' debt maturity. In the presence of asymmetric information, short-term debt can act as a signalling role of firms' quality and so a negative relationship between firms' quality and long-term debt can be predicted. We argue that overconfident managers are more disposed to issue short-term debt to signal their perceived quality. The reason for this is because overconfident managers overestimate the future outcomes of their projects and tend to believe their firms being undervalued by the market, which means they have to pay higher premiums to issue long-term debt than they expected. In order to avoid such unnecessary costs, overconfident managers are more likely to issue short-term debt. Moreover, they take advantage of the re-evaluation associating with the short-term debt to pursue a better debt contract in the future. Thus, we expect to find that managerial

overconfidence can increase the negative relationship between firms' quality and long-term debt ratio.

Moreover, in the presence of agency costs, since short-term debt can alleviate the underinvestment problems, then firms' with more growth opportunities tend to issue more short-term debt. The relationship between short-term debt and growth opportunity can be more significant for firms with overconfident managers. This is because the perceived growth opportunity by overconfident managers is higher than it should be. When overconfident managers realize that long-term debt is unable to help them invest at their desired level, they have more incentives to choose more short-term debt. Hence, we predict that managerial overconfidence can increase the negative relationship between firms' growth opportunity and long-term debt.

Also, we believe that managerial overconfidence as a psychological factor is irrelevant of managerial discretion. Thus, the impact of managerial overconfidence on debt maturity should be still pronounced when we take account of the impact of managerial ownership on debt maturity.

Third, we further consider whether the impact of managerial overconfidence on debt maturity is homogeneous across corporate governance mechanisms. It has been suggested that a potential prescription for managerial overconfidence could be outsider monitoring when biased decisions are recurrent problems (Kahneman and Lovallo, 1993; Malmendier and Tate, 2005). By that they mean that outsiders are capable of drawing managerial attention to information that may indicate that their perceptions are wrong. If this is the case, we expect to find the impact of managerial overconfidence on debt maturity becomes insignificant in firms with strong monitoring governance mechanisms. By contrast, the influences of managerial overconfidence on debt maturity should persist in firms with weak monitoring governance mechanisms. Meanwhile, given that corporate governance mechanisms can exert monitoring effects on managerial discretion, we predict that, in the presence of good governance mechanisms, managerial discretion can be effectively aligned and thus the non-linear relationship between debt maturity and managerial ownership becomes less pronounced.

To investigate these empirical hypotheses, we use a large sample of UK listed firms over the period 2002-2006. First of all, we collect the annual share dealings by executive directors to identify managerial overconfidence (OVER1), which is a dummy variable equalling 1 when executive directors are persistently net buyers in the open market over the period 2003-2006 and 0 otherwise. Meanwhile, we consider those firms which have been habitual net buyer for at least three years during 2003-2006 as an alternative measurement of managerial overconfidence (OVER 2) to provide more evidence. In addition, we use OVER3 for our robustness test, which is based on outside perception by using the business press which characterizes executive directors as "confident" or "optimistic". When the number of articles describing a firm's executive directors as "confident" or "optimistic" is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006, this firm is identified as the one with managerial overconfidence. We include two interaction terms of managerial overconfidence and firms' quality and managerial overconfidence and growth opportunity to test the impacts of managerial overconfidence on debt maturity. Moreover, in order to test the roles of corporate governance mechanisms in influencing debt maturity by overconfident managers, we split firms using a set of governance variables such as board size, non-executives' ratio and blockholders' ownership. In particular, for each variable we divide firms into those three subgroups: board size (*larger, medium, smaller*), non-executive ratio (*higher, medium, lower*) and blockholders' ownership (*higher, medium, lower*). Firms are assigned to the larger (higher) groups when they are in the top three deciles of the whole distribution, and vice versa. And the rest of them are assigned to the medium groups. Finally, in terms of the estimation methods, we initially utilize the average cross-sectional estimation (Rajan and Zingales, 1995) to control the possibilities that short-term fluctuations and endogeneity in data may also have some important impacts on debt maturity. To test the robustness of our results, we execute our estimation over two different time periods: one, the dependent variable is measured in 2006; two, the dependent variable is measured in 2005. And all the other explanatory variables are lagged average values. Finally, pooled regression is included to give more evidence.

The analysis of this chapter provides several important findings with regard to the association among firm-specific variables, managerial ownership, managerial overconfidence and debt maturity. We find firms with larger size and worse quality tend to issue more long-term debt, which is consistent with the asymmetric information hypothesis. As far as the firms' debt capacity is concerned, we find firms with higher leverage tend to issue more long-term debt. Moreover, we find a significantly negative relationship between firms' liquidity and long-term debt, which rejects the argument that firms with higher liquidity will be easier to access external funds. By contrast, our evidence suggests that higher liquidity limits firms' debt capacity, which is in line with the arguments by Myers and Rajan (1998). Moreover, our evidence strongly supports a non-linear relationship between managerial ownership and long-term debt. We observe that when managerial ownership is at a low level, a negative relationship exists between managerial ownership and long-term debt. It indicates an increase in managerial ownership can align the different interests between managers and shareholder. However, when managerial ownership exceeds a certain level, a positive relationship exists between managerial ownership and long-term debt. It implies that firms tend to lengthen their maturity of debt for their private benefits rather than pursue alignment benefits. Finally, there is only limited evidence for the tax hypothesis that long-term debt is directly related to tax rates.

As for the impact of managerial overconfidence, we observe strong evidence that managerial overconfidence can significantly increase the negative relationship between firms' quality and long-term debt, which is consistent in our robustness checks. We also find some evidence that the negative relationship between firms' growth opportunity and long-term debt is greater for firms with managerial overconfidence. However, it is not significant in our robustness checks. Moreover, our results imply that the impact of managerial overconfidence on debt maturity is distinct from the impact of managerial discretion on debt maturity. Both play significant roles in determining debt maturity.

Finally, the impacts of managerial overconfidence and managerial ownership on debt maturity can also be related to corporate governance mechanisms. With regard to the impact of managerial overconfidence, our findings show that the

negative impact on the relationship between firms' quality and long-term debt is retained to be significant in firms with weak governance mechanisms (i.e. lower non-executive ratio or lower blockholders' ownership. In contrast, this impact tends to be insignificant in firms with good governance mechanisms (i.e. medium non-executive ratio or medium blockholders' ownership). This is in line with our argument that, assuming the biased decision is a recurrent problem, outsider monitoring can be an effective prescription for the biased decision. In terms of managerial ownership, its non-linear impact on debt maturity becomes insignificant in firms with good governance mechanisms (i.e. firms with medium ratio of non-executive directors in boards or with medium blockholders' ownership). It suggests that effective outsider monitoring can align the conflicts between managers and shareholders and thus the impact of managerial ownership becomes less pronounced in these firms. However, we do not find consistent results that neither the impact of managerial overconfidence on debt maturity nor the impact of managerial ownership on debt maturity changes to be significant when firms with higher ratio of non-executive directors in boards or with higher blockholders' ownership.

The remainder of the chapter is organized as follows. In Section 4.2, we provide a brief review of related literature and organize our empirical hypothesis. In Section 4.3, we describe our dataset and methodology. And our results are presented in Section 4.4. Section 4.5 provides robustness checks using alternative measurements of managerial overconfident and an alternative estimation method such as pooled regression. Finally, we present the conclusion in Section 4.6.

4.2. Related Literature and Empirical Hypotheses

4.2.1 Determinants of Debt Maturity

4.2.1.1 Definition of Debt Maturity

Prior studies have used various measures of debt maturity. The most common one is to use the ratio of short-term or long-term debts to total debts as a proxy for the average debt maturity of firms. In particular, some studies on US firms

consider a debt as a long-term debt if it is due to be repaid after one year (e.g. Scherr and Hulburt, 2001) while others define it as long-term debt if it is due to repaid after three years (Barclay and Smith, 1995; Barclay *et al.*, 2003) or after five years (e.g. Datta *et al.*, 2005). Because of the limited availability of data, studies on the UK firms, such as Guney and Ozkan (2005) mainly use the standard accounting definition of long-term debt, which is that any debt due to be repaid in more than one year. This method has also been applied to international studies, such as evidence for Italy, the UK and India (e.g. Schiantarelli and Sembenelli, 1997a and 1997b), and for France, Germany and the UK (e.g. Antoniou *et al.*, 2006).

Another method to define debt maturity is to use the maturity of new public debt issues rather than existing issues. They adopt the term of maturity of each debt issue to identify debt maturity in years: in Mitchell (1991), short-term debt is less than 20 years, whereas in Guedes and Opler (1996) it is less than 10 years. This incremental approach enables to identify the determinants of maturity at all points. However, new debt issues may have a maturity that is very different from the average maturity of a firm's assets.

The third method to measure debt maturity is to use weighted average maturity of liabilities such as in Stohs and Mauer (1996) and Scherr and Hulburt (2001), which equals the fractions of each type of debt multiplied by its average remaining maturity in years (months). However, this method is strongly dependent on having the detailed information on outstanding debt, which is not available in the UK.

In this chapter, driven primarily by the available data, we define long-term debt as the debt maturing in more than one year, while short-term debt as the borrowing repayable within one year. And the debt maturity (MAT) ratio is defined as long-term debt divided by total debt.

4.2.1.2 Signalling vs Asymmetric Information

A large amount of studies on asymmetric information (Jaffee and Russell, 1996;

Stiglitz and Weiss, 1981) argue that lenders, in debt markets, cannot identify information about firms' value or the riskiness of firms' investment project, the asymmetric information between lenders and firms will make external financing costly (*the adverse selection problem and the moral hazard problem*) and affects firms' investment incentives (*the underinvestment problem*). In addition, Flannery (1986) suggests a signalling role of debt maturity associating with asymmetric information. He emphasizes the existence of different debt equilibriums according to zero transaction costs or positive transaction costs. On the one hand, if issuing debt is costless, then bad-quality firms can mimic good-quality firms. Hence, only a pooling equilibrium in this market can be achieved, reflecting the average quality of all firms. Thus, good-quality firms will suffer from this pooling equilibrium because of the negative mis-valuation by lenders. In contrast, bad-quality firms will benefit from this equilibrium because of the positive mis-valuation by lenders. On the other hand, if issuing debts is costly, the self-selection can induce bad-quality firms to have greater propensities to issue long-term debt. When the mis-valuation in pooling equilibrium by lenders is higher than the added transaction costs from the rollover short-term debt, then a separating equilibrium will be generated that good-quality firms turn to issue short-term debt. His argument has also been supported by Kale and Noe's study (1990), in which they find a sequential game equilibrium in an economy with no transaction costs. When the changes in firms' value are correlated over time, a similar separating equilibrium as in Flannery's (1986) can be achieved.

In summary, if the debt market cannot distinguish between good- and bad-quality firms, then firms with better quality prefer short-term debt to avoid paying extra premiums on long-term debt. Moreover, when firms need to renew their debt contracts, good-quality firms can benefit from a re-evaluation and have a new debt contract at better terms than bad-quality firms. In contrast, bad-quality firms will suffer from the re-evaluation and tend to issue long-term debts to postpone it. Therefore, short-term debt can be regarded as a signal of firms' good quality and we can predict a negative relationship between firms' quality and debt maturity (long-term debt ratio). In line with Ozkan (2000), we use the growth rate of earning to proxy for firms' quality (QUALITY1), which is defined as the difference between pretax profits in t+1 and the pretax profits in t divided by the

pretax profits in t. Alternatively, we use the difference between EPS in year t+1 and t divided by share price in t as an alternative proxy for firms' quality (QUALITY2).

4.2.1.3 Liquidity Risk vs Asymmetric Information

A major drawback of short-term debt is the high liquidity risk that it entails. Diamond (1991) creates a strong link between the credit rationing system and debt maturity that debt maturity is a trade-off between the benefits of short-term debt (such as signalling effects of their credit ratings, in Flannery (1986)) and its liquidity risk. In particular, liquidity risks are those risks undertaken when borrowers are unable to refinance because of the deterioration in financial or economic conditions. It suggests that short-term debt can give substantial control to lenders such that they are able to refuse to refinance the debt contract when bad news arrives resulting in inefficient liquidation for borrowers. For high-rated (good-quality) firms, since the private information benefits of credit ratings can overweigh the liquidity risk, they still prefer short-term debts such as commercial papers. For low-rated (bad-quality) firms, since their private information benefits of credit ratings cannot overweigh the liquidity risk, they would turn to prefer long-term debt. However, for very low-rated firms, they have no choice but to choose short-term debt via private placement and/or intermediaries. This is because the firms have more probabilities of insufficient cash flow to support long-term debt and the returns received in liquidation are a large part of returns received by these firms. In summary, the debt maturity is not a monotonic function of borrowers' credit rating, which contradicts the signalling hypothesis by Flannery (1986).

In the study of Leland and Toft (1996), bankruptcy as a kind of liquidity risk is determined endogenously and depends on the maturity and the amount of short-term debt. Optimal leverage level depends on debt maturity and is lower when firms are financed by short-term debt. In particular, firms with low levels of leverage are supposed to face less liquidity risk (Ferri and Jones, 1979; Titman and Wessel, 1988; Whited, 1992) and thereby have no incentives to shun short-term debt. Thus, liquidity risk increases with the leverage and firms with higher

leverage are expected to use more long-term debt. Thus, we predict a positive relationship between leverage and long-term debt. To test the robustness of our results, we measure leverage in two ways: (1) the ratio of total debt to total asset (LEV1); (2) The ratio of total debt to book value of total assets minus book value of equity plus the market value of equity (LEV2).

In addition to leverage, asset liquidity can act as another proxy for firms' debt capacity. A traditional view is that liquid assets give creditors greater value in liquidation. In the model of Harris and Raviv (1990), they note the advantages of debt in providing information about a firm's prospects. This is because managers are reluctant to provide the detailed information that could result in liquidation. Investors need to exploit the informational role of debt by observing a firm's ability to make contractual payments, and then decide whether to liquidate the firm or not. Consequently, the optimal debt is determined by trading off the expected costs of default against the mitigating agency costs of debt. Firms with higher asset liquidity can give investors greater value in liquidation than firms with lower asset liquidity. Hence, investors are more likely to use debt to obtain information about the firm. However, Myers and Rajan (1998) argue that excessive liquidity generates more potential conflicts between managers and investors over property rights and limits the managers' operating flexibility. As a result, greater asset liquidation can reduce firms' capacity of raising external funds. To the extent that firms with higher liquidity have more access to external funds, we can observe a positive relationship between asset liquidity and long-term debt. To test the robustness of our results, we measure the liquidity ratio in two ways: (1) the ratio of current assets to current liabilities (LIQ1); (2) the ratio of current assets to total assets (LIQ2).

4.2.1.4 Agency Costs of Debt

Myers (1977) emphasizes the role of short-term debt in reducing agency costs of debts, such as underinvestment. In this paper, the underinvestment problems are rather great when a debt contract matures after the expiry date of the investment. This is because shareholders cannot receive all the net benefits from future investment opportunities, and part of them will be transferred to bondholders.

Hence, shareholders choose to exercise the growth option only if net benefits can offset debt repayments. When only shareholders have the rights to decide whether to exercise an investment option before the debt matures or not, firms with risky debt to invest may have incentives to pass up some valuable growth options. To avoid the underinvestment problems, an efficient solution is to shorten debt maturity, i.e. issuing debt that matures before investment options are exercised. When the debt matures before growth (investment) options are exercised, firms can renew the debt contract such that net benefits from new investment will not be transferred to bondholders. Moreover, monitoring costs for bondholders will be reduced by periodical re-evaluation. Empirically, we can predict a negative relationship between long-term debt and growth opportunities, in which more growth options are associated with more short-term debts. Consistent with this prediction, there are some studies that find a negative relationship between long-term debts and growth opportunities (see, e.g. Titman, 1992; Barclay and Smith, 1995; Ozkan, 2000, 2002).

However, Hart and Moore (1995) emphasize the role of long-term debt in controlling managerial discretion to finance unprofitable investment, which has been acknowledged as an overinvestment problem in lower growth firms (see, Hoshi *et al.*, 1991; Vogt, 1994). And firms with higher risky growth options are also exposed to higher liquidity risks (Diamond, 1991; Guedes and Opler, 1996), which can induce firm to borrow more long-term debt to avoid such risks. Therefore, the nature of the relationship between growth opportunity and debt maturity is an empirical issue. We use market-to-book value (MTB) to measure growth opportunity, which is the ratio of the book value of total assets minus the book value of equity plus the market value of equity to book value of total assets.

Another agency problem is that asset substitution can happen when debt contracts have been issued. In order to maximize shareholders' value, managers may have incentives to choose riskier projects than those agreed with bondholders (e.g. Jensen and Meckling, 1976). Accordingly, Barnea *et al.* (1980) argue that short-term debt can be a tool to mitigate the adverse risk incentive of taking high payoff but risky projects. This is because the value of short-term debt is less sensitive to a change in value and variance of underlying assets, namely a

shift into the lower value-higher variance projects. Empirically, it is argued that larger firms are less exposed to asset substitution (Smith and Warner, 1979). Larger firms regularly have more opportunities to issue debt, and have incentives to mitigate the risk-shifting problem. Then, a negative relationship between firm size and risk-shifting behaviour can be predicted. Moreover, larger firms are expected to have a lower asymmetric information problem and more collateralizable assets (Titman and Wessel, 1988; Whited, 1992). So they have much easier access to long-term debt market. As a result, we can expect a positive relationship between firm size and long-term debt. We measure firms' size (SIZE) by using the natural logarithm of total assets and adjusted in 2002 prices. Moreover, Myers (1977) also argues that, in order to deal with agency problems between shareholders and bondholders, debt repayments should match the decline in the value of assets in place. We expect a positive relationship between long-term debt and asset maturity (AMAT), defined as the ratio of net property, plant and equipment to annual depreciation expense.

4.2.1.5 Agency costs of managerial discretion

Prior research points out that the firm's resources may be diverted by managers for their private benefits (Jensen and Meckling, 1976; Jensen, 1986). It is noted that managerial shareholdings as a potential incentive mechanism can alleviate the conflicting interests of managers and outside shareholders. Jensen and Meckling (1976) formalize a linear relationship between firm value and managerial ownership. They suggest that a firm's value depends on the fraction of shares owned by insiders. However, other studies indicate that the relationship between ownership and agency costs can be non-monotonic (see, Stulz, 1988; Morck, Shleifer and Vishney, 1988; McConnel and Serveas, 1990, 1995; Short and Keasey, 1999). When managerial ownership is at a low level, an increase in managerial ownership can help align the different interests between managers and shareholders. However, when managerial ownership exceeds a certain level, an increase in managerial ownership can no longer align the conflicts. Instead, managers would run the firms for their own private benefits and entrench themselves at the expense of other investors.

In the context of debt-maturity decisions, Datta *et al.* (2005) argue that managers with low or no equity ownership may deviate from the optimal debt maturity choice and prefer longer debt maturity. The reason for this is that managers can use long-term debt to avoid external monitoring for a longer period. Under this framework, an increase in managerial ownership can reduce managerial incentives for private benefits and insufficient efforts (*alignment effect*). As managerial ownership increases, the desire for long-term debt decreases. Then a negative relationship between long-term debt and managerial ownership can be predicted. The negative relationship has also been support by the UK study from Guney and Ozkan (2005). In particular, they find that the negative relationship significantly decreases in widely-held firms. Managers in widely-held firms have greater discretion and are more likely to avoid monitoring associated with short-term debt. Thus, they prefer long-term debt. Moreover, they analyse the discrepancy between control rights and cash flow rights can influence the negative relationship between debt maturity and managerial ownership. They argue the control rights have entrenchment effects on firms' value and cash flow rights have incentive effects on firms' value. Their evidence suggests that managers tend to have greater discretion in those firms with greater discrepancy. They provide evidence that firms with shareholders whose cash-flow rights are significantly less than their control-rights choose more short-term debt in order to curtail the negative impact of agency costs on firms' value.

In the spirit of these studies, we argue that the relationship between long-term debt and managerial ownership is likely to be non-monotonic. That is, at low levels of managerial ownership, an increase in managerial ownership can help align the conflicts between managers and shareholders and managers tend to use more short-term debt to facilitate external monitoring (*alignment effect*). A negative relationship between managerial ownership and long-term debt can then be predicted. However, when managerial ownership exceeds a certain level, the benefits from short-term debts cannot be higher than the benefits from long-term debts. Then the conflict will not be aligned and managers tend to lengthen their maturity of debt (*entrenchment effect*) to avoid external monitoring. Thus, a positive relationship between managerial ownership and long-term debt can be predicted.

We, therefore, carry out a preliminary investigation about the relationship between managerial ownership and debt maturity. Figure 4.1 presents the way in which two variables are associated. It seems that when managerial ownership is at a low level, managerial ownership is negatively related with debt maturity. However, after managerial ownership exceeds 10-20%, the decreasing rate is slower. And after managerial ownership exceeds 30-40%, the relationship becomes a positive one.

To control for the non-linear impact of managerial ownership on debt maturity, we include the level of managerial ownership (OWN) and the squared level of managerial ownership (OWN^2) in our empirical model. And managerial ownership (OWN) is measured as the percentage of shares held by all executive directors. We expect to observe a negative relationship between managerial ownership and long-term debt and a positive relationship between the squared level of managerial ownership and long-term debt.

More importantly, we do not expect a non-linear relationship between debt maturity and managerial ownership to be held in the firms with effective governance mechanisms. When corporate governance mechanism can act as an alternative monitoring role, managerial discretion can be aligned in the presence of effective corporate governance mechanism. By contrast, we expect that the non-linear relationship between managerial ownership and debt maturity is still held in weak-governed firms.

4.2.1.6 Taxation

Several studies demonstrate the impact of the tax system on debt-maturity choice. For example, Brick and Ravid (1985) suggest that if the term structure of corporate coupon rates is increasing, then long-term debt is optimal since there exist net tax benefits from the long-term debt owing to the acceleration of interest payments. Contrarily, if the term structure of corporate coupon rates is decreasing, then short-term debt is optimal since the net gains from long-term debt will be negative. In addition, Kane *et al.* (1985) develop a model in which the optimal debt maturity is determined by a trade-off between the tax advantage

of debt financing and bankruptcy costs and debt issue flotation costs on a period basis. And the net advantage of debt increases with corporate tax rate and decreases with debt flotation costs. Their simulation results imply that at a lower tax advantage, a longer maturity can amortize the flotation costs. Therefore, a positive relationship between long-term debt and tax rate can be expected. However, without considering agency costs and bankruptcy costs but taxation instead as the market imperfection, Lewis (1990) uses a time-state preference framework and relaxes the restriction that capital structure does not depend on debt maturity structure. He finds that there is no tax difference between long-term and short-term debt and debt maturity decision is independent of the firm value when optimal leverage and debt maturity are simultaneously determined. Moreover, Scholes and Wolfson (1992) propose that although the transaction costs of rolling-over short-term debt are higher, not all firms can afford to issue "expensive" long-term debt. Tax rate (TAX) is defined as the total tax charge divided by pre-tax profits (as in Ozkan, 2000 and 2002).

4.2.2 The Role of Managerial Overconfidence

4.2.2.1 Background

Several recent studies examine the relationship between corporate capital structure and managerial biases. Malmendier *et al.* (2007) keep consistent with their previous studies and define managerial overconfidence as the fact that managers overestimate the future returns of the project (better-than-average effect) and underestimate the likelihood of failure. They measure managerial overconfidence not only using the degree of under-diversification of the executives' personal portfolios, but also using press perception. They focus on two issues: the pecking-order of financing and debt conservatism. They argue that overconfident managers overestimate the outcome of their projects and perceive their firms to be undervalued by the market and thus believe external financing to be costly. As a result, they choose low levels of risky debt relative to available interest tax deductions. They find evidence that overconfident CEOs have pecking order preferences.

Apparently, in all Malmendier's papers (i.e. Malmendier and Tate, 2005; Malmendier and Tate, 2008; Malmendier *et al.*, 2007), the definition and the measure of managerial overconfidence is a combination of optimism and overconfidence. However, Hackbarth (2008) consider managerial biases according to two aspects: growth perception bias and risk perception bias. Growth perception means managers overestimate the growth rate of earnings, while risk perception bias means managers underestimate. They found a consistent result with Malmendier *et al.* (2007) that managers with growth perception bias follow a pecking order preference. However, when managers with risk perception bias need external funds, they prefer equity than debt. That is because, 'for managers with risk perception bias, perceived equity overvaluation provides incentives to issue more shares into the market'. Moreover, they find positive effects of managerial biases. That is 'mildly biased managers make capital structure decisions that are more in the interest of shareholders, while extreme managerial biases are detrimental to the firm'.

Ben-David *et al.* (2007) use miscalibration to measure managerial overconfidence. They design a survey of CFOs in the US asking them to predict expected one- and ten-year market equity returns as well as the 10^{th} and 90^{th} percentiles of the distributions of market. Their overconfident measure maps each CFO's 10^{th} and 90^{th} percentile predictions into individual probability distortion for each respondent. Wide distribution means high uncertainty, while narrow distribution reflects confidence. Then they calculate the volatility and generate two overconfidence measures based on one- and ten-year forecasts of the S&P500 respectively. Similarly, they create two optimism variables based on expected one- and ten-year return forecasts respectively. They found that overconfident CFOs issue more debt leverage, prefer long-term debt and pay fewer dividends.

4.2.2.2 Our Hypotheses

First, we discuss the direct relationship between managerial overconfidence and debt maturity, which is rather complicated. In Hackbarth (2008), they illustrate that managers with growth and risk perception biases exercise debt restructuring

options earlier resulting shorter refinancing periods. However, as mentioned by Ben-David *et al.* (2007), in a sense of inflexible, when managers tend to underestimate their riskiness of future cash flows and might choose less flexible capital structure to commit long-term interest payments. They find that the portion of long-term debt (more than one year) out of total debts is positively related to their overconfidence variable. Therefore, the direct relationship between managerial overconfidence and debt maturity in our analysis will be due to their combined effects. Taken together, we argue it is an empirical issue.

As noted in Section 4.2.1.2, short-term debt can be treated as a signal of firms' quality and a negative relationship between firms' quality and long-term debt can be predicted. In this framework, managerial overconfidence may also exert an impact on debt maturity decisions through the interaction with firms' quality. Overconfident managers are supposed to overestimate the outcomes of their projects and overestimate their precision of private information on firms' quality. When they are aware that asymmetric information about the firms' quality exists between the market and their firms, they tend to believe their firms are undervalued by the market. It can also be explained by risk perception bias (Hackbarth, 2008). When managers underestimate the volatility of risky process, they may perceive their perceived firms' cash flows are safer than they really are and thus, they believe that their firms are undervalued by the market. Moreover, the cognitive bias of firms' quality even leads overconfident mangers to ensure that they pay higher premiums on long-term debt than the premiums in their perspective. In order to avoid this, overconfident managers have more incentives to issue short-term debt rather than long-term debt. And they believe that issuing short-term debt can help them to have a contract at a better-term after a re-evaluation. In other words, overconfident managers aim to take advantage of the signalling role of short-term debt available to the market to seek a better debt contract in the future.

Consequently, firms with overconfident managers have greater propensity to issue short-term debt to signal their perceived quality to the market than those with non-overconfident managers. To test this hypothesis, we include the interaction term between our managerial overconfidence measure and firm

quality (OVER*QUALITY) in our debt maturity equation. We predict that the negative impact of firms' quality on long-term debt is greater when firms with managerial overconfidence.

Moreover, as noted in Section 4.2.1.4, if debt matures before the investment option expiration date, then the underinvestment problem will be eliminated. And a negative relationship between long-term debt and growth opportunity can be predicted. In our framework, managerial overconfidence may also exert an impact on debt maturity decisions through an interaction with growth opportunity. The perceived growth opportunity by managers should be greater for firms with managerial overconfidence. In order to invest to their desired level and eliminate underinvestment problems, overconfident managers have more incentives to issue short-term debt rather than long-term debt. To test this hypothesis, we include the interaction term between our managerial overconfidence measure and firm quality (OVER*MTB) in our debt maturity equation. We predict that the negative relationship between growth opportunity and long-term debt is greater for firms with managerial overconfidence.

Finally, our overconfidence variable (OVER1) is based on executive directors' stock dealings in the open market. When the amount of shares purchased by a manager during the sample period is larger than the amount of shares sold, the manager will be classified as net buyer or overconfident. In this chapter, we accumulate all executive directors' stock purchase amount (positive value) and selling amount (negative value) during each sample year (2003-2006). When firms have been persistently displayed as net buyers over the period 2003-2006, our overconfidence variable (OVER1) equals 1 and 0 otherwise. Meanwhile, we consider those firms which have been habitual net buyer for at least three years during 2003-2006 as an alternative measurement of managerial overconfidence (OVER 2) to provide more evidence. To test the robustness of our results, we use OVER3 to be another alternative measure of managerial overconfidence, which is a dummy variable equalling 1 when the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise.

4.2.3 The Role of Corporate Governance Mechanism

In the following text, we discuss whether the biased impact of managerial overconfidence on firms' debt maturity decisions can vary with corporate governance mechanisms. We attempt to analyse whether the impact of managerial overconfidence is only pronounced in firms with weak governance mechanism (weak monitoring mechanism).

It has been suggested that the potential prescription for managerial overconfidence could be outsider monitoring (Kahneman and Lovallo, 1993; Heaton, 2002; Malmendier and Tate, 2005). They argue that a standard incentive contract such as stock-based compensation is unable to mitigate the biased impact of overconfidence. The reason for this is that overconfident managers even believe that they are acting in the best interests of shareholders, although they are not actually, in the perspective of shareholders. By that they mean outsiders are capable of drawing managerial attention to information that may indicate that managers' perceptions are wrong.

Thus, if the biased perception is a recurrent problem, then the most effective prescription for managerial overconfidence can be the strong outsider monitoring by corporate governance mechanisms. If this is the case, we expect that the impact of managerial overconfidence on the negative relationship between firms' quality and long-term debt can be monitored by an efficient governance mechanism and tend to be insignificant. By contrast, the impact of managerial overconfidence on the negative relationship between firms' quality and long-term debt cannot be restrained for firms with weak governance mechanisms. Similarly, we predict that the impact of managerial overconfidence on the negative relationship between firms' growth opportunity (or growth opportunity) and long-term retains to be significant in firms with weak governance mechanism.

In order to identify firms as those with efficient monitoring mechanisms and those with weak monitoring mechanisms, we base on the following related issues such as board structure and ownership concentration. We use a more cautious

way than in Chapter 2 identifying firms with weak or good governance mechanisms. That is, we especially concern an issue that the relationship between board structure and ownership concentration and the effectiveness of corporate governance mechanism may not be a linear one[12].

For example, larger boards make coordination, communication more cumbersome than smaller boards and agency problems increase with board size (John and Senbet, 1998). However, larger boards can provide a range of expertise to help make better decision and might be better for corporate performance. It seems board size is not necessarily associated with its effectiveness. And neither smaller-size boards nor larger-size board can exert effective monitoring efforts on management. If this is the case, we predict that the impact of managerial overconfidence retains significant in these firms. To estimate, we define board size (BOARD) as the total number of directors on the board. In particular, we divide firms into three subgroups: firms with larger-size boards, medium-size boards and smaller-size boards. We assign firms to the ones with larger-size boards when those firms are in the top three deciles of the whole board size distribution, and vice versa. And the rest of them are assigned to those with medium-size boards.

Moreover, board composition can influence the effectiveness of governance mechanism. It is widely acknowledged that non-executive directors are appointed to act in the shareholders' interests and have incentive to monitor management (Fama and Jensen, 1983; Hart, 1995). They may act as professional referees to ensure that managers stimulate actions consistent with the interests of shareholders. It seems that, when there are fewer non-executive directors in boards, then they may have less incentive to monitor management. However, too many non-executive directors may also cause a free-rider problem that having more outsiders on the board reduces the efforts of all outsiders. If this is the case, we predict that the impact of managerial overconfidence retains significant when firms with too many or too few non-executive directors in boards. We define RATIO as the ratio of the number of non-executives to total number of directors.

[12] A literature brief can be found in the second chapter

In particular, we divide firms into three subgroups: firms with lower-ratio, medium level and higher-ratio of non-executive directors in boards. We assign firms to the ones with higher-ratio when those firms are in the top three deciles of the whole RATIO distribution, and vice versa. And the rest of them are assigned to those with medium ratio.

Finally, outside shareholders with substantial stakes have incentives to monitor management (Shleifer and Vishny, 1986; Shleifer and Vishny, 1997). However, Shleifer and Vishny (1997) argue that large investors may represent their own interest, which do not need to coincide with the interest of other investors in the firms, or with the interests of employees and managers. Thus, not all shareholders may benefit from the managerial monitoring by large investors. Woidtke (2002) also note that some institutional investors such as administrators of public pension funds may focus on political or social issues other than firm performance. It seems that, when blockholders' ownership is quite lower, they have less incentive to monitor management. However, when blockholders' ownership increases to a higher level, potential agency problems between large and minority shareholders may arise. Hence, large investors cannot effectively supervise management. If this is the case, we predict that the impact of managerial overconfidence is kept to be significant in these firms. We define BLOCK as the total ownership of non-management shareholders with more than 3% of shares. In particular, we split firms into three subgroups: firms with lower ownership, medium level and higher ownership. We assign firms to the ones with higher ownership when those firms are in the top three deciles of the whole BLOCK distribution, and vice versa. And the rest of them are assigned to be the medium group.

4.3 Data and Methodology

4.3.1 Data Description

We use a large sample of non-financial listed UK firms over the period 2002-2006. The initial data are available from the DataStream and Hemscott Guru Academic Database (Hemscott hereafter). The whole data set is constructed as follows:

First, the data for companies' accounting information are mainly collected from DataStream from 2002 to 2006. We use Datastream to collect information for the following variables: Market to book value ratio, firm size, leverage, long-term debt, firm's quality, tax rate and liquidity. We only chose those firms with no missing data over the period 2002- 2006.

Second, information on share dealing (2003-2006), firms' ownership (2003-2005), ownership concentration (2004-2005) and board structure (2004-2005) are collected from Hemscott. It provides detailed information about share dealings of each director in the open market each year, the share holding level of each director, ownership concentration, and numbers of executive directors and non-executive directors.

Finally, we compile these two datasets into one sample and drop missing firm-year observations and outliers by trimming to the 1-99% percentile. We create our final balanced sample of 564 firms for our empirical analysis. Table 4.1 provides the definitions of the variables used in this chapter whereas Table 4.2 summarizes the key descriptive statistics.

In Table 4.2, we observe that 47.6 % of total debt is due more than one year, which is close to the 46% reported by Antoniou *et al.* (2006) for UK. And the average market to book value ratio (MTB) is 1.928, which is between 2.05 the

figure reported by Florackis (2005) and 1.845 the figure reported by Guney and Ozkan (2005). Firm size measured as the logarithm of assets is 11.224, firms' quality (QUALITY 1) is -0.025 and QUALITY 2 is 0.086. Average book leverage ratio (LEVERAGE 1) is 0.165 and average market leverage ratio (LEVERAGE 2) is 0.236. And the book leverage ratio is in line with the figure in Guney and Ozkan (2005) and in Antoniou *et al.* (2006). Liquidity ratio measured by the ratio of current assets to current liabilities (LIQUIDITY 1) is 2.16, which is higher than 1.63 reported by Guney and Ozkan (2005), whereas liquidity ratio measured by the ratio of current assets to total assets (LIQUIDITY 2) is 0.52, which is lower than 0.57 reported by Antoniou *et al.* (2006).

As far as the ownership and board structure variables are concerned, we find that executive ownership is 8.75%, which is lower than the number reported by other studies. It maybe due to a declining evolution of ownership in UK firms (Marchica, 2005). The average ownership concentration (BLOCK) reaches the level of 36.87%, the average proportion of non-executive directors in board is 50.8% and the average board size is 7.073 directors. These are in line with the figures reported by Florackis (2005) in which he uses UK data for his analysis.

Finally, we report our managerial overconfidence variable (OVER1), which is a dummy variable and about 6.9% of firms persistently display as net buyers in the stock market over the period 2003-2006. Meanwhile, we report an alternative managerial overconfidence variable (OVER2), which is about 24.1% of the firms display as netbuyers for at least three years over the period 2003-2006. Finally, we report another managerial overconfidence variable (OVER3), which is about 37.2% of the firms that the number of articles describing executive directors as optimistic or confident is large than the number of articles describing executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident the over the period 2003-2006.

In Table 4.3, we present the Pearson's correlation for variables used in our regression. The results are generally in line with our prediction. The measures of firms' quality (QUALITY 1 and QUALITY 2) are negatively and significantly correlated with debt maturity. And firms' size (SIZE) increases with debt

maturity. These are in line with the asymmetric information hypothesis. Growth opportunity (MTB) appears to be negatively correlated with debt maturity, which is consistent with the agency costs hypothesis. Leverage (LEV1 and LEV2) is positively correlated with debt maturity. It implies that firms' with higher leverage tend to have higher debt capacity and issue more long-term debt. The observed negative correlation between liquidity (LIQ1 and LIQ2) and debt maturity rejects the argument that firms with higher liquidity will be easier to access external funds. But it is in line with the argument that higher liquidity limits firms' debt capacity. We also observe that managerial ownership (OWN) is negatively correlated with long-term debt, which is in line with managerial discretion hypothesis. Finally, our three overconfidence measures are highly correlated with each other. But, their direct relationship with debt maturity is unclear. However, such findings do not lead to concrete inferences given the impact of managerial overconfidence is interacting with the relationship between debt maturity and firm quality (growth opportunity).

4.3.2 Methodology

We examine the determinants of debt maturity by utilizing the average cross-sectional estimation proposed by Rajan and Zingales (1995). We execute our estimation over two time periods: 1). the dependent variable as a long-term debt ratio is measured in year 2006; 2). the dependent variable is measured in year 2005. And independent variables are average-past values over the period 2002-2005 and 2002-2004 respectively. Averaged values can mitigate annual adjustment of each firm or extreme values and lagged values can deal with endogeneity. In addition, we especially interact managerial overconfidence variable with firm quality and growth opportunity respectively to test whether managerial overconfidence can increase the negative relationships between firms' quality and long-term debt and whether the negative relationship between growth opportunity and long-term debt is greater in firms with managerial overconfidence.

Moreover, we use a pooled regression process to test the robustness of our results. The foremost advantage of using a pooled regression is that it provides an

examination of variations among cross-sectional units and variations within individual units over time simultaneously. Meanwhile, incorporating information relating to both cross-sectional and time series variables takes account of the situation that short-term fluctuations in the data may also have some important effects on debt maturity. In addition, using the pooled regression can provide an increased number of data points, which generates additional degrees of freedom. In our analysis, we use lagged explanatory (one year lag) variables to minimize endogeneity in the pooled regression. Due to the availability of managerial ownership information, we can execute the pooled regression over the period 2003-2005 when we include ownership variable in our estimation. Our empirical specification is as follows.

$$\text{DEBT MATURITY}_{it} = \sum \alpha_k X_{kit} + \beta\,(QUALITY_{it} * OVER_{it}) + \gamma\,(MTB_{it} * OVER_{it}) + \mu_{it}$$

$\text{DEBT MATURITY}_{it}$ is the dependent variable of debt maturity which is the ratio of long-term debt to total debt, $\sum \alpha_k X_{kit}$ denote all firm-specific characteristics we used to test our hypothesis which include size, quality, liquidity, taxation, market to book value ratio, leverage , executive ownership, squared value of executive ownership. μ_{it} is the error term. Hence, the coefficients of $QUALITY_{it} * OVER_{it}$ and $(MTB_{it} * OVER_{it})$ are the centres of our study, we expect that they are both negative and statistically significant.

4.4 Empirical Results

4.4.1 Univariate Analysis

Table 4.4 presents univariate mean and standard deviation comparisons of several firm-specific characteristics by debt maturity quartiles. We are interested in whether the characteristics of firms differ significantly across firms with shorter debt maturity (the first quartile) and firms with longer debt maturity (the fourth quartile).

In general, we find supportive evidence that firms in the first quartile differ from firms in the fourth quartile at 1% significant level. Generally, we find that smaller firms having lower leverage ratio, higher liquidity value and greater growth opportunities tend to have shorter debt maturity. In addition, we find that firms' quality is negatively related to debt maturity. This is consistent with our signalling hypothesis that firms with good-quality tend to issue more short-term debts. Moreover, it seems that firms with higher managerial ownership tend to issue more short-term debt, which is consistent with our initial hypothesis that managerial ownership can reduce managerial incentives of insufficient effort and private preferences for longer debt maturity. However, the potential non-linear relationship between managerial ownership and debt maturity has not been captured by the univariate analysis.

Finally, our univariate analysis does not capture a clear relationship between managerial overconfidence and debt maturity. There are at least two reasons. First, managerial overconfidence is a psychological characteristic, which can not be controlled by managers themselves. Second, univariate analysis does not capture the indirect effect of managerial overconfidence on the relationship between debt maturity and firms' quality (or MTB). According to our hypothesis, we emphasize the impact of managerial overconfidence by focusing the relationship between firms' quality and debt maturity. Hence, a complicated estimation technology should be required.

4.4.2 Multivariate Analysis

Table 4.5 presents the results from the average cross-sectional analysis of the determinants of debt maturity (long-term debt ratio). In this table, debt maturity is measured in year 2006 and other variables are average-past value of 2002-2005. We start with the regression in column (1), which includes the firm-specific characteristics as suggested in the previous literature review. In column (2), we add managerial ownership and the squared value of managerial ownership in our regression to test the nonlinear relationship between managerial ownership and debt maturity. In column (3), we interact managerial overconfidence with firms' quality (OVER1*QUALITY1) and with growth

opportunity (OVER1*MTB) in our regression to test the impact of managerial overconfidence on debt maturity. In column (4), we use alternative measures of liquidity and leverage variables to give further checks. Finally, in columns (5) and (6), we use alternative measures of quality (QUALITY2) to give further checks and other things are same as in the columns (3) and (4).

Firm Size: from column (1) to column (6), we find that firms with larger size tend to issue more long-term debt at the 1% significant level. This implies that larger firms having lower asymmetric information costs and easier access to the capital market tend to raise more long-term debt.

Quality: from column (1) to column (6), we find that firms with better quality tend to issue less long-term debt. And this result is statistically significant in columns (1)-(4). It supports the signaling hypothesis that short-term debt can act as a signaling role of firms' quality.

Leverage: in columns (1), (2), (3) and (5), we find a consistently positive relationship between LEVERAGE 1 and debt maturity, which is at the 1% significant level. This is consistent with the liquidity risk hypothesis that firms with higher leverage ratio need to control for the bankruptcy risks they may incur by issuing more long-term debt. This result is robust when we use the market leverage ratio (LEVERAGE 2) in columns (4) and (6) as an alternative measure for leverage.

Liquidity: the coefficients on liquidity in all models, as another proxy for liquidity risk, are negative and at the 1% significant level, which does not support the view that firms with higher asset liquidity are unable to raise more long-term debt. This is possibly due to the conflicts between managers and investors arising from the excessive liquidity (Myers and Rajan, 1988), which can limit managers' operating flexibility with providing limit output. As a result, the investors' control rights are lower than before and thus they may consider reducing financing. The negative relationship is consistently significant when we use an alternative measurement of liquidity (LIQUIDITY 2) in columns (4) and

(6).

Growth opportunity and Tax: In all columns, we find a mixed relationship between growth opportunity (MTB) and long-term debt. All the results are statistically insignificant. Moreover, we find a negative but insignificant relationship between long-term debt and taxation across column (1) to column (6).Similar results can be found in Antoniou *et al.* (2006), which implies the effective rate of tax cannot play an important role in determining the debt maturity structure in our sample.

Managerial ownership: in columns (2)-(6), we estimate the non-linear relationship between managerial ownership and long-term debt by including ownership (OWN) and squared value of ownership (OWN^2) in our regression. In line with our hypothesis, the results reveal that the relationship is non-linear. In particular, when the level of managerial ownership is low, an increase in ownership can align the different interests of managers and outside shareholders and less long-term debt are desired. However, when managerial ownership exceeds a certain level, the conflicts between managers and shareholders cannot be aligned and managers tend to lengthen their debt maturity to pursue their private benefits and avoid external monitoring. Our findings suggest a turning point of 40% in that the debt maturity decreases as managerial ownership decreases up to 40%, and then increases with managerial ownership level above 40%, which is in line with our Figure 4.1.

Managerial overconfidence: More importantly, in columns (3)-(6), we further investigate whether managerial overconfidence can affect the relationship between long-term debt and firms' quality and whether managerial overconfidence can affect the relationship between long-term debt and growth opportunity. To do so, we include two interaction terms OVER1*QUALITY and OVER1*MTB. We observe a negative and significant coefficient of OVER1*QUALITY. It indicates that overconfident managers tend to believe that the market underestimates their firms' quality which incurs higher costs for them to issue long-term debt. Hence, they have more incentives to issue short-term debt to signal their perceived quality to the market. Meanwhile, our results reveal

that the impact of managerial overconfidence on debt maturity is independent of the impact of managerial ownership on debt maturity. The results are statistically significant by controlling both managerial ownership and managerial overconfidence.

Moreover, we find a negative and significant coefficient of OVER1*MTB. Since overconfident managers tend to overestimate the outcome of their investment, their perceived growth opportunity is tend to be greater than it should be. And according to the agency costs theory, short-term debt can be used to alleviate underinvestment problems. In order to invest to their desired investment level, overconfident managers tend to issue more short-term debt.

In Table 4.6, it presents the results from the average cross-sectional analysis (CSA) of the determinants of debt maturity (long-term debt ratio). In this table, debt maturity is measured in year 2005 and other variables are average-past value of 2002-2004. Moreover, in Table 4.7, it presents the results from the pooled regressions. In each year, we use one-year lagged values of independent values. In these two tables, we find that firms with larger size, higher leverage and worse quality, lower liquidity tend to issue more long-term debt. They also support a non-linear relationship between managerial ownership and long-term debt. The most important thing is that the negative relationship between debt maturity and long-term debt is greater in firms with managerial overconfidence. Moreover, managerial overconfidence can increase the negative relationship between growth opportunity and debt maturity.

The role of corporate governance mechanisms: In Tables 4.8, 4.9 and 4.10, we test whether the impact of managerial overconfidence on debt maturity varies with corporate governance mechanisms. In Table 4.8, we use the cross-sectional average regression with dependent variable measured in year 2006. In table 4.9, we use the cross-sectional average regression with dependent variable measured in year 2005. And in Table 4.10, we use the pooled regression. In this procedure, we extend our analysis including two considerations: one is to test whether effective corporate governance mechanisms can affect managerial discretion; the other is to test whether different corporate governance environment can influence

debt maturity decision by overconfident managers. In particular, we split firms into three subgroups adopting a set of governance variables over the period 2004-2005, such as board size (BOARD), ratio (RATIO) and blockholders' ownership (BLOCK) as mentioned in section 4.2.3.

First, as for the impact of managerial ownership on debt maturity, we find that the relationship between managerial ownership and debt maturity is significant and negative when firms are with smaller-size boards (BOARD), lower ratio of non-executive directors in boards (RATIO) or with lower blockholders' ownership (BLOCK). It is in line with the view that firms with smaller-size boards, lower ratio of nonexecutive directors or with lower blockholders' ownership have less power or fewer incentives to monitor management. Then the effectiveness of these corporate governance mechanisms is weak. And in these firms, managerial ownership can play an important role as an incentive mechanism (alignment effects). That is, an increase in managerial ownership can align the conflicts between managers and shareholders and managers tend to issue more short-term debt to facilitate external monitoring. Meanwhile, we observe the coefficient of the squared value of managerial ownership (OWN^2) is positive and significant in these firms. Such evidence can be regarded as a support for the view that the entrenchment effect of managerial ownership can also be more pronounced in weak-governed firms. That is, when managerial ownership exceeds a certain level, managers in weak-governed firms tend to expropriate wealth by issuing less short-term debt to avoid external monitoring. Thus, the non-linear relationship between managerial ownership and debt maturity is held in the firms with smaller-size board, lower ratio of nonexecutive directors or lower blockholders' ownership.

In contrast, we observe that the coefficients of managerial ownership and the squared value of managerial ownership become insignificant when firms are with medium ratio of non-executive directors or medium level of blockholders' ownership. These firms are predicted to have better corporate governance mechanisms. The result supports the proposition that managerial ownership can less influence the debt maturity as an incentive mechanism in the case of firms

that already have more effective governance mechanisms. However, in the board size classification, we can only find consistent evidence in Tables 4.9 and 4.10.

Furthermore, when firms are with higher ratio of non-executive directors or higher level of blockholders' ownership in Table 4.10, we find that the coefficients of managerial ownership and the squared value of managerial ownership appear to be significant. It seems that these firms are with weak corporate governance mechanisms. Too many non-executive directors may result in free rider problems. And higher blockholders' ownership may induce agency problems between large and minority shareholders. Hence, the non-linear relationship between managerial overconfidence and debt maturity becomes significant. However, in Table 4.8 and Table 4.9, we do not find any consistent evidence.

Second, with regard to the impact of managerial overconfidence, we observe that the coefficient of interaction term (OVER1*QUALITY) remains negative and statistically significant in firms with smaller-size boards, lower ratio of non-executive directors or lower blockholders' ownership. This result is robust when we use different estimation methods in three tables. It implies that, when firms have weak corporate governance mechanisms, monitoring by outsiders can not restrain overconfident managers to pursue their desired debt maturity. In contrast, the coefficient of interaction term (OVER1*QUALITY) turns to be an insignificant one in firms with medium ratio of non-executive directors or lower blockholders' ownership, which implies the biased debt maturity decision , to some extent, can be restrained by the effective corporate governance mechanisms. But, for firms with higher ratio of non-executive directors or higher blockholders' ownership, we find limited evidence that the coefficient of interaction term (OVER1*QUALITY) can change to be significant. Also, we do not find any supportive evidence that the coefficient of interaction term OVER1*MTB varies with corporate governance mechanisms.

4.5 Robustness Check

In this section, we use two alternative managerial overconfidence variables (OVER2 and OVER3) to provide a further robustness check. Tables 4.11-4.13 present the results about the determinants of debt maturity using three different regression approaches with OVER2. And Tables 4.14-4.16 present the results about the determinants of debt maturity using three different regression approaches with OVER3.

Consistent with previous results, we find firms with larger size, higher leverage ratio, worse quality and lower liquidity tend to issue more long-term debt. Moreover, there is a supportive evidence for the non-linear relationship between managerial ownership and debt maturity. As far as the indirect impacts of managerial overconfidence on debt maturity are concerned, the results are consistent with our earlier findings that the coefficient of interaction term of managerial overconfidence and firms' quality (QUALITY1) is negative and significant. But, we do not find and supportive evidence when firms' quality is measured by QUALITY2. Finally, we find that the coefficient of the interaction term of (OVER2*MTB) is negative but insignificant.

Finally, Tables 4.17-4.19 present the evidence of the role of corporate governance mechanism using three different regression approaches with OVER2. And Tables 4.20-4.22 present the evidence of the role of corporate governance mechanism using three different regression approaches with OVER3.

Consistent with previous results, we find that managerial ownership plays an important role as an incentive mechanism (alignment effects) when firms do not have strong monitoring mechanisms such as firms with smaller-size boards, lower ratio of non-executive directors or lower blockholders' ownership. Moreover, the entrenchment effect of managerial ownership is more pronounced in these firms. By contrast, when firms are with medium ratio of non-executive directors or medium level of blockholders' ownership, managerial ownership play less important roles as an incentive mechanism and managers are unlikely to

expropriate wealth from shareholders when firms already have more effective monitoring mechanisms. However, we find limited evidence that the impact of managerial ownership on debt maturity is associated with higher ratio of non-executive directors or higher blockholders' ownership.

In terms of managerial overconfidence, we find consistent evidence that managerial overconfidence can significantly increase the negative relationship between debt maturity and firms' quality for firms with lower ratio of non-executives directors or lower blockholders' ownership. It indicates that when corporate governance can not oversee management effectively, the impact of managerial overconfidence on debt maturity is kept to be significant. In summary, the results from in these tables are consistent with the results from previous regressions and generally support our hypothesis.

4.6 Conclusion

In this chapter, we provide an empirical analysis of the determinants of debt maturity structure (long-term debt ratio). We particularly focus on the influences of managerial ownership and managerial overconfidence on debt maturity. To do so, we include managerial ownership and its squared value to allow us to test the nonlinear relationship between managerial ownership and debt maturity. Moreover, we use the interaction term of managerial overconfidence and firms' quality to test the hypothesis that managerial overconfidence can increase the negative relationship between long-term debt and firms' quality. Meanwhile, we include the interaction term of managerial overconfidence and firms' growth opportunity to test the hypothesis that managerial overconfidence can increase the negative relationship between long-term debt and growth opportunity. We use three alternative overconfidence measurements to give more evidence: two of them are related to the annual share dealing behaviour by executive directors and the rest one is related to the press perception.

Our empirical findings strongly suggest that firms with larger size, higher leverage ratio, worse quality and lower liquidity tend to issue more long-term

debt. Moreover, our results reveal that the relationship between debt maturity and managerial ownership is non-monotonic. In particular, when managerial ownership is at a low level, an increase in the ownership can align the conflicts between managers and shareholders and more short-term debt are desired to facilitate external monitoring. However, when managerial ownership exceeds a certain level, conflicts between managers and shareholders cannot be aligned and managers tend to lengthen their debt maturity to pursue their private benefits and avoid external monitoring. And the non-linear relationship between managerial ownership and debt maturity is kept to be significant when firms are with smaller-size boards, lower non-executive ratios or lower blockholders' ownership. This implies that the alignment and entrenchment effects of managerial ownership are significant when firms are without effective governance mechanisms.

More importantly, we find that managerial overconfidence can play a significant role in increasing the negative relationship between firms' quality (QUALITY 1) and long-term debt. This attributes to the fact that overconfident managers believe the debt market undervalues their firms' quality and tend to issue more short-term debt to signal their perceived quality. Meanwhile, they believe the re-evaluation associating with the short-term debt can help them to find a debt contract at better-terms in the future. This result is robust when we use alternative estimate methods and two other alternative overconfidence measurements. Moreover, we find some evidence that the negative relationship between debt maturity and growth opportunity managerial overconfidence tend to be greater for firms with overconfident managers. But the results are significant only in one of our overconfidence measurements (OVER 1). It provides some evidence that overconfident managers are more likely to issue short-term debt to invest to their desired level.

Finally, the impact of managerial overconfidence varies with different corporate governance mechanisms. In particular, managerial overconfidence can still significantly increase the negative relationship between long-term debt and firms' quality in firms with lower ratio of nonexecutive directors or lower blockholders' ownership. In contrast, this impact turns to be insignificant in

firms with medium ratio of non-executive directors in board or medium level of blockholders' ownership. These results are robust when we use different estimate approaches and two other alternative measurements of managerial overconfidence.

Table 4.1: Variables, Definitions and Sources.

Variable	Definition	Sources
MAT	The ratio of debt that matures in more than one year to total debt.	Datastream
MTB	The ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of total assets.	Datastream
SIZE	Total Assets(in nature logarithm).	Datastream
QUALITY1	The growth rate of earnings, defined as the difference between pretax profits in t+1 and the pretax profits in t divided by the pretax profits in t.	Datastream
QUALITY2	The difference between EPS in year t+1and t divided by share price in t.	Datastream
TAX	The ratio of total tax charge to pre-tax profits.	Datastream
LEV1	The ratio of total debt to total assets.	Datastream
LEV2	The ratio of total debt to book value of total assets minus book value of equity plus the market value of equity.	Datastream
LIQ1	The ratio of current assets to current liabilities.	Hemscott
LIQ2	The ratio of current assets to total assets.	Hemscott
OWN	The total percentage of shareholding by executive directors.	Hemscott
BLOCK	The total percentage of shareholding by all shareholders (other than managers) with ownership larger than 3%.	Hemscott
BOARD	The total number of directors in board room.	Hemscott
RATIO	The ratio of total number of non-executive directors to total number of all directors.	Hemscott
OVER1	Managerial overconfidence: a dummy variable, which takes the value of 1 if the firm is identified as a netbuyer for all years over the period 2003-2006 and 0 otherwise.	Hemscott
OVER2	Managerial overconfidence: a dummy variable, which takes the value of 1 if the firm is identified as a netbuyer for at least 3 years over the period 2003-2006 and 0 otherwise.	Hemscott
OVER3	A dummy variable, which takes the value of 1 if the number of articles describing a firm's executive directors as optimistic or confident is larger than the number of articles describing a firm's executive directors as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident over 2003-2006 and 0 otherwise.	NexisUK

Notes: Datastream database provides accounting and market data. Hemscott Guru Academic database provides financial data for the UK's top 300,000 companies and detailed data on all directors of UK listed companies. Nexis UK is a single most powerful global news and business information service.

Figure 4.1: The Relationship between Debt Maturity and Managerial Ownership.

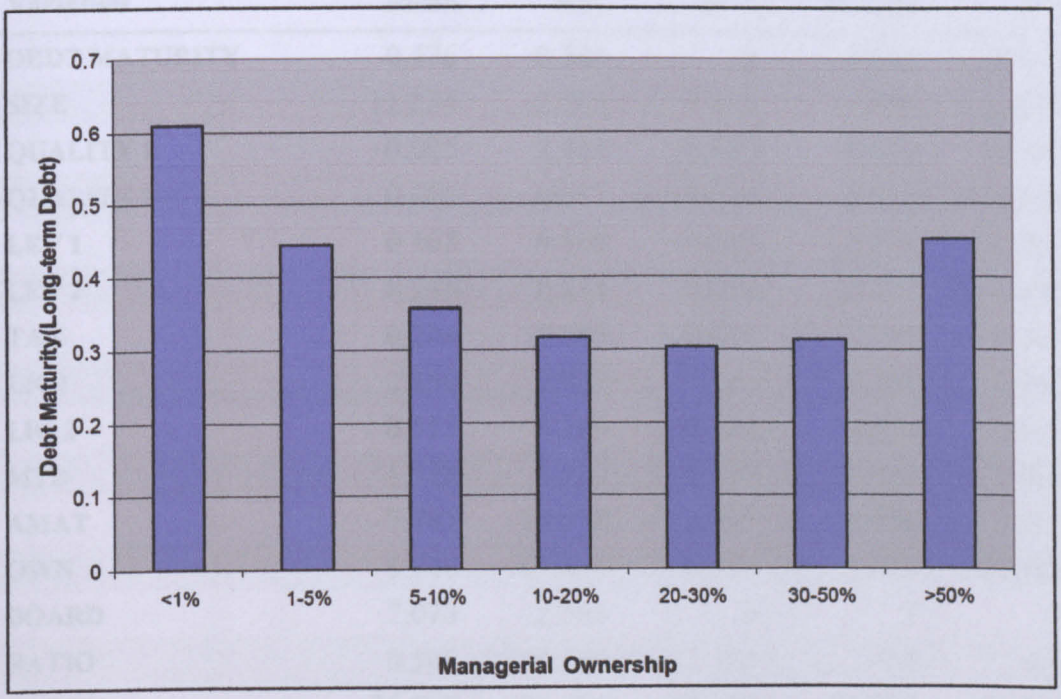


Table 4.2: Descriptive Statistics. (N=564)

Variables	Mean	S.D.	25%	Median	75%
DEDT MATURITY	0.476	0.386	0	0.542	0.852
SIZE	11.224	2.264	9.541	11.098	12.635
QUALITY 1	-0.025	2.414	-0.607	0.022	0.385
QUALITY 2	0.086	0.617	-0.020	0.011	0.056
LEV 1	0.165	0.168	0.012	0.125	0.267
LEV 2	0.236	0.211	0.026	0.211	0.387
TAX	0.204	0.585	0.028	0.261	0.327
LIQ1	2.156	2.835	1.014	1.408	2.142
LIQ 2	0.515	0.249	0.326	0.518	0.698
MTB	1.928	1.772	1.068	1.418	2.083
AMAT	7.781	15.578	1.997	4.454	7.997
OWN	8.748	15.044	0.150	1.309	11.169
BOARD	7.073	2.561	5	7	8
RATIO	0.508	0.159	0.4	0.5	0.6
BLOCK	36.867	21.776	21.102	36.291	51.179
OVER1	0.069	0.254	0	0	0
OVER2	0.241	0.428	0	0	0
OVER3	0.372	0.484	0	0	1

Notes: This table provides descriptive statistics for main variable used in our analysis. Debt maturity is measured over the period 2003-2006, OVER1, OVER2 and OVER3 are measured over the period 2003-2006 and internal corporate governance variables are measured over the period 2004-2006, managerial ownerships are measured over the period 2003-2005. All the other variables are measured over the period 2002-2005. Definitions of all variables are provided in Table 4.1.

Table 4.3: Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.MAT	1														
2.SIZE	0.466***	1													
3.QULIATY1	−0.061**	0.015	1												
4.QULIATY2	−0.043*	−0.111***	−0.070***	1											
5.LEV 1	0.476***	0.370***	−0.023	0.019	1										
6.LEV 2	0.508***	0.387***	−0.031	−0.013	0.914***	1									
7.TAX	0.001	0.075***	0.014	−0.011	−0.018	−0.023	1								
8.LIQ1	−0.289***	−0.253***	0.016	0.046*	−0.334***	−0.336***	−0.018	1							
9.LIQ2	−0.388***	−0.341***	−0.009	0.032	−0.387***	−0.472***	−0.005	0.344***	1						
10.MTB	−0.147***	−0.247***	0.04	0.019	−0.159***	−0.288***	−0.022	0.206v	0.232***	1					
11.AMAT	0.015	0.057**	0.082***	−0.038	0.063***	0.119***	0.015	−0.313***	−0.065***	−0.120***	1				
12.OWN	−0.226***	−0.381***	−0.033	0.012	−0.114***	−0.134***	0.056**	0.151***	0.119***	0.145***	−0.062**	1			
13.OVER1	0.045*	0.068***	0.031	−0.016	0.009	−0.007	−0.020	0.012	−0.010	0.0003	−0.049*	−0.093***	1		
14.OVER2	0.125***	0.124***	0.020	−0.015	0.038	0.036	−0.035	−0.070***	−0.056**	−0.047*	−0.013	0.172***	0.484***	1	
15.OVER3	0.018	0.135***	0.054**	−0.007	−0.041*	−0.058**	0.003	0.013	0.021	0.025	−0.028	0.007	0.108***	0.132***	1

Notes: This table presents the Pearson's Correlation matrix for the main variables used in our analysis. Definitions of all the variables are provided in Table 4.1. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively.

Table 4.4: Firm Characteristics by Debt Maturity Quartiles.

	First quartile	Second quartile	Third quartile	Fourth quartile	*t*-test
SIZE	9.801	10.795	11.902	12.492	-25.850***
	(1.630)	(1.932)	(2.450)	(1.945)	
QUALITY1	0.090	0.088	-0.105	-0.174	2.039**
	(2.263)	(2.778)	(2.186)	(2.430)	
QUALITY2	0.138	0.088	0.066	0.048	2.738***
	(0.703)	(0.809)	(0.505)	(0.363)	
LEV 1	0.040	0.161	0.215	0.257	-27.668***
	(0.098)	(0.151)	(0.164)	(0.166)	
LEV 2	0.062	0.238	0.299	0.359	-31.053***
	(0.129)	(0.192)	(0.191)	(0.195)	
TAX	0.201	0.187	0.241	0.187	0.369
	(0.711)	(0.489)	(0.500)	(0.592)	
LIQ 1	3.746	1.648	1.507	1.522	15.779***
	(4.570)	(1.164)	(1.475)	(1.448)	
LIQ 2	0.626	0.566	0.461	0.401	11.653***
	(0.258)	(0.202)	(0.227)	(0.231)	
MTB	3.746	1.648	1.507	1.522	15.779***
	(4.570)	(1.164)	(1.475)	(1.448)	
AMAT	8.251	6.296	7.763	8.633	-0.332
	(25.551)	(7.941)	(9.904)	(9.974)	
OWN	13.329	9.920	6.874	4.638	8.721***
	(17.102)	(14.843)	(13.804)	(12.386)	
OVER1	0.073	0.043	0.067	0.090	-1.099
	(0.260)	(0.203)	(0.251)	(0.287)	
OVER2	0.191	0.196	0.261	0.317	5.039***
	(0.394)	(0.397)	(0.439)	(0.466)	
OVER3	0.373	0.399	0.378	0.342	1.094
	(0.484)	(0.490)	(0.485)	(0.475)	

Notes: This table provides univariate mean comparisons of firm specific characteristics by debt maturity quartiles. It also provides standard deviation comparison in parentheses. We use debt maturity measured over the period 2003-2006, and split sample into four quartiles. The t-statistics is for the difference of means between the first and the fourth quartiles. ***and * indicate coefficient is significant at 1% and 10% respectively. Definitions of all variables are provided in Table4.1.

Table 4.5: CSA Regressions (2006): the Role of Managerial Overconfidence

Independent Variables	*Est*	Debt Maturity (MAT) 2006					
		(1)	(2)	(3)	(4)	(5)	(6)
SIZE	+	0.047 (6.41)***	0.036 (4.72)***	0.037 (4.88)***	0.034 (4.56)***	0.034 (4.36)***	0.032 (4.15)***
QUALITY1	–	–0.032 (2.61)***	–0.033 (2.18)**	–0.030 (2.38)**	–0.024 (2.09)**		
QUALITY2	–					–0.101 (1.55)	–0.063 (1.07)
LEV1 (LEV2 in 4,6)	+	0.734 (5.85)***	0.719 (5.87)***	0.717 (5.83)***	0.615 (6.82)***	0.772 (6.67)***	0.640 (6.77)***
TAX	+/–	–0.023 (0.46)	–0.016 (0.34)	–0.011 (0.25)	–0.002 (0.45)	–0.018 (0.40)	–0.008 (0.45)
LIQ1 (LIQ2 in 4,6)	+/–	–0.018 (3.25)***	–0.020 (3.74)***	–0.020 (3.77)***	–0.327 (4.07)***	–0.019 (3.50)***	–0.332 (4.16)***
MTB	+/–	0.0003 (0.24)	–0.0003 (0.02)	0.005 (0.43)	0.016 (1.26)	0.001 (0.08)	0.014 (1.06)
AMAT	+	–0.0002 (0.21)	–0.0003 (0.36)	–0.0001 (0.14)	–0.002 (1.61)	–0.0006 (0.72)	–0.002 (1.58)
OWN	–		–0.009 (3.84)***	–0.009 (3.62)***	–0.007 (3.18)***	–0.008 (3.55)***	–0.007 (3.12)**
OWN^2	+		0.0001 (3.71)***	0.0001 (3.53)***	0.0001 (3.63)***	0.0001 (3.36)***	0.0001 (2.66)***
OVER1	+/–			0.205 (0.21)	0.191 (1.48)	0.202 (2.46)**	0.196 (1.08)
OVER1* QUALITY1	–			–0.105 (3.02)***	–0.108 (3.63)***		
OVER1* QUALITY2	–					–0.241 (2.37)***	–0.307 (3.33)***
OVER1* MTB	–			–0.085 (2.46)**	–0.068 (1.94)*	–0.086 (2.48)**	–0.070 (2.04)**
CONSTANT		–0.124 (1.46)	0.051 (0.52)	0.021 (0.22)	0.145 (1.28)	0.071 (0.70)	0.182 (1.57)
Obs.		564	564	564	564	564	564
F-test		32.39***	32.39***	27.09***	32.55***	25.61***	32.03***
R^2		0.35	0.35	0.36	0.38	0.35	0.38
Adj. R^2		0.32	0.32	0.33	0.36	0.32	0.35

Notes: this table presents the impact of managerial overconfidence on debt maturity decision. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1%, 5% and 10% respectively. Definitions of all variables are provided in Table 4.1.

Table 4.6: CSA Regressions (2005): the Role of Managerial Overconfidence

Independent Variables	*Est*	Debt Maturity (MAT) 2005					
		(1)	(2)	(3)	(4)	(5)	(6)
SIZE	+	0.058 (8.84)***	0.046 (4.72)***	0.047 (4.88)***	0.043 (6.24)***	0.044 (6.06)***	0.043 (5.89)***
QUALITY1	–	–0.019 (2.01)**	–0.020 (2.08)**	–0.019 (2.38)**	–0.015 (1.53)		
QUALITY2	–					–0.076 (1.60)	–0.049 (1.08)
LEV1 (LEV2 in 4,6)	+	0.646 (6.38)***	0.638 (5.87)***	0.640 (5.83)***	0.564 (6.75)***	0.685 (7.34)***	0.577 (7.10)***
TAX	+/–	0.005 (0.09)	0.011 (0.34)	0.010 (0.17)	0.021 (0.40)	0.004 (0.07)	0.015 (0.31)
LIQ1 (LIQ2 in 4,6)	+/–	–0.016 (3.02)***	–0.017 (3.44)***	–0.018 (3.51)***	–0.272 (3.62)***	–0.017 (3.50)***	–0.272 (4.16)***
MTB	+/–	–0.002 (0.60)	–0.004 (0.45)	0.001 (0.11)	0.009 (0.99)	0.001 (0.12)	0.007 (0.87)
AMAT	+	–0.001 (1.42)	–0.001 (0.45)	–0.001 (1.40)	–0.003 (1.61)	–0.002 (0.72)	–0.003 (1.58)
OWN	–		–0.009 (3.66)***	–0.008 (3.48)***	–0.007 (2.98)***	–0.008 (3.43)***	–0.007 (2.93)**
OWN^2	+		0.0001 (3.37)***	0.0001 (3.21)***	0.0001 (2.47)**	0.0001 (2.99)***	0.0001 (2.32)**
OVER1	+/–			0.137 (1.63)	0.141 (1.07)	0.142 (1.59)	0.151 (1.23)
OVER1* QUALITY1	–			–0.048 (2.18)**	–0.049 (2.25)**		
OVER1* QUALITY2	–					–0.141 (1.93)*	–0.307 (2.60)**
OVER1* MTB	–			–0.048 (2.18)*	–0.041 (2.09)**	–0.050 (2.31)**	–0.044 (2.31)**
CONSTANT		–0.227 (0.91)	0.046 (0.50)	–0.067 (0.73)	0.034 (0.32)	–0.029 (0.31)	0.057 (0.53)
Obs.		564	564	564	564	564	564
F-test		44.94***	38.94***	32.63***	36.18***	31.32***	37.18***
R^2		0.38	0.40	0.40	0.43	0.40	0.43
Adj. R^2		0.36	0.37	0.38	0.40	0.38	0.40

Notes: this table presents the impact of managerial overconfidence on debt maturity decision. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1%, 5% and 10% respectively. Definitions of all variables are provided in Table 4.1.

Table 4.7: Pooled Regressions: the Role of Managerial Overconfidence

Independent Variables	Est.	Debt Maturity (MAT)					
		(1)	(2)	(3)	(4)	(5)	(6)
SIZE	+	0.03 (16.44)***	0.046 (11.10)***	0.046 (11.25)***	0.043 (10.72)***	0.047 (11.09)***	0.043 (10.72)***
QUALITY1	–	−0.007 (2.50)**	−0.008 (2.76)**	−0.009 (2.34)**	−0.008 (2.22)**		
QUALITY2	–					−0.010 (0.61)	−0.006 (0.34)
LEV1 (LEV2 in 4,6)	+	0.694 (13.41)***	0.688 (11.21)***	0.687 (11.23)***	0.600 (12.12)***	0.696 (11.16)***	0.608 (12.15)***
TAX	+/–	−0.007 (0.09)	−0.009 (0.69)	−0.009 (0.69)	−0.007 (0.58)	0.009 (0.07)	−0.007 (0.51)
LIQ1 (LIQ2 in 4,6)	+/–	−0.012 (4.88)***	−0.017 (5.04)***	−0.017 (5.11)***	−0.255 (5.91)***	−0.017 (5.14)***	−0.254 (5.85)***
MTB	+/–	−0.002 (0.41)	−0.001 (0.22)	−0.002 (0.47)	0.009 (1.96)*	0.002 (0.40)	0.011 (2.42)
AMAT	+	−0.001 (1.42)	0.001 (1.45)	−0.001 (1.79)*	−0.006 (1.91)*	−0.001 (1.72)*	−0.002 (1.58)
OWN	–		−0.006 (4.38)***	−0.006 (5.11)***	−0.006 (4.46)***	−0.006 (3.43)***	−0.005 (4.20)**
OWN^2	+		0.0001 (3.70)***	0.0001 (3.51)***	0.0001 (3.90)**	0.0001 (2.99)***	0.0001 (3.64)***
OVER1	+/–			0.121 (1.66)*	0.124 (1.87)*	0.111 (1.25)	0.115 (1.55)
OVER1* QUALITY1	–			−0.048 (2.72)***	−0.025 (2.77)**		
OVER1* QUALITY2	–					0.036 (0.40)	0.018 (0.25)
OVER1* MTB	–			−0.048 (2.76)***	−0.044 (2.88)***	−0.052 (2.76)**	−0.045 (2.90)***
CONSTANT		−0.208 (5.29)***	−0.083 (0.50)	−0.088 (1.63)	−0.005 (0.08)	−0.086 (1.58)	0.006 (0.10)
Obs.		1692	1692	1692	1692	1692	1692
F-test		73.07***	78.70***	65.03***	75.21***	62.29***	73.05***
R^2		0.36	0.37	0.38	0.40	0.37	0.40
Adj. R^2		0.35	0.36	0.37	0.39	0.36	0.39

Notes: this table presents the impact of managerial overconfidence on debt maturity decision. All regressions include industry dummies and time dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1%, 5% and 10% respectively. Definitions of all variables are provided in Table 4.1.

Table 4.8: CSA Regressions (2006): the Role of Corporate Governance

MAT	Independent Variables															
	SIZE	Quality1	LEV1	TAX	LIQ1	MTB	AMAT	OWN	OWN^2	OVER1	OVER1* Quality1	OVER1* MTB	Obs.	F-test	R^2	Adj. R^2
Est.	+	−	+	+/−	+/−	+/−	+	−	+	+/−	−	−				
Board Size (BOARD): (a) smaller-size board , (b) medium, and (c) larger-size board																
(a)	0.062 (3.16)***	−0.018 (0.85)	0.263 (1.48)	−0.093 (2.22)**	−0.045 (3.96)***	0.043 (2.14)**	0.0003 (0.11)	−0.012 (2.29)**	0.0001 (1.89)*	0.313 (0.69)	−0.126 (2.81)***	−0.091 (3.39)***	182	12.47***	0.37	0.27
(b)	0.033 (1.75)*	−0.045 (2.62)**	1.148 (6.15)***	0.092 (1.20)	−0.004 (0.55)	0.025 (1.63)	0.002 (1.35)	−0.008 (2.06)**	0.0001 (2.55)***	0.632 (3.41)***	−0.166 (3.90)***	−0.347 (3.52)***	206	18.35***	0.47	0.40
(c)	0.034 (2.24)**	−0.006 (0.18)	0.914 (4.23)***	−0.021 (0.13)	−0.019 (1.51)	0.009 (0.26)	0.001 (0.34)	−0.003 (0.40)	0.0001 (0.57)	0.020 (0.12)	−0.210 (2.77)***	−0.026 (0.34)	176	6.12***	0.31	0.20
Non-Executive Ratio (RATIO): (a) lower ratio , (b) medium, and (c) higher ratio																
(a)	0.042 (2.01)**	−0.051 (2.55)**	0.943 (3.71)***	−0.067 (1.38)	−0.015 (1.84)*	0.012 (0.66)	0.001 (0.64)	−0.009 (2.62)**	0.0001 (2.70)***	0.326 (0.96)	−0.115 (2.64)***	−0.153 (2.13)***	170	7.62***	0.38	0.28
(b)	0.052 (3.58)***	−0.030 (1.34)	0.535 (3.08)***	−0.014 (0.10)	−0.028 (2.92)***	0.018 (0.66)	−0.0001 (0.05)	−0.010 (1.54)	0.0001 (0.87)	0.174 (1.66)*	−0.187 (1.32)	−0.071 (2.03)**	225	11.42***	0.36	0.28
(c)	0.023 (1.75)*	−0.012 (0.46)	0.761 (3.14)***	0.055 (0.58)	−0.019 (1.25)	−0.029 (1.23)	−0.0001 (0.51)	−0.018 (0.94)	0.0006 (0.97)	0.195 (1.01)	−0.100 (1.64)	−0.094 (0.92)	169	6.12***	0.38	0.27
Blockholders' Ownership(BLOCK): (a) lower ownership , (b) medium, and (c) higher ownership																
(a)	0.033 (2.64)***	−0.026 (0.95)	0.766 (2.71)***	−0.010 (0.22)	−0.026 (3.60)***	−0.015 (1.08)	−0.001 (0.70)	−0.015 (3.28)**	0.0002 (2.87)***	−0.037 (0.19)	−0.138 (2.40)**	−0.032 (0.32)	170	24.72***	0.55	0.48
(b)	0.040 (2.99)***	−0.037 (2.11)**	0.711 (4.46)***	−0.096 (0.93)	−0.015 (1.95)*	−0.007 (0.37)	0.002 (1.37)	−0.011 (1.32)	0.0003 (1.43)	0.267 (0.85)	−0.079 (1.42)	−0.167 (0.90)	225	8.40***	0.39	0.31
(c)	0.025 (1.20)	−0.016 (0.73)	0.844 (3.16)***	0.022 (0.23)	−0.010 (0.47)	0.048 (1.65)	−0.002 (1.47)	−0.011 (1.70)*	0.0001 (1.83)*	0.388 (3.61)***	−0.154 (1.54)	−0.111 (3.10)	169	7.11***	0.29	0.17

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. The sample is divided into three subgroups as explained in Section 4.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 4.9: CSA Regressions (2005): the Role of Corporate Governance

MAT	Independent Variables															
	SIZE	Quality1	LEV1	TAX	LIQ1	MTB	AMAT	OWN	OWN^2	OVER1	OVER1* Quality1	OVER1* MTB	Obs.	F-test	R^2	Adj. R^2
Est.	+	−	+	+/−	+/−	+/−	+	−	+	+/−	−	−				
Board Size (BOARD): (a) smaller-size board , (b) medium,, and (c) large-size board																
(a)	0.047 (2.63)***	−0.023 (1.42)	0.339 (2.41)**	−0.118 (2.04)**	−0.035 (3.73)***	0.010 (0.71)	0.002 (0.68)	−0.015 (3.43)***	0.0002 (3.06)***	0.334 (3.26)***	−0.061 (1.94)*	−0.051 (3.08)***	182	14.36***	0.41	0.31
(b)	0.052 (2.52)**	−0.020 (0.98)	0.837 (4.14)***	0.081 (0.94)	−0.010 (1.38)	−0.009 (0.61)	−0.002 (1.57)	−0.005 (1.23)	0.0001 (1.28)	0.432 (2.02)**	−0.083 (2.11)***	−0.241 (2.53)***	206	9.62***	0.41	0.32
(c)	0.031 (2.10)**	−0.008 (0.56)	0.911 (4.75)***	0.045 (0.38)	−0.036 (3.02)***	−0.009 (0.40)	0.002 (0.49)	0.004 (0.52)	−0.0001 (0.88)	0.135 (0.74)	−0.078 (0.58)	0.012 (0.20)	176	6.93***	0.39	0.29
Non-Executive Ratio (RATIO): (a) lower ratio , (b) medium,, and (c) higher ratio																
(a)	0.059 (2.73)***	−0.030 (1.71)*	0.358 (1.72)*	−0.112 (1.20)	−0.025 (3.84)***	0.022 (1.66)*	0.001 (0.26)	−0.011 (3.24)***	0.0001 (3.26)***	0.231 (1.27)	−0.307 (2.22)**	−0.017 (0.22)	170	7.03***	0.36	0.25
(b)	0.064 (4.55)***	0.003 (0.20)	0.730 (5.37)***	−0.028 (0.24)	−0.013 (1.51)	−0.015 (1.07)	−0.002 (1.57)	−0.002 (0.27)	−0.0001 (0.11)	0.054 (0.51)	0.085 (0.63)	−0.030 (1.66)*	225	15.07***	0.42	0.34
(c)	0.028 (2.50)**	−0.027 (1.47)	0.575 (2.96)***	0.037 (0.43)	−0.032 (2.35)**	−0.017 (0.98)	−0.0001 (0.50)	−0.017 (1.18)	0.0005 (0.96)	0.223 (1.30)	−0.038 (1.46)	−0.092 (1.50)	169	11.61***	0.51	0.42
Blockholders' Ownership(BLOCK): (a) lower ownership , (b) medium,, and (c) higher ownership																
(a)	0.040 (3.73)***	−0.042 (2.87)***	0.641 (3.58)***	−0.057 (0.70)	−0.021 (2.91)***	−0.013 (0.99)	−0.001 (0.65)	−0.012 (2.69)***	0.0002 (2.27)**	−0.392 (3.11)***	−0.060 (2.36)**	0.075 (1.64)	170	20.79***	0.61	0.54
(b)	0.065 (5.46)***	0.003 (0.15)	0.600 (4.68)***	−0.030 (0.51)	−0.015 (1.40)	−0.009 (0.61)	0.001 (0.30)	−0.006 (1.16)	0.0001 (0.58)	0.314 (1.45)	−0.040 (1.18)	−0.217 (1.98)*	225	16.66***	0.44	0.37
(c)	0.029 (1.52)	−0.004 (0.24)	0.945 (4.65)***	0.051 (0.54)	−0.009 (0.51)	0.028 (1.77)*	−0.002 (1.76)*	−0.006 (1.26)	0.0001 (1.93)*	0.427 (4.94)***	−0.006 (0.07)	−0.083 (4.49)***	169	12.79***	0.36	0.25

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 4.10: Pooled Regressions: the Role of Corporate Governance

MAT	Independent Variables															
	SIZE	Quality1	LEV1	TAX	LIQ1	MTB	AMAT	OWN	OWN^2	OVER1	OVER1* Quality1	OVER1* MTB	Obs.	F-test	R^2	Adj. R^2
Est.	+	−	+	+/−	+/−	+/−	+	−	+	+/−	−	−				
Board Size (BOARD): (a) smaller-size board , (b) medium,, and (c) large-size board																
(a)	0.039 (4.07)***	−0.020 (1.89)*	0.622 (4.77)***	−0.015 (3.02)***	−0.028 (5.10)***	0.016 (2.41)**	0.002 (0.04)	−0.009 (3.71)***	0.0001 (2.66)***	0.219 (3.06)***	−0.032 (2.10)**	−0.046 (3.88)***	546	13.90***	0.55	0.52
(b)	0.064 (5.82)***	−0.006 (0.93)	0.890 (8.29)***	0.018 (0.65)	−0.010 (1.98)**	−0.009 (1.51)	−0.001 (0.91)	−0.002 (1.04)	0.0001 (1.56)	0.287 (2.48)**	−0.043 (2.28)**	−0.160 (3.30)***	618	17.14***	0.35	0.32
(c)	0.037 (4.34)***	−0.010 (1.79)*	0.891 (8.32)***	0.032 (0.76)	−0.022 (3.54)***	−0.001 (0.49)	0.001 (0.67)	−0.002 (0.63)	5.03e-06 (0.09)	0.085 (0.66)	0.0001 (0.01)	−0.075 (1.22)	528	17.14***	0.35	0.32
Non-Executive Ratio (RATIO): (a) lower ratio , (b) medium,, and (c) higher ratio																
(a)	0.045 (3.87)***	−0.013 (1.93)*	0.520 (1.65)	−0.019 (1.20)	−0.018 (5.39)***	0.011 (1.62)	−0.001 (0.26)	−0.008 (3.92)**	0.0001 (3.58)***	0.384 (1.57)	−0.043 (1.67)*	−0.166 (2.32)	510	13.19***	0.28	0.24
(b)	0.058 (7.85)***	−0.004 (0.72)	0.738 (8.91)***	−0.018 (0.48)	−0.013 (2.32)**	−0.015 (0.05)	−0.002 (1.57)	−0.002 (1.67)*	−0.0001 (1.11)	0.034 (0.55)	−0.040 (1.63)	−0.028 (2.42)**	675	15.07***	0.42	0.34
(c)	0.032 (4.92)***	−0.011 (1.50)	0.625 (5.68)***	0.021 (0.73)	−0.032 (5.12)***	−0.017 (1.59)	−0.001 (1.60)	−0.010 (1.94)*	0.0003 (3.81)***	0.143 (1.23)	−0.006 (0.49)	−0.053 (0.99)	507	25.17***	0.43	0.41
Blockholders' Ownership(BLOCK): (a) lower ownership , (b) medium,, and (c) higher ownership																
(a)	0.039 (6.06)***	−0.022 (3.42)***	0.695 (5.29)***	−0.012 (1.01)	−0.020 (4.96)***	−0.012 (1.84)*	−0.001 (0.65)	−0.010 (4.15)***	0.0001 (3.61)***	−0.190 (1.85)*	−0.048 (1.82)*	0.029 (0.76)	510	39.03***	0.53	0.51
(b)	0.056 (7.20)***	−0.003 (0.61)	0.644 (7.87)***	−0.023 (0.63)	−0.015 (2.56)**	−0.002 (0.24)	−0.001 (0.46)	−0.004 (1.41)	0.0001 (0.98)	0.057 (0.33)	−0.022 (2.17)**	−0.048 (0.50)	675	24.63***	0.36	0.34
(c)	0.043 (4.18)***	−0.003 (2.13)**	0.843 (6.83)***	0.001 (0.04)	−0.014 (1.77)*	0.030 (3.37)***	−0.001 (0.13)	−0.008 (2.37)**	0.0001 (2.73)***	0.304 (4.65)***	−0.027 (0.81)	−0.080 (4.14)***	507	16.93***	0.33	0.30

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment. The sample is divided into three subgroups as explained in Section 4.2.3. All regressions include industry dummies and time dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 4.11: Robustness Check 1: the Role of Managerial Overconfidence (OVER 2 and CSA 2006).

Independent Variables	*Est*	Debt Maturity (MAT)			
		(3)	(4)	(5)	(6)
SIZE	+	0.034 (4.42)***	0.030 (3.95)***	0.032 (4.05)***	0.028 (3.57)***
QUALITY1	–	–0.025 (1.85)*	–0.020 (1.58)		
QUALITY2	–			–0.136 (2.37)**	–0.123 (2.60)***
LEV1 (LEV2 in 4,6)	+	0.724 (5.90)***	0.676 (5.65)***	0.782 (6.81)***	0.725 (6.25)***
TAX	+/–	–0.008 (0.17)	–0.006 (0.12)	–0.017 (0.37)	–0.015 (0.31)
LIQ1 (LIQ2 in 4,6)	+/–	–0.022 (4.33)***	–0.389 (5.06)***	–0.019 (3.58)***	–0.378 (4.96)***
MTB	+/–	0.006 (0.47)	0.003 (0.20)	0.002 (0.12)	–0.001 (0.05)
AMAT	+	–0.0003 (0.36)	–0.002 (1.25)	–0.001 (0.82)	–0.002 (0.64)
OWN	–	–0.009 (3.72)***	–0.008 (3.47)***	–0.009 (3.63)***	–0.008 (3.44)***
OWN^2	+	0.0001 (3.63)***	0.0001 (3.25)***	0.0001 (3.44)***	0.0001 (3.13)***
OVER2	+/–	0.117 (1.00)	0.082 (1.39)	0.011 (0.90)	0.072 (1.20)
OVER2* QUALITY1	–	–0.048 (1.83)*	–0.051 (2.14)**		
OVER2* QUALITY2	–			0.112 (0.90)	0.081 (0.61)
OVER2* MTB	–	–0.044 (1.58)	–0.023 (0.81)	–0.041 (1.51)	–0.022 (0.76)
CONSTANT		0.043 (0.44)	0.273 (2.45)***	0.092 (0.92)	0.307 (2.72)***
Obs.		564	564	564	564
F-test		28.71***	28.96***	25.12***	25.61***
R^2		0.36	0.37	0.35	0.37
Adj. R^2		0.33	0.35	0.32	0.34

Notes: this table presents the impact of managerial overconfidence on debt maturity decision. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1%, 5% and 10% respectively. Definitions of all variables are provided in Table 4.1.

Table 4.12: Robustness Check 2: the Role of Managerial Overconfidence (OVER 2 and CSA 2005).

Independent Variables	*Est*	Debt Maturity (MAT)			
		(3)	(4)	(5)	(6)
SIZE	+	0.045 (6.12)***	0.042 (5.95)***	0.042 (5.68)***	0.040 (5.65)***
QUALITY1	–	–0.011 (1.95)*	–0.006 (0.53)		
QUALITY2	–			–0.128 (4.13)***	–0.100 (3.74)***
LEV1 (LEV2 in 4,6)	+	0.625 (6.46)***	0.571 (6.76)***	0.710 (7.73)***	0.598 (7.57)***
TAX	+/–	0.015 (0.27)	0.025 (0.49)	0.011 (0.19)	0.021 (0.41)
LIQ1 (LIQ2 in 4,6)	+/–	–0.018 (3.85)***	–0.279 (3.70)***	–0.016 (3.10)***	–0.253 (3.43)***
MTB	+/–	–0.001 (0.10)	0.005 (0.61)	0.003 (0.33)	0.005 (0.56)
AMAT	+	–0.001 (1.55)	–0.003 (1.63)	–0.002 (0.87)	–0.003 (1.13)
OWN	–	–0.008 (3.52)***	–0.007 (3.03)***	–0.008 (3.57)***	–0.007 (3.09)***
OWN^2	+	0.0001 (3.27)***	0.0001 (2.58)***	0.0001 (3.14)***	0.0001 (2.51)***
OVER2	+/–	–0.080 (1.58)	–0.054 (1.06)	–0.068 (1.36)	–0.048 (0.95)
OVER2* QUALITY1	–	–0.032 (1.66)*	–0.038 (2.04)**		
OVER2* QUALITY2	–			0.173 (1.17)	0.156 (1.56)
OVER2* MTB	–	–0.013 (0.72)	0.001 (0.03)	–0.018 (1.00)	–0.006 (0.29)
CONSTANT		0.047 (0.52)	0.057 (0.55)	0.004 (0.04)	0.069 (0.65)
Obs.		564	564	564	564
F-test		31.67***	33.78***	33.03***	35.41***
R^2		0.41	0.43	0.41	0.43
Adj. R^2		0.38	0.40	0.38	0.40

Notes: this table presents the impact of managerial overconfidence on debt maturity decision. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1%, 5% and 10% respectively. Definitions of all variables are provided in Table 4.1.

Table 4.13: Robustness Check 3: the Role of Managerial Overconfidence (OVER 2 and Pooled Regression)

Independent Variables	*Est*	Debt Maturity (MAT)			
		(3)	(4)	(5)	(6)
SIZE	+	0.045 (10.83)***	0.042 (10.59)***	0.045 (10.75)***	0.042 (10.48)***
QUALITY1	–	–0.006 (2.46)**	–0.005 (1.24)		
QUALITY2	–			–0.022 (1.52)	–0.159 (1.16)
LEV1 (LEV2 in 4,6)	+	0.692 (11.32)***	0.605 (12.29)***	0.703 (11.30)***	0.612 (12.27)***
TAX	+/–	–0.008 (0.59)	–0.006 (0.46)	–0.008 (0.62)	–0.007 (0.50)
LIQ1 (LIQ2 in 4,6)	+/–	–0.016 (5.70)***	–0.252 (5.88)***	–0.016 (5.02)***	–0.247 (5.73)***
MTB	+/–	0.001 (0.32)	0.010 (2.06)**	0.001 (0.27)	0.010 (2.05)**
AMAT	+	–0.001 (0.78)	–0.002 (1.61)	–0.001 (0.87)	–0.001 (1.58)
OWN	–	–0.006 (4.13)***	–0.005 (4.22)***	–0.006 (4.21)***	–0.005 (4.22)***
OWN^2	+	0.00008 (3.54)***	0.00007 (3.76)***	0.00008 (3.67)***	0.00007 (3.78)***
OVER2	+/–	0.079 (0.34)	0.057 (1.18)	0.075 (0.25)	0.054 (0.59)
OVER2* QUALITY1	–	–0.017 (2.33)**	–0.019 (2.63)***		
OVER2* QUALITY2	–			0.091 (1.14)	0.075 (1.63)
OVER2* MTB	–	–0.016 (1.30)	–0.003 (0.22)	–0.018 (1.49)	–0.005 (0.38)
CONSTANT		0.080 (1.48)	0.012 (0.20)	–0.082 (1.51)	–0.006 (0.10)
Obs.		1692	1692	1692	1692
F-test		65.24***	73.92***	64.81***	73.38***
R^2		0.38	0.40	0.37	0.40
Adj. R^2		0.37	0.39	0.36	0.39

Notes: this table presents the impact of managerial overconfidence on debt maturity decision. All regressions include industry dummies and year dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1%, 5% and 10% respectively. Definitions of all variables are provided in Table 4.1.

Table 4.14: Robustness Check 4: the Role of Managerial Overconfidence (OVER 3 and CSA 2006).

Independent Variables	*Est*	Debt Maturity (MAT)			
		(3)	(4)	(5)	(6)
SIZE	+	0.037 (4.88)***	0.033 (4.34)***	0.034 (4.30)***	0.032 (4.16)***
QUALITY1	–	–0.020 (2.38)**	–0.014 (0.98)		
QUALITY2	–			–0.176 (3.26)***	–0.139 (3.02)***
LEV1 (LEV2 in 4,6)	+	0.715 (5.83)***	0.329 (4.12)***	0.779 (6.72)***	0.327 (4.16)***
TAX	+/–	–0.019 (0.25)	–0.002 (0.45)	–0.025 (0.52)	–0.013 (0.28)
LIQ1 (LIQ2 in 4,6)	+/–	–0.021 (3.82)***	–0.329 (4.12)***	–0.021 (3.62)***	–0.327 (4.16)***
MTB	+/–	0.006 (0.43)	0.012 (0.80)	0.006 (0.38)	0.012 (0.80)
AMAT	+	–0.0003 (0.38)	–0.002 (1.61)	–0.001 (0.87)	–0.002 (1.58)
OWN	–	–0.009 (3.72)***	–0.008 (3.32)***	–0.008 (3.51)***	–0.007 (3.10)***
OWN^2	+	0.0001 (3.55)***	0.0001 (2.90)***	0.0001 (3.22)***	0.0001 (2.60)***
OVER3	+/–	0.166 (0.34)	0.191 (0.48)	0.004 (0.09)	–0.030 (0.59)
OVER3* QUALITY1	–	–0.044 (1.88)*	–0.049 (2.12)**		
OVER3* QUALITY2	–			0.207 (1.14)	0.191 (1.33)
OVER3* MTB	–	–0.015 (0.71)	0.006 (0.24)	–0.024 (1.16)	–0.003 (0.12)
CONSTANT		0.043 (0.44)	0.175 (1.54)	0.086 (0.86)	0.196 (1.71)*
Obs.		564	564	564	564
F-test		27.16***	31.88***	25.61***	29.16***
R^2		0.35	0.38	0.35	0.38
Adj. R^2		0.32	0.35	0.32	0.35

Notes: this table presents the impact of managerial overconfidence on debt maturity decision. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1%, 5% and 10% respectively. Definitions of all variables are provided in Table 4.1.

Table 4.15: Robustness Check 5 : the Role of Managerial Overconfidence (OVER 3 and CSA 2005).

Independent Variables	*Est*	Debt Maturity (MAT)			
		(3)	(4)	(5)	(6)
SIZE	+	0.048 (6.67)***	0.045 (4.34)***	0.045 (6.12)***	0.043 (5.96)***
QUALITY1	–	–0.011 (2.01)**	–0.007 (1.64)		
QUALITY2	–			–0.127 (2.84)***	–0.099 (2.53)***
LEV1 (LEV2 in 4,6)	+	0.625 (6.20)***	0.554 (6.39)***	0.694 (7.46)***	0.580 (7.15)***
TAX	+/–	0.018 (0.25)	0.030 (0.59)	0.006 (0.10)	0.018 (0.28)
LIQ1 (LIQ2 in 4,6)	+/–	–0.018 (3.44)***	–0.285 (3.79)***	–0.017 (2.46)***	–0.273 (3.62)***
MTB	+/–	–0.003 (0.30)	0.0004 (0.04)	0.003 (0.33)	0.001 (0.13)
AMAT	+	–0.001 (1.38)	–0.003 (1.61)	–0.002 (0.87)	–0.003 (1.58)
OWN	–	–0.008 (3.51)***	–0.007 (3.11)***	–0.008 (3.40)***	–0.007 (3.00)***
OWN^2	+	0.0001 (3.21)***	0.0001 (2.66)***	0.0001 (2.93)***	0.0001 (2.60)***
OVER3	+/–	–0.039 (0.80)	–0.062 (1.44)	–0.044 (1.00)	–0.070 (0.59)
OVER3* QUALITY1	–	–0.039 (1.91)*	–0.049 (2.20)**		
OVER3* QUALITY2	–			0.125 (1.14)	0.120 (0.71)
OVER3* MTB	–	–0.001 (0.05)	0.015 (0.91)	–0.004 (0.35)	–0.012 (0.81)
CONSTANT		0.043 (0.44)	0.066 (0.64)	0.086 (0.86)	0.087 (0.81)
Obs.		564	564	564	564
F-test		30.60***	34.60***	29.44***	34.15***
R^2		0.40	0.43	0.40	0.43
Adj. R^2		0.38	0.40	0.38	0.40

Notes: this table presents the impact of managerial overconfidence on debt maturity decision. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1%, 5% and 10% respectively. Definitions of all variables are provided in Table 4.1.

Table 4.16: Robustness Check 6: the Role of Managerial Overconfidence (OVER 3 and Pooled Regression)

Independent Variables	*Est*	Debt Maturity (MAT)			
		(3)	(4)	(5)	(6)
SIZE	+	0.047 (11.11)***	0.044 (10.80)***	0.047 (11.08)***	0.044 (10.66)***
QUALITY1	–	–0.006 (1.33)	–0.005 (1.15)		
QUALITY2	–			–0.005 (0.18)	0.004 (0.13)
LEV1 (LEV2 in 4,6)	+	0.680 (11.03)***	0.596 (11.94)***	0.688 (10.96)***	0.600 (11.89)***
TAX	+/–	–0.009 (0.69)	–0.007 (0.51)	–0.010 (0.74)	–0.008 (0.55)
LIQ1 (LIQ2 in 4,6)	+/–	–0.017 (5.16)***	–0.254 (5.89)***	–0.017 (5.11)***	–0.255 (5.86)***
MTB	+/–	0.002 (0.41)	0.008 (1.64)	0.002 (0.36)	0.008 (1.61)
AMAT	+	–0.003 (0.38)	–0.002 (1.61)	–0.001 (0.87)	–0.002 (1.58)
OWN	–	–0.006 (4.28)***	–0.006 (4.36)***	–0.006 (4.35)***	–0.006 (4.34)***
OWN^2	+	0.00008 (3.61)***	0.0001 (2.90)***	0.00008 (3.81)***	0.00007 (3.84)***
OVER3	+/–	–0.005 (0.20)	–0.024 (1.01)	–0.008 (0.31)	–0.026 (1.08)
OVER3* QUALITY1	–	–0.017 (2.30)**	–0.018 (2.58)**		
OVER3* QUALITY2	–			–0.008 (0.25)	–0.019 (0.64)
OVER3* MTB	–	–0.010 (1.10)	0.002 (0.18)	–0.011 (1.15)	0.001 (0.13)
CONSTANT		–0.077 (1.41)	0.023 (0.38)	–0.080 (1.46)	0.06 (0.06)
Obs.		1692	1692	1692	1692
F-test		63.22***	72.84***	62.27***	72.57***
R^2		0.38	0.40	0.37	0.39
Adj. R^2		0.37	0.39	0.36	0.38

Notes: this table presents the impact of managerial overconfidence on debt maturity decision. All regressions include industry dummies and year dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1%, 5% and 10% respectively. Definitions of all variables are provided in Table 4.1.

Table 4.17: Robustness Check 7: the Role of Corporate Governance (OVER 2 and CSA 2006)

MAT	Independent Variables															
	SIZE	Quality1	LEV1	TAX	LIQ1	MTB	AMAT	OWN	OWN^2	OVER2	OVER2* Quality1	OVER2* MTB	Obs.	F-test	R^2	Adj. R^2
Est.	+	−	+	+/−	+/−	+/−	+	−	+	+/−	−	−				
Board Size (BOARD): (a) smaller-size board , (b) medium,, and (c) large-size board																
(a)	0.060 (3.08)***	−0.019 (0.85)	0.274 (1.50)	−0.101 (2.16)**	−0.044 (3.88)***	0.042 (1.96)*	−0.0003 (0.14)	−0.012 (2.38)**	0.0002 (1.95)*	0.133 (1.21)	−0.044 (0.82)	−0.053 (1.80)*	182	8.19***	0.35	0.25
(b)	0.029 (1.56)	−0.041 (2.28)**	1.149 (6.30)***	0.114 (1.45)	−0.007 (1.00)	0.019 (1.29)	0.001 (0.81)	−0.009 (2.19)**	0.0001 (2.64)***	0.234 (1.83)*	−0.047 (1.24)	0.091 (1.25)	206	19.29***	0.47	0.40
(c)	0.032 (2.15)**	0.007 (0.19)	0.895 (4.29)***	−0.016 (0.10)	−0.020 (1.61)	−0.015 (0.40)	0.001 (0.25)	0.004 (0.47)	−0.0001 (0.58)	0.010 (0.09)	−0.066 (1.61)	−0.001 (0.01)	176	4.66***	0.31	0.20
Non-Executive Ratio (RATIO): (a) lower ratio , (b) medium,, and (c) higher ratio																
(a)	0.034 (1.66)*	−0.058 (3.10)***	0.937 (3.94)***	−0.067 (1.40)	−0.016 (2.18)**	0.013 (0.76)	−0.001 (0.66)	−0.009 (2.58)**	0.0001 (2.77)***	0.333 (2.36)**	−0.033 (2.21)***	−0.159 (2.36)	170	8.35***	0.39	0.29
(b)	0.048 (3.35)***	−0.009 (0.38)	0.566 (3.28)***	−0.032 (0.23)	−0.030 (3.49)***	0.014 (0.52)	−0.001 (0.46)	−0.010 (1.60)	0.0001 (0.91)	0.096 (0.97)	−0.090 (0.55)	−0.027 (0.63)	225	11.06***	0.37	0.29
(c)	0.022 (1.77)*	−0.004 (0.15)	0.730 (3.00)***	0.070 (0.72)	−0.018 (1.18)	−0.043 (1.82)*	−0.001 (0.88)	−0.019 (0.97)	0.0007 (1.00)	−0.045 (0.42)	−0.075 (1.80)*	−0.012 (0.23)	169	6.36***	0.37	0.27
Blockholders' Ownership(BLOCK): (a) lower ownership , (b) medium,, and (c) higher ownership																
(a)	0.031 (2.55)**	−0.035 (1.27)	0.770 (2.77)***	−0.012 (0.25)	−0.023 (3.10)***	−0.016 (1.18)	−0.001 (0.82)	−0.015 (3.28)***	0.0002 (2.84)***	−0.031 (0.26)	−0.060 (1.81)*	−0.003 (0.06)	170	24.15***	0.55	0.48
(b)	0.036 (2.77)***	−0.026 (1.38)	0.743 (4.76)***	−0.091 (0.91)	−0.017 (2.28)*	−0.005 (0.28)	0.002 (1.27)	−0.011 (2.23)**	0.0002 (2.38)**	0.076 (0.55)	−0.041 (1.36)	0.034 (0.41)	225	9.35***	0.39	0.31
(c)	0.021 (0.96)	0.015 (0.13)	0.837 (3.22)***	0.021 (0.21)	−0.015 (0.83)	0.055 (1.71)*	−0.002 (1.45)	−0.013 (2.01)**	0.0001 (2.16)**	0.258 (2.26)**	−0.072 (0.96)	−0.091 (2.10)**	169	5.13***	0.28	0.16

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. The sample is divided into three subgroups as explained in Section 4.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 4.18: Robustness Check 8: the Role of Corporate Governance (OVER 2 and CSA 2005)

MAT	Independent Variables															
	SIZE	Quality1	LEV1	TAX	LIQ1	MTB	AMAT	OWN	OWN^2	OVER2	OVER2* Quality1	OVER2* MTB	Obs.	F-test	R^2	Adj. R^2
Est.	+	–	+	+/–	+/–	+/–	+	–	+	+/–	–	–				
Board Size (BOARD): (a) smaller-size board , (b) medium,, and (c) large-size board																
(a)	0.047 (2.70)***	−0.021 (1.15)	0.335 (2.35)**	−0.115 (2.04)**	−0.033 (3.34)***	0.005 (0.34)	0.002 (0.74)	−0.015 (3.47)***	0.0002 (3.04)**	0.077 (0.81)	−0.023 (0.59)	−0.019 (0.84)	182	7.79***	0.38	0.28
(b)	0.051 (2.47)**	0.002 (0.08)	0.822 (4.20)***	0.084 (0.97)	−0.014 (2.15)**	−0.007 (0.47)	−0.003 (2.04)**	−0.006 (1.42)	0.0001 (1.51)	0.091 (0.79)	−0.090 (2.82)***	−0.010 (0.18)	206	10.59***	0.42	0.34
(c)	0.028 (1.96)*	−0.013 (0.79)	0.885 (4.81)***	0.044 (0.37)	−0.035 (2.85)***	−0.006 (0.27)	−0.001 (0.20)	0.005 (0.60)	−0.0002 (0.94)	0.088 (0.96)	0.014 (0.64)	−0.016 (0.42)	176	7.06***	0.39	0.29
Non-Executive Ratio (RATIO): (a) lower ratio , (b) medium,, and (c) higher ratio																
(a)	0.054 (2.48)**	−0.008 (0.43)	0.492 (2.56)**	−0.124 (1.38)	−0.027 (4.53)***	0.021 (1.65)	−0.001 (0.41)	−0.012 (3.31)***	0.0001 (3.26)***	0.181 (1.12)	−0.102 (3.53)***	−0.085 (1.11)	170	8.75***	0.38	0.27
(b)	0.063 (4.54)***	0.005 (0.29)	0.753 (5.43)***	−0.014 (0.12)	−0.011 (1.44)	−0.017 (1.26)	−0.002 (1.62)	−0.001 (0.18)	−0.0002 (0.15)	0.128 (1.69)*	0.003 (0.08)	−0.013 (0.59)	225	13.57***	0.42	0.35
(c)	0.027 (2.42)**	−0.027 (1.24)	0.610 (3.19)***	0.036 (0.41)	−0.026 (2.01)**	−0.029 (1.95)*	−0.001 (0.56)	−0.014 (0.98)	0.0003 (0.71)	0.003 (0.03)	−0.013 (0.46)	0.032 (0.85)	169	8.32***	0.51	0.42
Blockholders' Ownership(BLOCK): (a) lower ownership , (b) medium,, and (c) higher ownership																
(a)	0.038 (3.66)***	−0.039 (2.34)**	0.628 (3.49)***	−0.062 (0.78)	−0.018 (2.55)***	−0.014 (1.12)	−0.001 (0.33)	−0.011 (2.46)**	0.0002 (2.11)**	0.041 (0.33)	−0.019 (2.63)***	0.005 (0.11)	170	20.23***	0.59	0.52
(b)	0.063 (5.03)***	−0.020 (0.83)	0.627 (4.81)***	−0.020 (0.35)	−0.016 (1.69)*	−0.008 (0.56)	−0.001 (0.37)	−0.005 (0.94)	0.00004 (0.40)	0.009 (0.08)	−0.053 (1.59)	−0.009 (0.15)	225	14.90***	0.44	0.37
(c)	0.025 (1.29)	0.002 (0.08)	0.964 (4.66)***	0.054 (0.57)	−0.011 (0.66)	0.025 (1.57)	−0.002 (2.08)**	−0.009 (1.63)	0.0001 (2.28)**	0.158 (1.56)	−0.032 (0.74)	−0.042 (1.64)	169	7.56***	0.32	0.21

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. The sample is divided into three subgroups as explained in Section 4.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 4.19: Robustness Check 9: the Role of Corporate Governance (OVER 2 and Pooled Regression)

MAT	Independent Variables															
	SIZE	Quality1	LEV1	TAX	LIQ1	MTB	AMAT	OWN	OWN^2	OVER2	OVER2* Quality1	OVER2* MTB	Obs.	F-test	R^2	Adj. R^2
Est.	+	–	+	+/–	+/–	+/–	+	–	+	+/–	–	–				
Board Size (BOARD): (a) smaller-size board , (b) medium,, and (c) large-size board																
(a)	0.044 (4.19)***	–0.008 (1.38)	0.430 (4.66)***	–0.030 (2.87)***	–0.027 (4.84)***	0.012 (1.84)*	0.0001 (0.04)	–0.010 (3.86)***	0.0001 (2.83)***	0.042 (0.78)	–0.022 (1.88)*	–0.011 (0.64)	546	14.72***	0.34	0.31
(b)	0.062 (5.70)***	–0.001 (0.12)	0.897 (8.52)***	0.024 (0.88)	–0.009 (2.03)**	–0.008 (1.21)	–0.001 (1.19)	–0.002 (1.06)	0.00005 (1.58)	0.132 (2.18)**	–0.034 (3.29)***	–0.030 (1.09)	618	28.28***	0.40	0.37
(c)	0.034 (4.11)***	–0.012 (1.77)*	0.881 (8.24)***	0.030 (0.74)	–0.022 (3.36)***	–0.0001 (0.01)	–0.001 (0.32)	–0.001 (0.49)	1.41e-06 (1.58)	0.118 (1.64)	0.007 (0.73)	–0.046 (1.20)	528	16.97***	0.35	0.32
Non-Executive Ratio (RATIO): (a) lower ratio , (b) medium,, and (c) higher ratio																
(a)	0.040 (3.46)***	–0.004 (0.65)	0.530 (4.06)***	–0.021 (1.69)*	–0.019 (5.77)***	–0.010 (1.54)	–0.001 (1.46)	–0.008 (3.94)***	0.0001 (3.64)***	–0.152 (0.67)	–0.035 (2.97)***	–0.073 (1.60)	510	12.65***	0.28	0.24
(b)	0.057 (7.74)***	–0.005 (0.74)	0.748 (9.10)***	–0.010 (0.27)	–0.013 (2.26)**	–0.001 (0.17)	–0.002 (1.94)*	–0.004 (1.63)	–0.0001 (1.14)	0.065 (1.40)	–0.007 (0.56)	–0.009 (0.55)	675	25.15***	0.38	0.35
(c)	0.029 (4.61)***	–0.009 (1.17)	0.678 (5.93)***	0.021 (0.69)	–0.028 (4.61)***	–0.022 (2.46)**	–0.001 (1.60)	–0.010 (1.94)*	0.0003 (3.62)***	0.037 (0.71)	–0.007 (0.55)	0.012 (0.52)	507	24.94***	0.44	0.41
Blockholders' Ownership(BLOCK): (a) lower ownership , (b) medium,, and (c) higher ownership																
(a)	0.036 (5.83)***	–0.020 (2.83)***	0.689 (5.31)***	–0.011 (0.99)	–0.018 (4.69)***	–0.014 (2.31)**	–0.001 (0.69)	–0.010 (3.93)***	0.0001 (3.50)***	0.030 (0.43)	–0.015 (1.84)*	0.017 (0.63)	510	41.69***	0.53	0.51
(b)	0.055 (6.88)***	–0.001 (0.08)	0.657 (8.07)***	–0.020 (0.58)	–0.015 (2.49)**	–0.001 (0.11)	–0.001 (0.48)	–0.003 (1.19)	0.00004 (0.86)	0.043 (0.69)	–0.019 (1.81)*	0.002 (0.07)	675	24.05***	0.37	0.34
(c)	0.040 (3.88)***	0.001 (0.08)	0.844 (6.80)***	–0.002 (0.06)	–0.014 (1.87)*	0.030 (3.38)***	–0.001 (0.13)	–0.009 (2.74)***	0.0001 (3.09)***	0.151 (2.79)***	–0.020 (1.55)	–0.050 (2.84)***	507	14.14***	0.32	0.28

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment. The sample is divided into three subgroups as explained in Section 4.2.3. All regressions include industry dummies and time dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 4.20: Robustness Check 10: the Role of Corporate Governance (OVER 3 and CSA 2006)

MAT	Independent Variables															
	SIZE	Quality1	LEV1	TAX	LIQ1	MTB	AMAT	OWN	OWN^2	OVER3	OVER3* Quality1	OVER3* MTB	Obs.	F-test	R^2	Adj. R^2
Est.	+	–	+	+/–	+/–	+/–	+	–	+	+/–	–	–				
Board Size (BOARD): (a) smaller-size board , (b) medium,, and (c) large-size board																
(a)	0.060 (3.07)***	–0.012 (0.43)	0.251 (1.39)	–0.097 (2.12)**	–0.045 (3.89)***	0.045 (2.06)**	–0.0004 (0.02)	–0.013 (2.46)**	0.0002 (2.00)**	0.130 (1.39)	–0.033 (1.82)*	–0.057 (1.80)*	182	8.51***	0.36	0.26
(b)	0.041 (2.15)**	–0.031 (1.67)*	1.143 (5.90)***	0.092 (1.16)	–0.005 (0.68)	0.029 (1.73)*	0.001 (1.05)	–0.008 (1.98)**	0.0001 (2.40)**	0.126 (1.72)*	–0.093 (2.07)**	0.030 (0.99)	206	18.33***	0.47	0.40
(c)	0.035 (2.22)**	0.012 (0.28)	0.906 (4.23)***	–0.039 (0.21)	–0.018 (1.46)	0.004 (0.09)	0.001 (0.37)	0.004 (0.47)	–0.0001 (0.58)	0.016 (0.13)	–0.062 (1.17)	–0.016 (0.25)	176	4.11***	0.32	0.20
Non-Executive Ratio (RATIO): (a) lower ratio , (b) medium,, and (c) higher ratio																
(a)	0.036 (1.72)*	–0.038 (1.43)	0.905 (3.73)***	–0.077 (1.38)	–0.018 (2.25)**	0.018 (0.89)	–0.001 (0.68)	–0.010 (2.66)**	0.0001 (2.70)***	0.084 (0.92)	–0.047 (1.83)*	–0.040 (1.25)	170	8.08***	0.38	0.28
(b)	0.049 (3.38)***	–0.026 (0.97)	0.549 (3.17)***	–0.012 (0.09)	–0.028 (2.97)***	0.009 (0.31)	–0.0002 (0.19)	–0.011 (1.69)*	0.0001 (0.95)	–0.003 (0.04)	–0.030 (0.71)	0.007 (0.17)	225	9.92***	0.35	0.27
(c)	0.025 (1.98)**	–0.005 (0.15)	0.739 (2.99)***	0.051 (0.47)	–0.016 (1.12)	–0.033 (1.03)	–0.001 (0.75)	–0.017 (0.90)	0.0006 (0.95)	–0.082 (0.81)	–0.059 (1.30)	–0.018 (0.38)	169	5.27***	0.37	0.26
Blockholders' Ownership(BLOCK): (a) lower ownership , (b) medium,, and (c) higher ownership																
(a)	0.031 (2.28)**	–0.022 (0.72)	0.758 (2.71)***	–0.017 (0.42)	–0.025 (3.50)***	–0.015 (0.96)	–0.001 (0.63)	–0.014 (3.09)***	0.0002 (2.68)***	–0.036 (0.43)	–0.032 (1.80)*	–0.008 (0.27)	170	23.53***	0.55	0.47
(b)	0.038 (2.83)***	–0.028 (1.27)	0.733 (4.57)***	–0.110 (1.06)	–0.015 (1.89)*	–0.007 (0.34)	0.002 (1.34)	–0.011 (2.26)**	0.0003 (2.40)**	0.002 (0.02)	–0.041 (1.36)	0.001 (0.02)	225	9.09***	0.38	0.31
(c)	0.028 (1.31)	0.003 (0.13)	0.881 (3.27)***	0.014 (0.23)	–0.005 (1.88)*	0.058 (1.77)*	–0.002 (1.47)	–0.011 (1.87)*	0.0001 (1.83)*	0.029 (0.27)	–0.054 (1.04)	–0.064 (1.47)	169	4.48***	0.28	0.16

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment. In this table, dependent variable is measured in 2006, while other independent variables are averaged over 2002-2005. The sample is divided into three subgroups as explained in Section 4.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 4.21: Robustness Check 11: the Role of Corporate Governance (OVER 3 and CSA 2005)

MAT	Independent Variables															
	SIZE	Quality1	LEV1	TAX	LIQ1	MTB	AMAT	OWN	OWN^2	OVER3	OVER3* Quality1	OVER3* MTB	Obs.	F-test	R^2	Adj. R^2
Est.	+	−	+	+/−	+/−	+/−	+	−	+	+/−	−	−				
Board Size (BOARD): (a) smaller-size board , (b) medium,, and (c) large-size board																
(a)	0.048 (2.71)***	−0.019 (1.05)	0.308 (2.16)**	−0.118 (2.06)**	−0.035 (3.45)***	0.011 (0.66)	0.002 (0.68)	−0.015 (3.48)***	0.0002 (3.00)***	0.079 (1.06)	−0.020 (0.60)	−0.036 (1.80)*	182	8.67***	0.38	0.29
(b)	0.063 (3.17)***	−0.012 (0.61)	0.753 (3.76)***	0.119 (1.32)	−0.011 (1.59)	−0.008 (0.52)	−0.002 (1.61)	−0.005 (1.25)	0.0001 (1.31)	−0.091 (1.21)	−0.085 (1.85)*	−0.001 (0.02)	206	9.80***	0.41	0.33
(c)	0.033 (2.30)**	0.001 (0.09)	0.858 (4.64)***	0.043 (0.36)	−0.037 (2.90)***	−0.042 (1.73)*	−0.001 (0.39)	0.006 (0.78)	−0.00021 (1.09)	0.142 (1.60)	−0.031 (0.98)	0.061 (1.59)	176	6.93***	0.39	0.29
Non-Executive Ratio (RATIO): (a) lower ratio , (b) medium,, and (c) higher ratio																
(a)	0.058 (2.66)***	−0.016 (0.84)	0.416 (2.19)**	−0.118 (1.25)	−0.026 (4.00)***	0.020 (1.33)	−0.001 (0.15)	−0.011 (3.04)**	0.0001 (3.02)***	−0.030 (0.37)	−0.075 (1.96)*	0.007 (0.23)	170	7.79***	0.36	0.24
(b)	0.063 (4.36)***	−0.001 (0.07)	0.743 (5.51)***	−0.044 (0.38)	−0.012 (1.46)	−0.025 (1.81)*	−0.002 (1.67)*	−0.002 (0.29)	−0.00001 (0.09)	−0.035 (0.47)	0.027 (0.71)	0.015 (0.61)	225	15.07***	0.42	0.34
(c)	0.032 (2.89)***	−0.013 (0.69)	0.510 (2.56)***	0.052 (0.62)	−0.028 (2.34)**	−0.017 (0.62)	−0.001 (0.91)	−0.020 (1.35)	0.0005 (1.12)	−0.072 (0.91)	−0.085 (2.82)***	−0.004 (0.12)	169	11.61***	0.51	0.42
Blockholders' Ownership(BLOCK): (a) lower ownership , (b) medium,, and (c) higher ownership																
(a)	0.043 (3.91)***	−0.033 (2.04)**	0.629 (3.47)***	−0.067 (0.84)	−0.019 (2.78)***	−0.009 (0.64)	−0.001 (0.27)	−0.010 (2.23)**	0.0001 (1.83)*	−0.033 (0.49)	−0.054 (1.84)*	−0.003 (0.10)	170	20.63***	0.60	0.53
(b)	0.067 (5.52)***	−0.002 (0.08)	0.605 (4.69)***	−0.032 (0.56)	−0.014 (1.33)	−0.015 (1.01)	−0.001 (0.31)	−0.005 (0.95)	0.0001 (0.51)	−0.057 (0.75)	−0.002 (0.05)	−0.017 (0.57)	225	14.21***	0.43	0.36
(c)	0.029 (1.50)	0.017 (0.77)	0.957 (4.59)***	0.067 (0.74)	−0.008 (0.48)	0.019 (1.01)	−0.003 (2.98)***	−0.006 (1.24)	0.0001 (1.90)*	0.012 (0.13)	−0.080 (1.86)*	−0.029 (1.11)	169	7.56***	0.34	0.22

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment. In this table, dependent variable is measured in 2005, while other independent variables are averaged over 2002-2004. The sample is divided into three subgroups as explained in Section 4.2.3. All regressions include industry dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Table 4.22: Robustness Check 12: the Role of Corporate Governance (OVER 3 and Pooled Regression)

MAT	Independent Variables															
	SIZE	Quality1	LEV1	TAX	LIQ1	MTB	AMAT	OWN	OWN^2	OVER3	OVER3* Quality1	OVER3* MTB	Obs.	F-test	R^2	Adj. R^2
Est.	+	−	+	+/−	+/−	+/−	+	−	+	+/−	−	−				
Board Size (BOARD): (a) smaller-size board , (b) medium,, and (c) large-size board																
(a)	0.044 (4.21)***	−0.011 (1.54)	0.420 (4.58)***	−0.031 (2.96)***	−0.028 (5.08)***	0.018 (2.44)**	−0.0001 (0.04)	−0.010 (4.31)***	0.0001 (3.18)***	0.2041 (1.02)	−0.002 (0.22)	−0.030 (2.58)**	546	15.52***	0.34	0.31
(b)	0.070 (6.31)***	−0.001 (0.12)	0.861 (8.02)***	0.017 (0.59)	−0.009 (2.14)**	−0.009 (1.51)	−0.001 (0.84)	−0.003 (1.08)	0.00004 (1.56)	−0.042 (1.03)	−0.038 (2.71)***	−0.009 (0.68)	618	29.26***	0.40	0.37
(c)	0.037 (4.36)***	−0.008 (1.44)	0.870 (7.82)***	0.030 (0.71)	−0.021 (3.34)***	−0.011 (0.75)	−0.001 (0.60)	−0.001 (0.43)	3.62e-07 (0.01)	0.051 (0.96)	0.006 (0.47)	0.015 (0.59)	528	15.77***	0.35	0.31
Non-Executive Ratio (RATIO): (a) lower ratio , (b) medium,, and (c) higher ratio																
(a)	0.043 (3.63)***	−0.004 (0.54)	0.500 (3.65)***	−0.016 (1.72)*	−0.019 (5.68)***	−0.012 (1.60)	−0.001 (1.19)	−0.008 (3.92)***	0.0001 (3.60)***	−0.002 (0.05)	−0.022 (1.65)*	−0.014 (0.90)	510	12.44***	0.27	0.23
(b)	0.007 (7.48)***	−0.002 (1.15)	0.746 (9.02)***	−0.015 (0.39)	−0.013 (2.29)**	−0.005 (0.56)	−0.002 (1.94)*	−0.005 (1.78)*	−0.0001 (1.23)	−0.005 (0.12)	0.004 (0.27)	0.006 (0.38)	675	24.45***	0.38	0.35
(c)	0.034 (5.45)***	−0.006 (0.83)	0.628 (5.42)***	0.023 (0.78)	−0.029 (4.85)***	−0.018 (1.20)	−0.002 (1.97)*	−0.010 (1.99)**	0.0003 (3.89)***	−0.064 (1.37)	−0.027 (2.34)**	−0.001 (0.03)	507	27.12***	0.45	0.42
Blockholders' Ownership(BLOCK): (a) lower ownership , (b) medium,, and (c) higher ownership																
(a)	0.041 (6.19)***	−0.017 (2.42)**	0.679 (5.17)***	−0.013 (1.06)	−0.020 (5.15)***	−0.007 (0.96)	−0.001 (0.69)	−0.009 (3.66)***	0.0001 (3.15)***	−0.025 (0.70)	−0.035 (2.82)**	0.006 (0.59)	510	42.85***	0.53	0.51
(b)	0.056 (7.15)***	−0.005 (0.66)	0.650 (7.95)***	−0.021 (0.58)	−0.015 (2.52)**	−0.003 (0.37)	−0.001 (0.45)	−0.003 (1.29)	0.00005 (0.90)	−0.011 (0.25)	−0.004 (0.36)	0.004 (0.23)	675	22.97***	0.36	0.33
(c)	0.044 (4.16)***	0.004 (0.53)	0.836 (6.66)***	−0.004 (0.16)	−0.012 (1.55)	0.027 (2.78)***	−0.002 (0.13)	−0.008 (2.46)**	0.0001 (2.81)***	0.304 (0.51)	−0.027 (2.16)**	−0.036 (2.42)**	507	13.92***	0.32	0.28

Notes: This table shows the impact of corporate governance on the relation between managerial overconfidence and cash flow sensitivity of investment. The sample is divided into three subgroups as explained in Section 4.2.3. All regressions include industry dummies and time dummies. We use consistent heteroscedasticity standard errors. T-statistic values are reported in parentheses. ***, ** and * indicate coefficient is significant at 1, 5 and 10%, respectively. Definitions of all variables are provided in Table 2.1.

Chapter 5

Conclusions

5.1 Main Findings

The objective of this thesis is to provide more insight into our understanding of the impact of managerial overconfidence on corporate investment decisions and financial policies. Two main financial policies have been discussed in our analysis: cash holding policy and debt maturity policy. Using a large sample of UK listed firms, we show several findings of managerial overconfidence issues as follows.

In Chapter 2, there are two important features in our analysis. First, we focus on the importance of financial constraints in determining the linkage between managerial overconfidence and investment cash-flow sensitivity. Since overconfident managers tend to overestimate the return of the project, they have more incentives to increase their investment with cash flow, especially in financially constrained firms. Specifically, we use firm-specific characteristics such as size, leverage, dividend, age and cash holding to identify financially constrained and unconstrained firms. Meanwhile, we use executive directors' stock purchasing activities as the main proxy for managerial overconfidence rather than CEO's stock purchasing activities in Malmendier and Tate (2005). This is a dummy variable which equals 1 when the net amount of stock purchased by all executive directors in one firm is positive for certain duration during our sample period. It indicates this firm is a net buyer and possessing managerial overconfidence. Moreover, we use outsiders' perception of the executive directors as captured by press as an alternative proxy for managerial overconfidence. Second, we attempt to test whether different corporate governance mechanisms can influence the impact of managerial overconfidence.

Our results show that the relationship between cash flow and investment is significantly positive in financially constrained firms in dividend, leverage, cash and age groups. It indicates that financially constrained firms tend to increase their investment with internal fund, while financially unconstrained firms do not. Moreover, managerial overconfidence can increase this positive sensitivity, especially in the financially constrained firms. This implies that overconfident

managers tend to increase more investment with cash flow than other non-overconfident managers do. Finally, we find that the positive effect of managerial overconfidence on investment-cash flow sensitivity in financially constrained firms is still significant in these firms with weak corporate governance mechanisms, such as firms with low ratio of nonexecutive directors or low blockholders' ownership. However, the impact of managerial overconfidence on investment-cash flow sensitivity in financially constrained firms become insignificant in constrained firms with high ratio of non-executive directors or high blockholders' ownershp. It is in line with the argument that the potential prescription for managerial overconfidence could be outsider monitoring (see Heaton, 2002; Malmendier and Tate, 2005; Doukas and Petmezas, 2007), in which outsiders are capable of drawing managerial attention to information that may indicate that their perceptions are wrong and restrain overconfident managers' decision.

In Chapter 3, we further show the linkage between investment decisions and firms' cash holding policy emphasizing the role of financial constraints. It is presented in two stages. One is to analyze how investment decisions affect cash flow sensitivity of cash and the other is to discuss how investment decisions by overconfident managers influence this sensitivity. In the spirit of Almeida *et al.* (2004), we acknowledge that financial constraints can create a demand for hoarding cash and facilitate future investment. In addition, we argue that investment decisions can limit the available source for cash holding and increase cash flow fluctuations in the future in financially constrained firms, which lead cash holding to be more sensitive to cash flow. However, investment decisions by overconfident managers would reframe this linkage. This is because overconfident managers tend to believe that the benefits of their desired investment projects should be larger than the benefits of cash holding and thus they would rather invest than save cash out of cash flow. Hence the positive impact of investment on cash flow sensitivity of cash is no longer held in financially constrained firms with managerial overconfidence.

The empirical findings reveal that firms with less dividend payouts and lower investment expenditure tend to hold more cash. In particular, investment can

increase cash flow sensitivity of cash in financially constrained firms. More importantly, our findings show that the positive relationship between cash flow sensitivity of cash and investment becomes less pronounced in financially constrained firms with overconfident managers. This indicates that overconfident managers in financially constrained firms are more disposed to increase their investment with cash flow but are reluctant to save cash out of cash flow. Finally, our dynamic panel data models show that UK firms adjust partially towards their target cash holding levels. And the adjustment speed is much slower in financially constrained firms than in financially unconstrained firms. This implies that financially unconstrained firms are able to quickly change their cash holding level by choosing among several alternative sources of financing. However, it would take longer for financially constrained firms to adjust to their target cash levels — either because of the relatively higher target levels or the costs of adjustment they entail.

In Chapter 4, we aim to extend the empirical literature on the role of managerial overconfidence in determining debt maturity (long-term debt ratio). Specifically, we are concerned with the effects of managerial overconfidence on the relationship between firms' quality (or growth opportunity) and debt maturity. We control this effect by interacting managerial overconfidence with firms' quality variable (or growth opportunity).

Our results show that firms with larger size, higher leverage ratio, worse quality and lower liquidity tend to issue more long-term debt. In addition, our results exhibit a non-linear relationship between managerial ownership and debt maturity. When managerial ownership is at a low level, an increase in managerial ownership can align the conflicts between managers and shareholders and thus more short-term debt will be issued. However, when managerial ownership exceeds a certain level, the alignment effects of managerial ownership will be replaced by the entrenchment effects and thus more long-term debt will be issued. More importantly, managerial overconfidence can decrease the negative relationship between firms' quality and long-term debt. It seems that overconfident managers believe their firms have been undervalued, which leads

them to pay extra premium on long-term debt. Hence, they have more incentives to take advantage of short-term debt to signal their perceived quality. However, we do not find consistent evidence that the negative relationship between growth opportunity and debt maturity is greater in firms with managerial overconfidence. Finally, our results suggest that the negative impact of managerial overconfidence on the relationship between debt maturity and firms' quality varies with different corporate governance mechanisms. It is shown the negative impact of managerial overconfidence on the relationship between firms' quality and debt maturity is still pronounced in firms with weaker corporate governance mechanism such as those with lower ratio of non-executive directors or lower blockholders' ownership. And this negative impact changes to be insignificant when firms are with better corporate governance mechanisms (i.e. medium ratio of non-executive directors, medium level of blockholders' ownership).

5.2 Conclusions and Implications

The main conclusions and implications of this thesis can be summarized as follows. This thesis makes an attempt to explain and increase understanding the fact that managerial overconfidence could potentially play a significant role in corporate decision-making process. In our above analysis, the biased decisions by overconfident managers are clearly reflected to corporate investment, cash holding policy and debt maturity policy.

Moreover, our results indicate that the impacts of managerial overconfidence are more likely to be found in firms with weak monitoring mechanisms (e.g. lower ratio of non-executive directors, lower blockholders' ownership) but they are less widespread in firms with strong monitoring mechanisms(e.g. higher ratio of non-executive directors, higher blockholders' ownership). It would provide possible hints for a potential prescription of managerial overconfidence. That is outsider investors should play an effective monitoring role and be active in disciplining rather than advisory. They may not only act as counsellors to oversee that manager run the business to maximize shareholders' value, but also make sure that they collect information to help managers to realize that some of their

perception might be wrong. Also, when managerial overconfidence has been documented as a recurrent distortion in one firm, outsiders should consider a more cautious way to select their management and set up a proper compensation contract.

Finally, this thesis enriches economic understanding by incorporate human nature into corporate finance models. A comprehensive study of managerial biases needs an integration of many different schools of thoughts and fields, in which it includes scholars from the social sciences (psychology) and business administration such as management, marketing, finance and accounting. As we anticipated, a combination of standard corporate finance (e.g. agency theory and asymmetric information theory) and behaviour finance should yield a large crop. Thus, it would be desirable to find a common framework in order to analyze both problems and get predictions on common ground. A better understanding can help investors/management to recognize the mistakes of others to make a superior decision and assist investors/management to develop their efficient range of disciplines.

5.3 Future Research

Several lines for further research can be suggested. First, a natural extension of our work would be to investigate the implications of managerial overconfidence on other corporate policies. Dividend decision, for example, has been acknowledged as an efficient way to mitigate market frictions. Some have documented that dividend payouts can enhance firms' value and be treated as a signal of firms' future earnings. However, an increase in dividend payouts may result in passing up some investment projects. The possible question could be whether firms with managerial overconfidence tend to issue less dividend payouts[13].

Second, we do not yet provide answers to such questions as whether managerial overconfidence effects are positive or negative with respect to firms' value, or if

[13] A possible reference could be the study by Deshmukh *et al.* (2009)

there exist an optimal level of managerial overconfidence. In our framework, we mainly attribute the downside effects of managerial overconfidence to the fact that overconfident managers tend to choose some negative NPV investments but positive in their perspective, which may hurt firm's value. However, there is a need to develop a more sophisticated mechanism of the linkage between managerial overconfidence and corporate decisions. A possible scenario is that overinvestment by overconfident managers may eliminate the underinvestment problem arising from the conflicts between managers and shareholders. If this is the case, the different degrees of managerial overconfidence have different impacts on firms' value. One way to think about answering this question is to consider the nonlinear relationship between overconfidence and firms' value. When managerial overconfidence is low or moderate, it could exert effects on aligning the conflicts between two different parties and make performance better. However, as managerial overconfidence increasing to extreme, the alignment effects could be dominated by overinvestment, which makes firms' value to be worse off. Some efforts have been concerned with this possible advantage of overconfidence but the existing literature is restricted to the theoretical models (see, e.g., Gervais and Goldstein, 2003; Gervais, Heaton and Odean, 2006; Goel and Thakor, 2007; Hackbarth, 2007). More importantly, in this process, the measurement of managerial overconfidence should be developed rather than a dummy variable so far, which no longer can control the non-linear impacts of managerial overconfidence[14].

Finally, there is a need to investigate the determinants of managerial overconfidence. Some observable personal characteristics would reinforce individual overconfidence. For example, managers with successful histories in career/education may think that they are more experienced and are more likely to be overconfident in their own judgements and overestimate the positive outcomes of their decisions (Gervais and Odean, 2001). In addition, Barber and Odean (2001) find that gender can help in predicting a person's degree of overconfidence in that men are prone to be overconfident than women. Their results reveal that females not only trade less but also face lower trading costs

[14] A possible reference can be the study by Campell *et al.* (2009)

than their male counterpart. Finally, the learning objection may also lead to a positive impact. Learning from experiences also means irrational managers will learn from their experience to be rational. This process can be made by considering the linkage between the outcomes of previous performance, education, career and the corporate financial policies in firms with overconfident managers. And a satisfactory answer to this question will improve our measurement of managerial overconfidence as well.

Appendix

Appendix A: Industry Index

Industry No.	Description
1	Automotive, Aviation and Transportation
2	Beverage, Tobacco
3	Building and construction
4	Chemicals , health care and pharmaceuticals
5	Computer, electrical& electronic equipment
6	Diversified industry
7	Engineering, Mining, Metallurgy and Oil and Gas Exploration
8	Food Producer , Processors and Farming and Fishing
9	Leisure, Hotels, Restaurants and Pubs
10	Other Business
11	Paper, Forestry, Packaging, Printing and Publishing Photography
12	Retailers, wholesalers and distributor
13	Services
14	Textile, leather, clothing & footwear and furniture
15	Utility

Appendix B: OLS and IV Estimates for Panel Data

Here we provide a brief review of OLS and IV techniques (see Greene, 2000)

The basic linear regression is a departure point of empirical analysis. There are six assumptions about this model:

1) linearity; the model can be written as: $y_i = x_{i1}\beta_1 + x_{i2}\beta_2 + \cdots + x_{iK}\beta_K + \varepsilon_i$;

2) full rank;

3) exdogeneity of independent variables: $E\left[\varepsilon_i \middle| x_{j1}, x_{j2}, \cdots x_{jK}\right] = 0$;

4) homoscedasticity and nonautocorrelation: each disturbance ε_i has the same finite variance σ^2 and is uncorrelated with other disturbance ε_j;

5) Exogenously generated data and;

6) the disturbances are normally distributed.

Panel data is a dataset which combine time series and cross sections. This is quite common in economics. The fundamental advantage of a panel dataset is that it provides greater flexibility in modelling differences in behaviour across individuals (firms).

The basic framework of a panel data set can be written as:

$y_{it} = \alpha_i + \boldsymbol{\beta}' \mathbf{x}_{it} + \varepsilon_{it}$

In this model, y_{it} represents the dependent variable for cross-section unit i at time t where $i=1,\ldots\ldots,n$ and $t=1,\ldots\ldots,T$. $\mathbf{x}_{it}$ represent a matrix of explanatory variables for unit i at time t. This matrix includes K explanatory variables but not includes constant term. α_i represents the individual effect which is constant over time t but specific to each individual (i).

If α_i is to be the same across all individuals, then OLS can provide consistent and efficient estimates of α and $\boldsymbol{\beta}$. However, if α_i is unobserved but correlated with the explanatory variables $\mathbf{x}_{it}$, then the OLS estimator of $\boldsymbol{\beta}$ will be biased

and inconsistent as a consequence of an omitted variable. In this instance, we can use fixed effects approach. This approach takes α_i to be a group specific constant term in the regression model. And the above equation can be rewritten as:

$$\mathbf{y}_i = \mathbf{i}\alpha_1 + \boldsymbol{\beta}'\mathbf{X}_1 + \boldsymbol{\varepsilon}_1$$

or

$$\begin{bmatrix} \mathbf{y}_1 \\ \mathbf{y}_2 \\ \vdots \\ \mathbf{y}_n \end{bmatrix} = \begin{bmatrix} \mathbf{X}_1 \\ \mathbf{X}_2 \\ \vdots \\ \mathbf{X}_n \end{bmatrix} \boldsymbol{\beta} + \begin{bmatrix} \mathbf{i} & \mathbf{0} & \cdots & \mathbf{0} \\ \mathbf{0} & \mathbf{i} & \cdots & \mathbf{0} \\ & & \vdots & \\ \mathbf{0} & \mathbf{0} & \cdots & \mathbf{i} \end{bmatrix} \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \vdots \\ \alpha_n \end{bmatrix} + \begin{bmatrix} \boldsymbol{\varepsilon}_1 \\ \boldsymbol{\varepsilon}_2 \\ \vdots \\ \boldsymbol{\varepsilon}_n \end{bmatrix}$$

or

$$\mathbf{y} = \begin{bmatrix} \mathbf{X} & \mathbf{d}_1 & \mathbf{d}_2 & \cdots & \mathbf{d}_n \end{bmatrix} \begin{bmatrix} \boldsymbol{\beta} \\ \boldsymbol{\alpha} \end{bmatrix} + \boldsymbol{\varepsilon}$$

where $\mathbf{d}_i$ is a dummy variable indicating the ith unit. This model is usually referred to as the least squares dummy variable (LSDV) model. If n is small enough, then the model can be estimated by OLS.

On the other hand, if α_i is unobserved and uncorrelated with $\mathbf{x}_{it}$, then OLS will produce consistent estimates of $\boldsymbol{\beta}$ but the standard errors will be understated. In this instance, random effects approach can be used. This approach takes α_i to be a group specific disturbance, similar to ε_{it} except that for each group. In other words, random effects model is to deal with the fact that T observations on n individuals are not the same as observations on nT different individuals. And the equation can be rewritten as:

$$y_{it} = \alpha + u_i + \boldsymbol{\beta}'\mathbf{x}_{it} + \varepsilon_{it} \ .$$

The model can be estimated by a feasible generalized least square (GLS). The GLS model is quite straightforward :

First , it derives an estimator of the covariance matrix of the error term. We assume that

$$E[\varepsilon_{it}|\mathbf{X}]=E[\mu_i|\mathbf{X}]=0,$$

$$E[\varepsilon_{it}^2|\mathbf{X}]=\sigma_\varepsilon^2,$$

$$E[u_i^2|\mathbf{X}]=\sigma_u^2,$$

$$E[\varepsilon_{it}u_j|\mathbf{X}]=0 \text{ for all } i, t \text{ and } j,$$

$$E[\varepsilon_{it}\varepsilon_{js}|\mathbf{X}]=0 \quad \text{if } t\neq s \text{ or } i\neq j,$$

$$E[u_iu_j|\mathbf{X}]=0 \quad \text{if } i\neq j.$$

Let $\eta_{it}=\varepsilon_{it}+u_i$ and $\boldsymbol{\eta}_i=[\eta_{i1},\eta_{i2},\cdots\eta_{iT}]$

$$\Sigma=E[\boldsymbol{\eta}_i\boldsymbol{\eta}_i'|\mathbf{X}]=\sigma_\varepsilon^2\mathbf{I}_T+\sigma_u^2\mathbf{ii}'=\begin{bmatrix}\sigma_u^2+\sigma_\alpha^2 & \sigma_\alpha^2 & \cdots & \sigma_\alpha^2\\ \sigma_\alpha^2 & \sigma_u^2+\sigma_\alpha^2 & \cdots & \sigma_\alpha^2\\ \vdots & \vdots & \ddots & \vdots\\ \sigma_\alpha^2 & \sigma_\alpha^2 & \cdots & \sigma_u^2+\sigma_\alpha^2\end{bmatrix}$$

and the disturbance covariance matrix for the full nT observations is:

$$\mathbf{V}=\begin{bmatrix}\boldsymbol{\Omega} & \mathbf{0} & \mathbf{0} & \cdots & \mathbf{0}\\ \mathbf{0} & \boldsymbol{\Omega} & \mathbf{0} & \cdots & \mathbf{0}\\ & & & \vdots & \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & & \boldsymbol{\Omega}\end{bmatrix}=\mathbf{I}_n\otimes\boldsymbol{\Omega}$$

Then the generalized least squares estimator of $\boldsymbol{\beta}$ is

$$\hat{\boldsymbol{\beta}}=(\mathbf{X}'\boldsymbol{\Omega}^{-1}\mathbf{X})^{-1}\mathbf{X}'\boldsymbol{\Omega}^{-1}\mathbf{y}=(\sum_{i=1}^{n}\mathbf{X}_i'\boldsymbol{\Omega}^{-1}\mathbf{X}_i)^{-1}(\sum_{i=1}^{n}\mathbf{X}_i'\boldsymbol{\Omega}^{-1}\mathbf{y}_i)$$

In order to computer this estimate, we need only find $\boldsymbol{\Omega}^{-1/2}$, which is

$$\boldsymbol{\Omega}^{-1/2}=\frac{1}{\sigma_\varepsilon}\left[\mathbf{I}-\frac{\theta}{T}\mathbf{i}_T\mathbf{i}_T'\right] \text{ where } \theta=1-\frac{\sigma_\varepsilon}{\sqrt{\sigma_\varepsilon^2+T\sigma_u^2}}$$

Then the transformation of $\mathbf{y}_i$ and $\mathbf{X}_i$ for GLS is

$$\Omega^{-1/2}\mathbf{y}_i = \frac{1}{\sigma_\varepsilon}\begin{bmatrix} y_{i1} - \theta\overline{y_{i.}} \\ y_{i2} - \theta\overline{y_{i.}} \\ \vdots \\ y_{iT} - \theta\overline{y_{i.}} \end{bmatrix}$$

Thus, for GLS, it is essential to know θ. If the variance components are known, then GLS can be easily computed. However, when the variance components are unknown, we must estimate the disturbance variances and then use GLS approach.

Heteroscedasticity occurs when the variances of regression disturbances are not constant across observations, such as

$$\mathbf{Var}[\varepsilon_i|\mathbf{x}_i] = \sigma_i^2 = \sigma^2\omega_i \quad i = 1,\cdots,n$$

$$\mathbf{E}[\boldsymbol{\varepsilon}\boldsymbol{\varepsilon}'|\mathbf{X}] = \boldsymbol{\sigma}^2\boldsymbol{\Omega} = \boldsymbol{\sigma}^2\begin{bmatrix} \omega_1 & 0 & 0 & \cdots & 0 \\ 0 & \omega_2 & 0 & \cdots & \\ & & & \vdots & \\ 0 & 0 & 0 & \cdots & \omega_n \end{bmatrix} = \begin{bmatrix} \sigma_1^2 & 0 & 0 & \cdots & 0 \\ & \sigma_2^2 & 0 & \cdots & \\ & & & \vdots & \\ 0 & 0 & 0 & \cdots & \sigma_n^2 \end{bmatrix}$$

Heteroscedasticity only affects the elements on the principal diagonal of Var(ε) and disturbances are still assumed to be pairwise uncorrelated.

In the presence of heteroscedasticity, OLS estimator is still unbiased, consistent and asymptotically normally distribution. But it is inefficient compared to GLS. In GLS, it consists of the regression of a transformed y vector on a transformed X matrix, gives a best linear unbiased estimator. However, OLS regresses untransformed variables, produces linear unbiased but not minimum variance estimators.

Meanwhile, OLS coefficient standard errors are incorrect, and the conventional test statistics based on them are invalid. The correct variance matrix for the OLS coefficient vector is

$$
\begin{aligned}
\text{var}(\mathbf{b}) &= E\left[(\mathbf{b}-\beta)(\mathbf{b}-\beta)'\right] \\
&= E\left[(\mathbf{x}'\mathbf{x})^{-1}\mathbf{x}'\mathbf{u}\mathbf{u}'\mathbf{x}(\mathbf{x}'\mathbf{x})^{-1}\right] \\
&= \sigma^2(\mathbf{x}'\mathbf{x})^{-1}\mathbf{x}'\Omega\mathbf{x}(\mathbf{x}'\mathbf{x})^{-1} \\
&= \frac{\sigma^2}{n}\left[\frac{1}{n}(\mathbf{x}'\mathbf{x})\right]^{-1}\left[\frac{1}{n}(\mathbf{x}'\Omega\mathbf{x})\right]\left[\frac{1}{n}(\mathbf{x}'\mathbf{x})\right]^{-1}
\end{aligned}
$$

But the conventional formula only calculates part of this correct expression, which is $\sigma^2(\mathbf{x}'\mathbf{x})^{-1}$. Therefore, the conventional test statistics are invalidated.

However, White(1980) has shown that it is still possible to obtain an appropriate estimator for the variance of the OLS estimator. And the covariance matrix of **b** is $(\mathbf{X}'\mathbf{X})^{-1}\left[\mathbf{X}'(\sigma^2\Omega)\mathbf{X}\right](\mathbf{X}'\mathbf{X})^{-1}$, in which $\mathbf{X}'\sigma^2\Omega\mathbf{X}$ can be rewritten as

$$
\mathbf{X}'\sigma^2\Omega\mathbf{X} = \begin{bmatrix} \vdots & \vdots & & \vdots \\ x_1 & x_2 & \cdots & x_n \\ \vdots & \vdots & & \vdots \end{bmatrix}\begin{bmatrix} \sigma_1^2 & 0 & 0 & \cdots & 0 \\ 0 & \sigma_2^2 & 0 & \cdots & 0 \\ \vdots & \vdots & & \ddots & \\ 0 & 0 & 0 & \cdots & \sigma_n^2 \end{bmatrix}\begin{bmatrix} \cdots & x_1' & \cdots \\ \cdots & x_2' & \cdots \\ & \vdots & \\ \cdots & x_n' & \cdots \end{bmatrix} = \sum_{t=1}^{n}\sigma_t^2\mathbf{x}_t\mathbf{x}_t'
$$

The White estimator replace the unknown σ_t^2 by e_t^2, where e_t denote the OLS residuals, $y_t - x_t'b$. And

$$
\begin{aligned}
&est.\text{var}(\mathbf{b}) = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\sigma^2\hat{\Omega}\mathbf{X}(\mathbf{X}'\mathbf{X})^{-1} \\
&\text{where } \sigma^2\hat{\Omega} = \text{diag}\left\{e_1^2, e_2^2, \cdots, e_n^2\right\}
\end{aligned}
$$

This provides a consistent estimator of the variance matrix for the OLS coefficient vector and the square roots of the elements on the principal diagonal of *est.*var(**b**) are the estimated standard errors of the OLS coefficients.

Autocorrelated disturbances are found in time-series data when the disturbances are autocorrelated in that variance around the regression is not independent from one period to the next. Suppose in the model

$$
\begin{aligned}
&y_t = \beta x_t + u_t \\
&u_t = \varphi u_{t-1} + \varepsilon_t, \quad |\varphi| < 1
\end{aligned}
$$

where $E(\boldsymbol{\varepsilon})=\mathbf{0}$, $E(\boldsymbol{\varepsilon}\boldsymbol{\varepsilon}')=\sigma_\varepsilon^2\mathbf{I}$ and $\gamma_s=E(\varepsilon_t\varepsilon_{t+s})\quad s=0,\pm1,\pm2,\cdots$

Then $\text{var}(u_t)=\sigma_u^2=\dfrac{\sigma_\varepsilon^2}{1-\varphi^2}$ and variance matrix of the disturbance vector is

$$\text{var}(\mathbf{u})=\begin{bmatrix}\gamma_0 & \gamma_1 & \cdots & \gamma_{n-1}\\ \gamma_1 & \gamma_0 & \cdots & \gamma_{n-2}\\ \vdots & \vdots & \ddots & \vdots\\ \gamma_{n-1} & \gamma_{n-2} & \cdots & \gamma_0\end{bmatrix}=\sigma_u^2\begin{bmatrix}1 & \varphi & \cdots & \varphi^{n-1}\\ \varphi & 1 & \cdots & \varphi^{n-2}\\ \vdots & \vdots & \ddots & \vdots\\ \varphi^{n-1} & \varphi^{n-2} & \cdots & 1\end{bmatrix}$$

OLS estimation in the presence of nonstochastic X and autocorrelated disturbances can provide unbiased consistent estimators but inefficient estimation and invalid inference procedures. The OLS estimate of β is

$$b=\frac{\sum_{t=1}^n y_t x_t}{\sum_{t=1}^n x_t^2}$$

And correct sampling variance of this coefficient is

$$\text{var}(b)=\frac{\sigma_u^2}{\sum_{t=1}^n x_t^2}\times\left(1+2\varphi\frac{\sum_{t=2}^n x_t x_{t-1}}{\sum_{t=1}^n x_t^2}+2\varphi^2\frac{\sum_{t=3}^n x_t x_{t-2}}{\sum_{t=1}^n x_t^2}+\cdots+2\varphi^{n-1}\frac{x_1x_n}{\sum_{t=1}^n x_t^2}\right)$$

$\dfrac{\sigma_u^2}{\sum_{t=1}^n x_t^2}$ is the conventional but incorrect expression of $\text{var}(b)$. If the regressor variable is not autocorrelated then the term in brackets are negligible. However, if the regressors and disturbances are both positively autocorrelated, the conventional standard error is likely to underestimate the true standard errors.

OLS is inefficient comparing to GLS. That is because:

$$\text{var}(b_{GLS})=\sigma_u^2\left(\mathbf{x}'\boldsymbol{\Omega}^{-1}\mathbf{x}\right)^{-1}$$

$$=\frac{\sigma_u^2}{\sum_{t=1}^n x_t^2}\times\left(\frac{1-\varphi^2}{1+\varphi^2-2\varphi\sum_{t=2}^n x_t x_{t-1}/\sum_{t=1}^n x_t^2-\varphi^2(x_1^2+x_n^2)/\sum_{t=1}^n x_t^2}\right)$$

$$\frac{\text{var}(b_{GLS})}{\text{var}(b)}\approx\frac{1-\varphi^2}{(1+\varphi^2-2\varphi r)(1+2\varphi r)}$$

r is the sample, first-order autocorrelation coefficient of the regressors.

Furthermore, if the regression is a combination of a lagged dependent variables and an autocorrelated disturbance, OLS will be inconsistent.

Suppose the model

$y_t = \beta y_{t-2} + u_t,\ |\beta| < 1$

$u_t = \varphi u_{t-1} + \varepsilon_t,\ |\varphi| < 1$

OLS estimate of β is:

$$b = \frac{\sum y_t y_{t-1}}{\sum y_{t-1}^2} = \beta + \frac{\sum y_{t-1} u_t}{\sum y_{t-1}^2}$$

$$\text{Thus, } \operatorname{plim} b = \beta + \frac{\operatorname{plim}(\frac{1}{n}\sum y_{t-1} u_t)}{\operatorname{plim}(\frac{1}{n}\sum y_{t-1}^2)}$$

The consistence of b depends on $\operatorname{plim}(\frac{1}{n}\sum y_{t-1} u_t)$. Since $y_{t-1} = u_{t-1} + \beta u_{t-2} + \beta^2 u_{t-3} + \cdots$ then,

$\operatorname{plim}(\frac{1}{n}\sum y_{t-1} u_t) = \varphi\sigma_u^2 + \beta\varphi^2\sigma_u^2 + \beta^2\varphi^3\sigma_u^2 + \cdots = \frac{\varphi\sigma_u^2}{1-\beta\varphi}$ Thus, OLS cannot be used in such a case.

Finally, under the classical assumptions, OLS estimators are best linear unbiased. However, if the assumption of the independence of regressors from the disturbance term, OLS estimators are biased and inconsistent.

Suppose the observed x can be represented by true value $\tilde{x}$ and a random measurement error v, that is ,

$x = \tilde{x} + v$

Then OLS estimator of β is

$$b = \frac{\sum yx}{\sum x^2} = \frac{\sum x(\beta\tilde{x} + u)}{\sum x^2} = \beta\frac{\sum x\tilde{x}}{\sum x^2} + \frac{\sum xu}{\sum x^2}$$

$$\text{Plim} b = \beta\left(\frac{\sigma_{\tilde{x}}^2}{\sigma_{\tilde{x}}^2 + \sigma_v^2}\right)$$

Thus OLS is biased and inconsistent.

A consistent estimator may be obtained by the use of instrumental variables (IV). That is we can find a data matrix $\mathbf{Z}$ in which the variable in $\mathbf{Z}$ are correlated with those in $\mathbf{X}$ and $\mathbf{Z}$ is uncorrelated with the disturbance term.

Multiplying the basic model by $\mathbf{Z}'$ gives

$$\mathbf{Z}'\mathbf{y} = \mathbf{Z}'\mathbf{X}\boldsymbol{\beta} + \mathbf{Z}'\boldsymbol{\varepsilon} \text{ and } Var(\mathbf{Z}'\boldsymbol{\varepsilon}) = \sigma^2(\mathbf{Z}'\mathbf{Z}),$$

$$\text{If } \operatorname{plim}\frac{1}{T}\mathbf{X}'\boldsymbol{\varepsilon} \neq \mathbf{0}$$

$$\text{Then } \mathbf{b}_{IV} = (\mathbf{X}'\mathbf{Z}(\mathbf{Z}'\mathbf{Z})^{-1}\mathbf{Z}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{Z}(\mathbf{Z}'\mathbf{Z})^{-1}\mathbf{Z}'\mathbf{y}$$

$$\text{Let } \mathbf{P}_{\mathbf{Z}} = \mathbf{Z}(\mathbf{Z}'\mathbf{Z})^{-1}\mathbf{Z}'$$

$$\mathbf{b}_{IV} = \boldsymbol{\beta} + \left(\frac{1}{n}\mathbf{X}'\mathbf{P}_{\mathbf{z}}\mathbf{X}\right)^{-1}\left(\frac{1}{n}\mathbf{X}'\mathbf{P}_{\mathbf{z}}\boldsymbol{\varepsilon}\right)$$

We find that $\operatorname{plim}(\mathbf{b}_{IV}) = \boldsymbol{\beta}$. Thus, the IV estimator is consistent.

Appendix C: OLS and Fama-MacBeth Estimates for Panel Data

In a study by Peterson (2009), he shows that both OLS and the Fama-MacBeth standard errors are biased when firm and time effects are present in the data. The proof is as follows:

The standard regression of a panel data set is :

$$Y_{it} = X_{it}\beta + \varepsilon_{it}$$

It is known that OLS standard errors are unbiased when the residuals are independent and identically distributed. When the residuals are correlated across observations, OLS standard errors can be biased. For example,

$$\hat{\beta}_{OLS} = \frac{\sum_{i=1}^{N}\sum_{t=1}^{T} X_{it}Y_{it}}{\sum_{i=1}^{N}\sum_{t=1}^{T} X_{it}^2} = \beta + \frac{\sum_{i=1}^{N}\sum_{t=1}^{T} X_{it}\varepsilon_{it}}{\sum_{i=1}^{N}\sum_{t=1}^{T} X_{it}^2}$$

and

$$Asy(\hat{\beta}_{OLS} - \beta) = \underset{\substack{N\to\infty \\ T\text{fixed}}}{p\lim}\left[\frac{1}{N^2}\left(\sum_{i=1}^{N}\sum_{t=1}^{T} X_{it}\varepsilon_{it}\right)^2\left(\frac{\sum_{i=1}^{N}\sum_{t=1}^{T} X_{it}^2}{N^2}\right)^{-2}\right]$$

$$= \underset{\substack{N\to\infty \\ T\text{fixed}}}{p\lim}\left[\frac{1}{N^2}\left(\sum_{i=1}^{N}\sum_{t=1}^{T} X_{it}^2\varepsilon_{it}^2\right)\left(\frac{\sum_{i=1}^{N}\sum_{t=1}^{T} X_{it}^2}{N^2}\right)^{-2}\right] = \frac{1}{N}\left(T\sigma_X^2\sigma_\varepsilon^2\right)\left(T\sigma_X^2\right)^{-2} = \frac{\sigma_\varepsilon^2}{\sigma_X^2 NT}$$

The above results are based on the assumption that the errors are independent (i.e. the covariance of residuals is zero) and identically distributed (i.e. homoscedastic errors). However, the independent assumption is always violated in panel data.

For example, if X_{it} and ε_{it} are correlated across the observation of the same firms but are independent across firms. That is:

$$corr(X_{it}, X_{js}) = \begin{cases} 1 & i = j, t = s \\ \rho_X & i = j, t \neq s \\ 0 & i \neq j \end{cases}$$

and

$$corr(\varepsilon_{it},\varepsilon_{js}) = \begin{cases} 1 & i=j, t=s \\ \rho_\varepsilon & i=j, t\neq s \\ 0 & i\neq j \end{cases}$$

Then,

$$Asy(\hat{\beta}_{OLS}-\beta) = \underset{\substack{N\to\infty \\ T\text{fixed}}}{p\lim}\left[\frac{1}{N^2}\left(\sum_{i=1}^{N}\sum_{t=1}^{T}X_{it}\varepsilon_{it}\right)^2\left(\frac{\sum_{i=1}^{N}\sum_{t=1}^{T}X_{it}^2}{N^2}\right)^{-2}\right]$$

$$= \underset{\substack{N\to\infty \\ T\text{fixed}}}{p\lim}\left[\frac{1}{N^2}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}X_{it}\varepsilon_{it}\right)^2\left(\frac{\sum_{i=1}^{N}\sum_{t=1}^{T}X_{it}^2}{N^2}\right)^{-2}\right]$$

$$= \underset{\substack{N\to\infty \\ T\text{fixed}}}{p\lim}\left[\frac{1}{N^2}\sum_{i-1}^{N}\left(\sum_{t-1}^{T}X_{it}^2\varepsilon_{it}^2+\sum_{t-1}^{T-1}\sum_{s-t+1}^{T}X_{it}X_{is}\varepsilon_{it}\varepsilon_{is}\right)\left(\frac{\sum_{i=1}^{N}\sum_{t=1}^{T}X_{it}^2}{N^2}\right)^{-2}\right]$$

$$= \frac{1}{N}\left(T\sigma_X^2\sigma_\varepsilon^2+T(T-1)\rho_X\sigma_X^2\rho_\varepsilon\sigma_\varepsilon^2\right)\left(T\sigma_X^2\right)^{-2} = \frac{\sigma_\varepsilon^2}{\sigma_X^2 NT}\left(T+(T-1)\rho_X\rho_\varepsilon\right)$$

Hence, the OLS standard error will be underestimated when ρ_X and ρ_ε are non-zero.

An alternative way to estimate the regression coefficients and standard errors when the residuals are not independent is the Fama-MacBeth approach (Fama and MacBeth, 1973). In this approach, the researcher runs T cross sectional regressions.

The average of the T estimates is the coefficient estimate:

$$\hat{\beta}_{FM} = \sum_{t=1}^{T}\frac{\hat{\beta}_t}{T} = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{\sum_{i=1}^{N}X_{it}Y_{it}}{\sum_{i=1}^{N}X_{it}^2}\right) = \beta+\frac{1}{T}\sum_{t=1}^{T}\left(\frac{\sum_{i=1}^{N}X_{it}\varepsilon_{it}}{\sum_{i=1}^{N}X_{it}^2}\right)$$

And the variance of estimates is :

$$S^2\left(\hat{\beta}_{FM}\right) = \frac{1}{T}\sum_{t=1}^{T}\frac{\left(\hat{\beta}_t-\hat{\beta}_{FM}\right)^2}{T-1}$$

And the asymptotic variance of estimates is

$$Asy.Var(\hat{\beta}_{FM}) = \frac{1}{T^2} Asy.Var\left(\sum_{t=1}^{T} \hat{\beta}_t\right) = \frac{Asy.Var(\hat{\beta}_t)}{T} + \frac{2\sum_{t=1}^{T-1}\sum_{s=t+1}^{T} Asy.Cov(\hat{\beta}_s, \hat{\beta}_t)}{T^2}$$

$$= \frac{Asy.Var(\hat{\beta}_t)}{T} + \frac{T(T-1)}{T^2} Asy.Cov(\hat{\beta}_s, \hat{\beta}_t)$$

And

$$Asy.Cov(\hat{\beta}_s, \hat{\beta}_t) = \underset{N \to \infty}{p\lim} \left[\left(\frac{\sum_{i=1}^{N} X_{it}^2}{N} \right)^{-1} \left(\frac{\sum_{i=1}^{N} X_{it}\varepsilon_{it}}{N} \right) \left(\frac{\sum_{i=1}^{N} X_{is}\varepsilon_{is}}{N} \right) \left(\frac{\sum_{i=1}^{N} X_{is}^2}{N} \right)^{-1} \right]$$

$$= (\sigma_X^2)^{-2} \underset{N \to \infty}{p\lim} \left[\left(\frac{\sum_{i=1}^{N} X_{it}\varepsilon_{it}}{N} \right) \left(\frac{\sum_{i=1}^{N} X_{is}\varepsilon_{is}}{N} \right) \right]$$

$$= (\sigma_X^2)^{-2} \underset{N \to \infty}{p\lim} \left[\frac{\sum_{i=1}^{N} X_{it}\varepsilon_{it}X_{is}\varepsilon_{is}}{N^2} \right] = (\sigma_X^2)^{-2} \frac{\rho_X \sigma_X^2 \rho_\varepsilon \sigma_\varepsilon^2}{N} = \frac{\rho_X \rho_\varepsilon \sigma_\varepsilon^2}{N\sigma_X^2}$$

Finally,

$$Asy.Var(\hat{\beta}_{FM}) = \frac{Asy.Var(\hat{\beta}_t)}{T} + \frac{T(T-1)}{T^2} Asy.Cov(\hat{\beta}_s, \hat{\beta}_t)$$

$$= \frac{\sigma_\varepsilon^2}{T\sigma_X^2} + \frac{T(T-1)}{T^2} \frac{\rho_X \rho_\varepsilon \sigma_\varepsilon^2}{N\sigma_X^2} = \frac{\sigma_\varepsilon^2}{\sigma_X^2 NT}(T + (T-1)\rho_X \rho_\varepsilon)$$

As we can see, the Fama-MacBeth standard errors are biased in exactly the same way as the OLS estimates. In other words, Fama-MacBeth standard errors do account for the cross correlation (i.e. ε_{it} ε_{jt}) but are not robust to serial correlation (i.e. ε_{it} ε_{it}). In OLS and Fama-MacBeth, the magnitude of the bias is a function of the serial correlation of both the independent variable and the residual within a cluster and the number of time periods per firm.

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