

Cash Flow Volatility and Corporate Investment

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ABSTRACT

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I examine the effect of cash holdings on the relationship between cash flow volatility and corporate investment. My results call into question the long-assumed negative association between cash flow volatility and corporate investment. Using an expanded dataset of U.S. domestic firms, I show that firms with high cash holdings increase investment in the face of increasing cash flow volatility, whereas firms with low cash holdings lower their investment expenditure. In doing so, I provide empirical evidence in support of recent theoretical models predicting that the sensitivity of investment to cash flow volatility is dependent on the level of balance sheet cash holdings. My results are robust to a number of model specifications.

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Dedication

I would like to thank my family for their love, encouragement, and support.

I dedicate this work in memory of my mentor, Professor Nahum Melumad. I am forever grateful to his kindness, caring, and unwavering support. His wisdom and encouragement served as my guiding light in the program. His loss left a painful void, but his advice continues to guide my way. I am so grateful and blessed to have known him.

1. Introduction

Corporate investment is a fundamental determinant of both micro- and macro-economic viability. In a frictionless environment, corporate investment should solely be a function of the firm's investment opportunity set (Modigliani and Miller 1958). Therefore the extent to which cash flow volatility does affect corporate investment is essential to our understanding of how financing frictions impact real economic activity. Prior literature suggests that cash flow volatility is associated with a decrease in corporate investment and that firms do not access external capital markets to make up for the decline, but instead permanently forgo investment opportunities (e.g., Minton and Schrand 1999). These studies, though, do not address the possibility that firms could use balance sheet cash holdings to absorb the impact of cash flow volatility on investment. This perhaps is because balance sheet cash did not play as prominent a role at the time as it does today. Recent analytical models however suggest that there may be more to the relationship between corporate investment and cash flow volatility, and that this relationship could indeed be affected by the level of the firm's cash holdings (e.g., Hirth and Viswanatha 2011). These analytical models show that if firms have sufficient cash holdings, then an increase in cash flow volatility may lead managers to forgo the option of waiting to invest. The following paper extends the literature by empirically examining the relationship between cash flow volatility and corporate investment in light of the recent increase in corporate balance sheet cash holdings.

I predict that firms with low cash holdings will lower their investment in the face of increasing cash flow volatility, whereas firms with high cash holdings will be able to buffer against this volatility. I run my analysis on an expanded data set spanning from 1980 through 2012. The two key constructs used in the analysis are cash flow volatility and corporate

investment. I use an accounting-based measure for both. First, I follow Richardson (2006) and construct an aggregate measure of new investment. Second, I adhere to the accounting literature in measuring cash flow, which serves as the basis for my cash flow volatility measure. I do so because the extant finance literature dealing with the investment cash flow sensitivity typically measures cash flow as earnings before depreciation, which allows for both a cash component and a non-cash working capital component to be included in the cash flow measure. Bushman et al. (2012) show that the non-cash working capital accrual component includes elements of investment, which may lead to a mechanical relationship. The accounting measure for cash flow alleviates this concern. For comparability with the finance literature, in the primary analysis, I also look at earnings before depreciation as a measure of cash flow.

My analysis yields two key results. First, in contrast to prior literature, my results suggest that the long-assumed negative relationship between cash flow volatility and corporate investment reverses and that this reversal is driven by firms that are better able to absorb that volatility. And second, I find evidence supporting analytical models predicting that the sensitivity of investment to cash flow volatility is dependent on the level of balance sheet cash holdings. Taken together, my results suggest that for firms facing increasing financing constraints in the form of cash flow volatility, cash holdings could potentially be a value-increasing response.

This paper contributes to a number of different studies in both the accounting and finance literatures. First, this paper contributes directly to studies looking at the sensitivity of investment to cash flow volatility (e.g., Minton and Schrand 1999) by reexamining this relationship in light of the dramatic increase in balance sheet cash holdings observed in recent years (Bates et al. 2009). My results provide empirical support to analytical models that predict that the impact of

cash flow volatility on investment is actually a function of firm cash holdings (Boyle and Guthrie 2003; Hirth and Viswantha 2011; Bolton et al. 2013).

Second, this study complements recent work that looks at the value proposition of corporate cash holdings (Mikkelson and Partch 2003; Almeida et al. 2004; Denis and Sibilkov 2010; Brown and Petersen 2011) by providing evidence that balance sheet cash can serve as a natural hedge against financing constraints such as cash flow volatility.

Third, this paper adds to a nascent but growing body of research in the accounting literature looking at the determinants of firm-level investments (McNichols and Stubben 2008; Biddle et al. 2009; Goodman et al. 2013). It extends this literature by shedding light on the mechanism by which volatility affects investment and by showing that it is not the volatility itself that managers appear to consider when making investment expenditure decisions but rather the volatility remaining after taking into consideration the ability of cash holdings to absorb that volatility.

Finally, this study offers both micro- and macro-level considerations. On the firm level, this paper sheds additional insight into the role of risk management activities. Given that investment is a major determinant of shareholders' return, my results provide an additional source of information that managers can use to assess the benefits of managing cash flow risk. On the macro level, by showing that cash flow volatility does not necessarily lead to lower levels of corporate investment, this study lends support to recent work suggesting that measuring the real effects of a financial crisis by the change in corporate investment expenditure may be misguided (Bolton et al. 2013).

The remainder of the paper proceeds as follows. Section 2 reviews related literature and develops empirical predictions. Section 3 details the research design. Section 4 describes the

sample selection and provides descriptive statistics. Section 5 presents the empirical findings. Section 6 reports findings from additional analyses and Section 7 concludes.

2. Related Literature and Empirical Predictions

In a frictionless market, corporate investment should be a function of the firm's investment opportunity set, not the firm's internally generated liquidity nor, by extension, the volatility of this internally generated liquidity (Modigliani and Miller 1958). The reason for this is that in a frictionless environment any internal cash flow shortfalls would be seamlessly supplemented by external markets. Prior research however has shown a positive association between the firm's investment and its cash flows (Fazzari et al. 1988; Hubbard 1998), and a negative association between its investment and cash flow volatility (Minton and Schrand 1999). One possible reason for these observed associations is capital market imperfections.¹ These imperfections can lead to an increase in the firm's cost of external capital, which may prevent firms from pursuing all value-increasing investment opportunities (Myers and Majluf 1984).

Minton and Schrand (1999) find that an increase in cash flow volatility leads to a decrease in investment. They show that while firms could potentially smooth internal cash flow fluctuations using external capital markets, they do not, and instead permanently forgo investment opportunities.² Their study, however, does not address the possibility that firms could use cash holdings to buffer or hedge against volatility. This perhaps is because at the time

¹ Another reason attributed for the positive association between cash flow and investment is the manifestation of agency problems (Jensen 1986). Yet while empirical studies have shown this to exist (Harford 1999; Harford et al. 2008) and to exist systematically (Richardson 2006), collectively, the ability of governance structures to explain cross-sectional variation among U.S. sample firms is generally weak (Opler et al. 1999; Richardson 2006; Han and Qiu 2007).

² Minton and Schrand (1999) look at three forms of investment which they refer to as discretionary: capital expenditure, research and development, and advertising. I use a comprehensive aggregate measure to capture new investment, which is detailed in Section 3. I also analyze the disaggregated components of investment in Section 6.

of their study, cash holdings did not play as significant a role on the balance sheet as it has since then.

In fact, the unprecedented amount of cash firms have stock-piled in recent years has been discussed at length in both the business press and academic literature.³ Bates et al. (2009), for example, report that between 1980 and 2006 the average cash-to-assets ratio of publicly traded U.S. firms more than doubled. In addition to this increase, they document a contemporaneous increase in cash flow volatility, suggesting that the trend to increase corporate cash holdings among U.S. public firms is driven by a functional precautionary motive.⁴ These cash holdings can be particularly valuable when other sources of funds, including cash flows, are insufficient to satisfy corporate demand for capital. Because cash flow volatility increases the likelihood of cash flow shortfalls and makes external sources of financing more costly (Minton and Schrand 1999), a firm's balance sheet cash can potentially serve as a buffering mechanism in the face of increasing volatility, ensuring that firms have sufficient internal funds to undertake attractive investment opportunities.

To this end, Bolton et al. (2013) model an investment framework and show that those firms that have high cash holdings before a financial crisis are able to maintain their investment policy almost unaltered. Furthermore, Hirth and Viswanatha (2011), building on the work of Boyle and Guthrie (2003), show analytically that if firms have sufficient cash buffers, then an increase in cash flow volatility may lead managers to forgo the option of waiting to invest: that

³ Vipal Monga and Maxwell Murphy, "Three Money Trends," *The Wall Street Journal*, August 6, 2013, p.B5.

⁴ While the focus of my paper is not why firms have increased their cash holdings, a large body of literature does look at the reasons behind the increase. These reasons include agency, tax and precautionary motives. Bates et al. (2009) provide evidence that firms increase cash holdings for precautionary reasons, which supports my study. Han and Qiu (2007) note that "empirical evidence in support of agency costs using U.S. sample firms is generally weak." And I remove from consideration tax motives by excluding multinational firms from my sample.

is, the threat of future cash flow shortfalls can reduce the value of the firm's timing options and lead managers to exercise these options early. More volatility in a firm's cash flow distribution could lead to an increase in current investment.⁵ Taken together, these analytical studies imply that cash holdings may serve as a buffer between investment and cash flow volatility. Yet, whether the sensitivity of investment to cash flow volatility is dependent on the level of balance sheet cash remains an open empirical question, which leads to my primary research question: does the relationship between cash flow volatility and corporate investment depend on the level of the company's balance sheet cash holdings?

To address this question, I analyze whether the firm's balance sheet cash holdings affect the relationship between cash flow volatility and investment. After all, just because a firm maintains high cash holdings does not necessarily mean that it would use these cash holdings to adjust for cash flow shortfalls. Building on recent analytical work (e.g., Hirth and Viswanatha 2011), I predict that balance sheet cash holdings do indeed affect the sensitivity of investment to cash flow risk. Firms with low cash holdings will lower their investment in the face of increasing cash flow volatility, whereas firms with high cash holdings will be able to buffer against this volatility. More formally:

H1a: As cash flow volatility increases, firms with low levels of balance sheet cash holdings will decrease investment.

H1b: As cash flow volatility increases, firms with high levels of balance sheet cash holdings will not decrease investment.

⁵ While my paper examines how the relationship between cash flow volatility and corporate investment depends on the level of the firm's cash holdings, it is agnostic as to whether these balance sheet cash buffers allow for more optimal investment. Forgoing the real option to wait may be equivalent to investing in less favorable projects. The goal of my paper is not to assess the optimality of these investments but rather to test whether the relationship between cash flow volatility and investment is affected by the firm's balance sheet cash holdings.

3. Research Design

Section 3.1 presents the primary measures used in the study and describes how they are constructed. Section 3.2 outlines the methodology used to analyze the relationship between cash flow volatility and investment. Section 3.3 incorporates balance sheet cash holdings into the research design.

3.1 Measures of investment and cash flow volatility

The two primary constructs in this study are investment and cash flow volatility. This section describes how these variables are measured. I base my research design on elements from both the accounting and finance literatures, and provide detailed explanation when my approach deviates from common practice in the literature. For a more detailed description of variable composition and Compustat data items, please refer to Appendix A.

Investment. For my primary measure of investment expenditure, I follow Richardson (2006) and use an accounting-based aggregate measure calculated as the sum of capital expenditure, research and development, and acquisitions, less depreciation and amortization and proceeds from the sale of property, plant and equipment.⁶ I remove depreciation and amortization from my overall measure since I am interested in new investment expenditure only, and depreciation and amortization is the estimate I use for mandatory investment expenditure required to maintain the operation of existing assets.⁷ Using an aggregate measure for investment contrasts from the majority of the finance literature, which uses capital expenditure as

⁶ I do not include advertising expenditure as part of aggregate investment since (i) firms do not always list advertising expense separately (it is often embedded in selling general & administrative expenses), and (ii) while it is a form of discretionary investment, it is not necessarily part of what this study considers core firm investment.

⁷ Since depreciation and amortization may not be a perfect proxy for maintenance expenditure, I run the analysis using alternative specification in Section 6.

the primary measure for investment. However, while capital expenditure may have accurately summarized firm investment in the past, Bates et al. (2009) document that during the past thirty years, research and development and acquisitions have taken on a greater role in overall firm investment. I therefore include both research and development and acquisitions in my aggregate measure of investment.⁸ This resulting aggregate measure (INV_{NEW}) captures investment expenditure on new projects.

Cash flow. Cash flow serves as the basis for the cash flow volatility measure. I use two primary measures for cash flow, the first based on the finance literature which defines cash flow as earnings before depreciation and amortization (EBD).⁹ However, this measure contains both a cash component and a non-cash working capital accrual component. Bushman et al. (2012) show that because working capital accruals are inherently connected to capital investment, the investment cash flow sensitivity discussed in the finance literature may actually be driven by the mechanical relationship between investment and this non-cash working capital accrual component of earnings. I therefore use a second cash flow measure anchored in the accounting literature (e.g., Sloan 1996). To construct the accounting based measure, I begin with cash from operations, which is the cash component of earnings.¹⁰ Since I am specifically interested in cash flow available for investment, I augment this measure by adding research and development and subtracting from it depreciation and amortization. I add research and development expense

⁸ For additional comparability with prior literature I investigate the subcomponents of investment in Section 6.

⁹ Examples using this definition include Fazzari et al. (1988), Erickson and Whited (2000), Biddle and Hilary (2006), among others.

¹⁰ I use cash from operations directly from the cash flow statement; however, because the cash flow statement is only available post-1988, I follow the accounting literature and measure cash from operations using line items from both the balance sheet and income statement, when data from the cash flow statement is not available (e.g. Sloan 1996; McNichols and Stubben 2008). Please see Appendix A for further details.

because, unlike the accounting standards for capital expenditure, the standards for research and development require that it be immediately expensed. I subtract depreciation and amortization because as mentioned earlier, this represents a mandatory maintenance expenditure rather than discretionary investment. This augmented cash flow measure (*CF*) is a more indicative measure of firm liquidity available for investment.¹¹

Cash flow volatility. Following both the accounting and finance literatures, I measure cash flow volatility as the standard deviation of the ratio of the cash flow measure (*CF* or *EBD*) scaled by total assets over the preceding five years. I require at least three observations for the measure to be calculated for a given firm-year observation.¹²

3.2 The relationship between cash flow volatility and investment

I first reexamine the relationship between cash flow volatility and investment documented in Minton and Schrand (1999), using the following model:

$$INV_{NEW\ i,t} = \beta_0 + \beta_1 (CFV) + \beta_j \Sigma(CONTROLS) + \varepsilon_{i,t} \quad (1)$$

I estimate the model in Equation (1) for the following three time periods: (i) the full sample period spanning from 1980 to 2012; (ii) a pre-1995 sample period, roughly corresponding to the timeframe in the Minton and Schrand (1999) study; and (iii) a post-1995 sample period, roughly corresponding to the documented period of high corporate cash holdings (Bates et al. 2009). As documented in Minton and Schrand (1999), I expect to find a negative association between cash flow volatility and corporate investment in the pre-1995 period. Whether this negative

¹¹ For additional robustness, Section 6 reports results using alternative measures of cash flow.

¹² See for example Biddle et al. (2009) who use a similar approach. In order to enhance statistical robustness, Section 6 reports results using cash flow volatility measured over a longer period of time.

association holds for the entire sample will depend, among other things, on the impact balance sheet cash has on this relationship.

Investment (INV_{NEW}) and cash flow volatility (CFV) measures are as defined in Section 3.1. To control for investment opportunities, I follow the accounting and finance literature and use a variant of Tobin's q (Q), measured as the ratio of the market value of assets to the book value of assets. To the extent that Tobin's q may be a poor proxy for marginal q (Erickson and Whited 2000, 2006), I refer to the accounting literature and use sales growth ($SALESGWTH$) as a second proxy for investment opportunity (Minton and Schrand 1999; Biddle et al. 2009).¹³ The benefit of using $SALESGWTH$, which is defined as the growth in net sales, is that unlike Q , it is a non-price-based measure of investment opportunities. Additional controls include cash from operations (OCF), balance sheet cash holdings ($CASH$), and debt ($DEBT$) in order to control for the firm's ability to implement growth. Please see Appendix A for detailed variable descriptions.

3.3 Cash holdings and the relationship between cash flow volatility and investment

To test whether a firm's balance sheet cash holdings affect the relationship between cash flow volatility and investment, I estimate Equation (1) by partitioning my sample on the level of balance sheet cash holdings. This allows me to empirically test the analytical predictions that balance sheet cash affects the sensitivity of investment to cash flow risk (e.g., Hirth and Viswanatha 2011). I estimate Equation (1) separately for high cash-holding firms and for low cash-holding firms. Firms are classified as high (low) cash-holding firms if their balance sheet cash level for a given year is in the top (bottom) quartile for their respective 2-digit SIC industry classification. Recall that the analytical models predict that high cash holding firms, when faced

¹³ For additional robustness, Section 6 reports results using additional proxies for investment opportunities, including, among others, the ratio of market-to-book equity (MTB) and the ratio of earnings-to-price (E/P).

with increasing cash flow volatility, will forgo the option of waiting to invest, and instead increase current investment. That is, more volatility in these firms' cash flow distribution will be associated with an increase in investment. The opposite is predicted for firms with low cash buffers: these firms would postpone investment in the face of increasing cash flow volatility. I therefore expect to find $\beta_1 < 0$ for low cash holding firms, consistent with H1A; and I expect to find $\beta_1 \geq 0$ for high cash-holding firms, consistent with H1B.

4. Sample Selection and Descriptive Statistics

Section 4.1 outlines the sample used in the study and discusses observed time trends. Section 4.2 describes the data and presents descriptive information on firm characteristics. Section 4.3 presents a univariate analysis of the main variables of interest.

4.1 Data

I construct my sample using all firms in COMPUSTAT between 1980 and 2012 with sufficient data available to calculate the variables used in the study. In addition, I apply the following restrictions to the data: first, I require that firms have positive assets (data item AT), positive sales (data item SALE), and positive book value of equity (data item CEQ) to be included in a given year.

Second, I remove firms whose reasons for holding cash are non-economic in nature. Specifically, I exclude utilities from my sample (SIC codes between 4900 and 4999) because their cash holdings can be subject to regulatory supervision. I also remove financial institutions (SIC codes between 6000 and 6999) because they may carry cash to meet capital requirements rather than for the reasons studied here.

And third, I restrict my sample to domestic firms incorporated in the United States.¹⁴ Doing so allows me to reduce the likelihood that either tax or agency motives constitute the reasons for a firm's high balance sheet cash holdings.¹⁵ All regressions are run controlling for industry-year fixed effects.¹⁶ And to ensure data robustness, particularly for those variables created using industry-year ranking, I require at least ten observations for each industry-year grouping.¹⁷ See Appendix A for a detailed description of how the variables are measured.

Figures 1 through 3 illustrate observed time trends in the data as they relate to my primary constructs. Figure 1 illustrates that corporate cash holdings increased throughout the sample period, with the smallest firms, as defined by total assets, experiencing the largest increase. Figure 2 further shows that cash holdings increased most for firms with the highest level of cash flow volatility; and Figure 3 illustrates how cash flow volatility varied over the sample period.

4.2 Firm Characteristics

Table 1 Panel A presents descriptive information for my entire sample, while Panel B (Panel C) do so for firms categorized as either high (low) cash holding firms. Firms are classified as high (low) cash-holding firms if their balance sheet cash level for a given year is in the top (bottom) quartile for their respective 2-digit SIC industry classification.

¹⁴ Domestic firms are defined as U.S. incorporated firms with no foreign income; and multinational firms are defined as U.S. incorporated firms with foreign income.

¹⁵ By removing multinational firms, I reduce the likelihood that tax is a motive for a firm's high cash holdings. As for agency motives, Han and Qiu (2007) note that "empirical evidence in support of agency costs using U.S. sample firms is generally weak." And Bates et al. (2009) provide evidence that during my sample period publically traded U.S. firms sharply increased cash holdings for precautionary motives, which supports my study.

¹⁶ Using a combined industry-year vector is more robust than using separate vectors for annual fixed effects and industry fixed effects.

¹⁷ Furthermore, to mitigate the influence of outliers, variables are winsorized at the top and bottom one percent.

Panel A shows that the average firm holds 16.4% of its total assets as cash and marketable securities. This figure jumps to 41.5% for the high cash holding group versus to 2.1% for the low cash holding group. Furthermore, high cash holding firms are not as levered as the rest of the sample, and the majority of these firms exhibit negative net debt. That is, high cash holding firms retain more cash than they do debt. Also noteworthy, the ratio of cash-to-debt for high cash holding firms is 3.14, compared to 0.07 for low cash holding firms. Not surprisingly then, the average debt and net debt for the low cash holding firms is approximately equal. Taken together, this provides descriptive evidence that firms with high cash holdings are in a much stronger position to potentially use their cash to buffer against cash flow volatility.

Table 1 also provides interesting insight into the relationship between cash from operations (*OCF*) and cash flow (*CF*). Panel A shows that in the full sample, the average level of *OCF* is approximately equal to the average level of *CF*. Recall from Section 3 that, whereas *OCF* is taken directly from the cash flow statement, *CF* is calculated by augmenting *OCF* and adding to it maintenance expense and removing from it research and development expense.¹⁸ *CF* is therefore a more indicative measure of firm liquidity available for investment. While both *OCF* and *CF* are approximately equivalent for the average firm in the full sample, the two diverge when looking at firms in the top and bottom cash holding group. In the top (bottom) quartile of balance sheet cash holdings, the amount of *CF* is approximately 1.09 (0.55) of its *OCF*. This provides descriptive evidence that firms in the high cash quartile not only have higher cash levels, but also higher levels of cash flow available for investment.

¹⁸ For my sample that predates the cash flow statement, I calculate cash from operations using line items from the balance sheet and income statement. Please refer to Section 3 for a detailed discussion on variable measurement and Appendix A for a detailed calculation.

Table 1 shows that cash flow volatility increases with firm cash holdings: the average firm in the low (high) cash holding group experiences 8.6% less (17.3% more) *CF* volatility from than the average firm in the full sample. That is, firms in the highest quartile of balance sheet cash holdings exhibit the highest level of cash flow volatility, while firms in the lowest quartile exhibit the lowest level of volatility, which is in line with studies documenting that corporate cash holdings have increased primarily for precautionary motives (e.g., Bates et al. 2009).

Furthermore, Table 1 shows that the average firm undertakes new investment equal to approximately 7.9% of its asset base. Firms in the top (bottom) quartile invest on average 21.5% more (25.3% less) than the average firm.¹⁹ Consistent with prior studies, the largest component of investment is capital expenditure followed by research and development. However, while capital expenditure remains relatively constant in all three panels, research and development exhibits sharper deviations. The average firm in the high (low) cash quartile sample invests 39.5% more (39.5% less) than the average firm in the full sample. This is consistent with recent studies documenting that research and development has taken on a much greater role in overall firm investment and with studies documenting that firms with a greater need for research and development hold higher levels of cash on their balance sheets (Bates et al. 2009; Brown and Petersen 2011).

¹⁹ The average firm in my sample undertakes new investment equal to 7.9% of its asset base. The average firm in the high cash (low cash) sample undertakes new investment equal to 9.6% (5.9%) of its asset base. This constitutes a 21.5% (25.3%) increase (decrease) compared to the average firm in the full sample.

Also noteworthy is that compared to the proportion of mandatory maintenance investment, the proportion of new investment to total investment increases with cash holdings.²⁰ In the full sample presented in Panel A, new (maintenance) investment accounts for 59% (41%) of total investment; in the high cash sample presented in Panel B, new (maintenance) investment accounts for 65% (35%) of total investment; and in the low cash sample presented in Panel C, new (maintenance) investment accounts for 51% (48%) of total investment. To the extent that depreciation and amortization expense is a good measure of mandatory investment expenditure, this implies that low cash firms are more financially constrained, utilizing roughly half of their investment expenditures on mandatory asset maintenance, rather than on new investments.

Taken together, these descriptive statistics provide preliminary indication that firms facing increasing cash flow volatility are the very firms with higher levels of investment expenditure and higher levels of cash flow available for investment. This is in contrast to the period covered by the Minton and Schrand (1999) study, where firms with higher levels of cash flow volatility are the very firms associated with lower levels of investment.

4.3 Univariate Correlations

Correlations between the main variables of interest are reported in Table 2. Table 2 reveals that the correlation between cash flow volatility (CFV_{CF}) and investment (INV_{NEW}) over the entire sample is positive and significant (0.070). This association provides preliminary univariate evidence in support of my predictions, but is incomplete without a multivariate analysis. Table 2 also shows that the correlation between CFV_{CF} and INV_{NEW} is positive and significant, while the correlation between CFV_{CF} and depreciation & amortization ($MAINT$) is

²⁰ Total investment is defined as new investment expenditure plus maintenance expenditure. Recall from Section 3.1 that depreciation and amortization is used as a proxy for mandatory maintenance expense.

positive but *not* significant, which implies that for the average firm maintenance is indeed a mandatory expenditure, irrespective of the level of cash flow volatility. The correlation between *CASH* and *CFV_{CF}* is positive and significant, providing univariate support that the average firm is holding cash for precautionary motives. And finally the correlation between *CASH* and *INV_{NEW}* for the average firm is positive and significant, suggesting that higher levels of balance sheet cash holdings are associated with higher levels of aggregate investment.

5. Results

Section 5.1 addresses the relationship between cash flow volatility and corporate investment. Section 5.2 incorporates the firms' balance sheet cash holdings into the analysis, and does so for the full sample period (Section 5.2.1) and for the pre- and post-1995 sample (Section 5.2.2).

5.1 The relationship between cash flow volatility and investment

I begin my analysis by reexamining the relationship between cash flow volatility and investment using an expanded data set from 1980 to 2012. Table 3 presents preliminary results showing a positive association between investment and cash flow volatility.

The coefficient estimate of interest β_I is positive and significant implying that an increase in cash flow volatility is associated with an increase in firm investment expenditure. This result is particularly important in that it calls into question the assumed relationship in the empirical literature between cash flow volatility and corporate investments, that higher cash flow volatility is associated with lower investment expenditure (Minton and Schrand 1999).

As expected, the coefficient estimates on the investment opportunity variables in columns II and III are positive and statistically significant, implying that firms with more investment

opportunities are associated with more investment expenditure. The coefficient estimate on debt is negative and significant, implying that on average, debt imposes a financing constraint on the firm, leading firms with higher levels of debt to invest less. Interesting to note is that the coefficient estimate on operating cash flows (*OCF*) is positive but *not* significant, which stands in contrast to the positive and significant investment-cash flow sensitivity extensively documented in the finance literature. As noted earlier, Bushman et al. (2012) contend that the investment-cash flow sensitivity in the finance literature may be driven in part by the fact that the variable used to measure cash flow (earnings before depreciation) actually includes elements of investment in the form of working capital accruals. In other words, in addition to the cash flow component, earnings before depreciation includes a non-cash flow component which may actually be the driving force behind the observed investment-cash flow sensitivity. Observing an insignificant coefficient estimate on *OCF* is consistent with the findings in Bushman et al. (2012) and mitigates concern that any association I find between cash flow volatility and investment is simply a manifestation of cash flow capturing growth opportunities.²¹

Table 4 presents the results for the two sub-periods: pre- and post-1995. To ensure comparability with Minton and Schrand (1999), I use a simplified model similar to the one in their study. In the pre-1995 period, the period roughly corresponding to the Minton and Schrand (1999) study, the coefficient estimate on *CFV* is negative and significant, confirming their original findings. While in the later period, which corresponds roughly to the documented period of high corporate cash holdings, I find that aggregate investment increases with cash flow volatility. The coefficient estimate on *CFV* here is positive and significant. This suggests that

²¹ *OCF* is not included in tests to follow since it appears not to be a significant determinant of new investment expenditure. Removing it from the model also alleviates concerns of multicollinearity among the variables.

the overall positive association documented in Table 3 for the full sample is driven by this later period when balance sheet cash holdings are at their highest levels and provides preliminary evidence that cash holdings may play a role in the relationship between cash flow volatility and corporate investment.

5.2 Balance sheet cash holdings and the relationship between cash flow volatility and investment

5.2.1 Partitioning on the level of cash holdings: testing H1A and H1B

Table 5 presents the results examining whether cash holdings affect the sensitivity of investment to cash flow volatility. To formally test my predictions I partition the entire sample based on the level of firm cash holdings. I run the analysis using both measures for cash flow volatility, one comprised on the accounting-based cash flow measure (CFV_{CF}) and the other based on the cash flow measure used in the finance literature (CFV_{EBD}). Results from estimating Equation (1) for firms with low balance sheet cash holdings using CFV_{CF} (CFV_{EBD}) are presented in Panels A (C), whereas results for firms with high balance sheet cash holdings using CFV_{CF} (CFV_{EBD}) are presented in Panels B (D).

In Panels A and C, the coefficient estimate on the main variable of interest, CFV , is negative and significant, suggesting that as volatility increases, firms with low cash holdings will reduce investment expenditure. In Panels B and D, the coefficient estimate on CFV is positive and significant, suggesting that as volatility increases, firms with high cash holdings will increase, rather than decrease, investment. In other words, firms with high cash holdings increase investment when faced with increasing cash flow volatility, whereas, firms with low cash holdings reduce their investment expenditure when faced with increasing cash flow

volatility. This dual relationship confirms H1A and H1B, and provides empirical evidence supporting the analytical predictions of Hirth and Viswantha (2011).

In all four panels, the controls for growth opportunities load positive and significant as expected, implying that firms with more investment opportunities are associated with more investment expenditure. The coefficient on *CASH* is positive and significant in the low cash holding groups (Panels A and C) but not significant in the high cash holding groups (Panels B and D). This suggests that low cash holding firms are constrained by their cash position and therefore utilize their cash holding to implement growth, whereas high cash holding firms are not constrained by their cash position as it relates to driving corporate growth. The coefficient estimate on *DEBT* offers interesting insight: in the high cash holding groups (Panels B and D), the estimate is positive and significant, indicating that additional debt is associated with additional investment. In the low cash holding groups (Panels A and C), the coefficient estimate is negative indicating that additional debt is associated with lower investment expenditure. This suggests that firms with low cash holdings are constrained by their debt obligations, whereas high cash holding firms use leverage to help invest in growth.

5.2.2 Partitioning on the level of cash holdings by time period

Table 6 further analyzes whether the sensitivity of investment to volatility is dependent on the level of balance sheet cash holdings by dividing the entire sample into a pre- and post-1995 period. Panel A presents results for the pre-1995 period and Panel B for the post-1995 period using CFV_{CF} as the cash flow volatility measure; similarly, Panel C presents results for the pre-1995 period and Panel B for the post-1995 period using CFV_{EBD} as the cash flow volatility measure. The results in Panel A and Panel C are striking in that they show that the negative association between INV_{NEW} and both measures of CFV holds only for low cash firms.

Those firms with high cash holdings exhibit a positive association between INV_{NEW} and CFV . This suggests that the dual impact of cash holdings on the relationship between investment and cash flow volatility was distinguishable even during the period analyzed in the Minton and Schrand (1999) study: when faced with increasing cash flow volatility, firms with high levels of balance sheet cash holdings are more likely to forgo the option to wait and instead increase investment expenditure.

Panels B and D of Table 6 presents results for the post-1995 period. Panel B shows that firms in the top quartile of cash holdings exhibit a positive association between volatility and investment. This, again, is in line with firms forgoing the real option of waiting to invest. Panels B and D also shows that firms in the bottom quartile of cash holdings exhibit a negative association between cash flow risk and investment expenditure, suggesting that firms that are less likely to have sufficient cash holdings to buffer cash flow volatility exhibit a lower level of investment in the fact of increasing cash flow volatility. Interesting to note here is that while the signed effect of CFV on INV_{NEW} is similar in the pre- and post-1995 periods, the magnitude is not. Low cash holding firms exhibit a larger decrease in investment in the pre-1995 period than in the post-1995 period, suggesting that overall increase in cash holdings in the post period somewhat buffers the negative effect of volatility on investment.

Taken together, the results in Tables 5 and 6 provide empirical evidence in support of analytical models predicting that the relationship between investment and cash flow volatility differs based on the level of firm cash holdings (Boyle and Guthrie 2003; Hirth and Viswanatha 2011; Bolton et al. 2013).

6. Additional Analyses

This section presents additional tests to assess the robustness of my primary findings that the relationship between cash flow volatility and corporate investment is dependent on the firm's level of balance sheet cash holdings. As detailed below, these analyses provide evidence in support of my primary findings.

6.1 Corporate governance tests

As noted earlier, evidence in support of agency costs among U.S. firms is generally weak (Han and Qiu 2007). Nonetheless, a credible alternative interpretation to my results is that they may be capturing the effect of different corporate governance mechanisms that are correlated with balance sheet cash holdings. That is, firms with high balance sheet cash holdings could represent firms that are more likely to face agency conflicts and as a result overinvest (Jensen 1986; Harford 1999; Harford et al. 2008). To address this concern, I refer to the corporate governance literature to test whether there are discernable differences in governance structures within my sample. I use the entrenchment index created by Bebchuk et al. (2009). This index which is based on the work of Gompers et al. (2003) aims to identify how well firms are governed.²² If the positive association observed between INV_{NEW} and CFV_{CF} among high cash holding firms – or firms that are more likely to use cash to buffer against cash flow volatility – is driven by agency motives, then I would expect on average, firms with high cash balances to have lower corporate governance ratings than the rest of the sample.²³ Table 7 presents results showing that the high cash holdings group has a significantly higher corporate governance rating.

²² The entrenchment index (Bebchuk et al. 2009) is only available from 1990-2006, which limits my test to this time period.

²³ The entrenchment index ranges from 0 to 6, where a higher index score corresponds to lower corporate governance rating.

This supports my overall findings by showing that agency motives in the form of poor corporate governance are not likely driving my results.²⁴

6.2 Multinational firms

My primary analysis focuses on U.S. domestic firms for a number of reasons, one of which is to reduce the likelihood that tax motives constitute the reason firms hold cash on their balance sheets.²⁵ Foley et al. (2007) find that U.S. firms with multinational operations exhibit higher balance sheet cash holdings because these firms prefer to keep their foreign income cash parked abroad rather than incur the tax burden associated with repatriating foreign income. However, these multinational firms whose cash is parked abroad may still be investing that cash, even if these projects are outside the U.S.²⁶ I therefore rerun the analysis and find that my results (reported in Tables 8 and 9) hold when looking at multinational firms. This implies that the effect of cash flow volatility and corporate cash holdings on firm investment holds regardless of whether the firm keeps its cash at home or parks it abroad.

6.3 Alternative measures of investment opportunities

A primary assumption of this paper is that the proxies used to capture the firm's investment opportunities indeed do so, thereby ensuring that the variables of interest, namely cash flow volatility, are not also capturing the firm's investment. If my construct for cash flow volatility is capturing investment opportunities, then the relationship between corporate investment and cash flow volatility may not be capturing the what it is purported to be capturing.

²⁴ This result is also in-line with Dittmar and Mahrt-Smith (2007) who find that the potential negative impact large cash holdings have on the firm cancel out if that firm is well governed.

²⁵ Recall, domestic firms are defined as U.S. firms with no foreign income; and multinational firms are defined as U.S. incorporated firms with foreign income.

²⁶ Whether these investments are optimal is separate question, which is not the focus of this study.

Therefore, because it is essential that a firm's investment opportunities are properly controlled for, I examine the relationship between cash flow volatility and corporate investment using alternative measure of investment opportunities. I use additional measures including the ratio of market-to-book equity (*MTB*) and the ratio of earnings-to-price (*EP*) as alternative measures for investment opportunity (e.g., Biddle and Hilary 2006; Richardson 2006).²⁷ These measures are used extensively in the literature and I find that my results are robust to these alternative measures of growth opportunities. I also use the growth in the number of employees *EMPGWTH* to capture growth opportunities (Zhang 2007). The benefit of using *EMPGWTH* is that unlike *MTB* and *EP*, it is a non-price-based measure of investment opportunities. Using *EMPGWTH* further offers the benefit of having a growth proxy derived external to the financial statements, though a drawback of using *EMPGWTH* is that it may be capturing growth opportunities ex-post. Tables 10 and 11 present a replication of the analysis using *EMPGWTH* as an alternative measure of growth opportunities. The results suggest that the primary findings of the study hold to this alternative measure for growth opportunities. Nonetheless, any inferences drawn from the study are contingent on the quality of the investment model used.

6.4 Alternative measures of investment

The investment measure used in the study attempts to capture aggregate new investment by separating out the maintenance component of investment. However, this approach is only effective to the extent that my proxy for maintenance (depreciation and amortization) is indeed an accurate proxy for maintenance expenditure. I therefore run the analysis without removing depreciation and amortization from my aggregate investment component. Doing so creates a

²⁷ Richardson (2006) also uses V/P ratio which is a linear combination of BTM and EP ratios. I do not use this measure as it requires making constant assumptions to time-variant parameters.

comprehensive *total* measure of investment (INV_{TOT}) which includes both new investment and maintenance investment. Results reported in Tables 12 and 13 using INV_{TOT} suggest that the findings are robust to this total measure of firm investment.

Furthermore, I also analyze the subcomponents of the INV_{NEW} measure, specifically capital expenditure, acquisitions, and research and development. I find that the positive association between cash flow volatility and investment are primarily driven by research and development (Tables 18 and 19). This is particularly interesting given that Bates et al. (2009) document that during the past thirty years, research and development and acquisitions have taken on a greater role in overall aggregate firm investment.

Results using capital expenditure and acquisitions as the dependent variable are presented in Tables 14 through 17. These results indicate that as cash flow volatility increases firms in the low cash holding groups decrease investment in the face of increasing cash flow volatility, whereas those in the high cash holding groups do not. Results for firms in the high cash holding groups are interesting in that sense that an increase in volatility does not lead to lowered investment as was previously documented in the literature (e.g., Minton and Schrand 1999)

6.5 Alternative measures of cash flow

In the primary analysis I used two measures to capture the firm's cash flow. The first is an augmented measure of cash flow from operations which I refer to as cash available for investment (CF); the second is earnings before depreciation (EBD), a measure frequently used in the finance literature (please refer to Section 3.1 above for a detailed discussion). For additional robustness, I further augment CF to account of the fact that cash from operations as recorded on the cash flow statement is not a pure operational measure. Under GAAP, cash from operations has embedded within it financing components such as interest income and interest expense.

Since I am interested in cash flow available for operational investment, I rerun my analysis by removing the financing components from cash from operations. Results presented in Tables 20 and 21 show that the findings remain robust to this more intrinsic measure of cash flow available for investments.²⁸

6.6 Robustness measure of cash flow volatility

I measure cash flow volatility (*CFV*) as the standard deviation of cash flow (cash flow defined as either *CF* or *EBD*) over the preceding five years. While this approach is in line with prior literature, it could be criticized for not allowing sufficient data points to aptly capture a firm's cash flow volatility. Therefore, in order to enhance the statistical robustness of my measure, I extend the number of annual cash flow data points used in calculating cash flow volatility. Since this is ostensibly a more robust measure of a firm's cash flow volatility, I would expect my primary findings to hold. Nonetheless, using an extended length of time to measure volatility may reduce my sample size, which in turn can lower the power of my tests. The results presented in Tables 22 and 23 show that my results not only hold to this alternative measure of cash flow volatility, they appear to be more robust.

6.7 Alternative measure of firm cash holdings

My measure for cash holdings is defined as cash and marketable securities scaled by the book value of total assets at the beginning of the period.²⁹ Scaling by total assets allows for the control of firm size, which otherwise would be an omitted variable. As an alternative to scaling by total assets at the beginning of the period, another option would be to scale by total assets net

²⁸ Note that the number of years in the pre-1995 period is considerably smaller than in the main analysis as this augmented measure applies only for data derived from the cash flow statement which is available post 1988.

²⁹ While firms may hold cash in the form of long term investments, this study focuses on the firm's short-term cash and marketable securities: that is, liquid cash holdings that can readily be available to buffer cash flow shortfalls.

of cash holdings. Doing so should not affect the results as the ranking of the firm's cash holdings for a given industry-year does not change. This alternative approach may however lead to overweighting of companies with large cash holdings relative to their total asset base. Tables 24 and 25 present the results using this alternative measure and show that doing so does not affect my primary findings.

6.8 Dividend and stock repurchase policy

Firms may hold cash as part of their dividend policy or stock repurchase policy. A number of papers in the finance literature consider non-dividend paying firms to be financially constrained. To explore this further and ensure that these policies are not driving my results, I run my analysis by partitioning on firms' dividend and stock repurchase policy. Table 26 presents results for dividend paying firms only (Panel A); firms involved in stock repurchase only (Panel B); firms involved in both activities (Panel C); and firms involved in neither dividend payment nor stock repurchase (Panel D). I find that my results hold for this last group – for firms involved in neither dividend payment nor stock repurchase policy. This is consistent with Bates et al. (2009) who show that the large run-up in firm cash holdings is not driven by established, dividend paying firms. This further provides support, albeit indirect, for the notion of the precautionary motive for holding cash. If the precautionary motive for holding cash is not analogous to being financially constrained, this evidence suggests that we may want to rethink whether dividend payout can continue to be used as a valid proxy for financing constraints.

6.9 Endogeneity concerns and the financial crisis

One criticism of this study is the potential endogeneity that may arise between a firm's cash holdings and its cash flow volatility. That is, a firm may choose its cash holding position because of its cash flow volatility: those firms with higher cash holdings may be holding more

cash because they experience more volatility. Interestingly however, it is not only firms experiencing high cash flow volatility that increase their cash holdings. Figure 2 illustrates that cash holding increased for all firms in my sample. Also, I am not necessarily claiming that cash flow volatility and cash holdings should be considered separately from one another. As mentioned earlier, one of the motivations for firms to hold higher levels of cash is the precautionary motive. These may be considered as two sides of the same constraint. Nonetheless, in order to address this concern, I use the recent financial crisis as form of natural experiment. If firms that increase cash holdings before the crisis do so because of increase in cash flow volatility, implying that cash flow volatility is a source of financing constraint, then the financial crisis provides a natural setting in which to test my predictions while alleviating the endogeneity concern. The magnitude of the 2008 financial crisis and its impact on sources of corporate liquidity was for the most part unexpected leaving firms with little time to build up cash reserves in expectation of the liquidity shock. Tables 27 and 28 present results for the financial crisis period. Table 27 shows that the overall relationship between cash flow volatility and corporate investment remains positive during this period of an exogenous shock to financial liquidity, and Table 28 shows that dual relationship between low and high cash holding firms continues during this period as well. This helps mitigate some concerns of endogeneity driving my results.

7. Conclusion

This paper examines the relationship between cash flow volatility and corporate investment in light of the dramatic increase in balance sheet cash holdings observed in recent years. I first show that the long assumed negative relationship between cash flow volatility and

corporate investment reverses, and that this reversal is driven by firms that are better able to absorb that volatility. I then provide empirical evidence in support of analytical models contending that the sensitivity of investment to volatility is dependent on the level of balance sheet cash holdings. This implies that the relationship between cash flow volatility and investment is not necessarily driven by how much volatility a company faces, but rather by how much volatility the company faces after controlling for the ability of balance sheet cash to absorb that volatility. Overall, I provide further insight into the process by which managers make investment decisions.

As with other studies in the finance and accounting literature, this paper is subject to the same limitations and criticisms of studies using investment expectation models. Any inferences drawn are subject to the quality of the investment model used. I have based my model on existing research, but nonetheless it is still subject to the same criticism of endogeneity, non-linearities, and that correlated omitted variables may be driving the results.

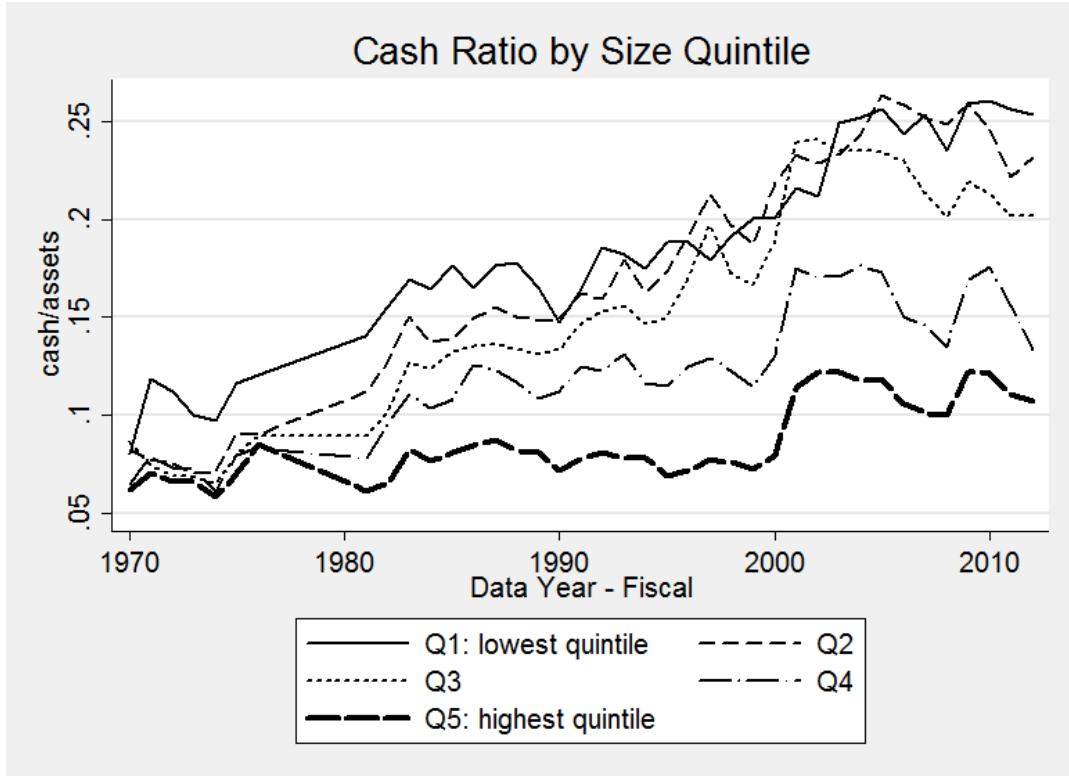
Finally, while my paper examines how the relationship between cash flow risk and corporate investment depends on the level of the firm's cash holdings, it is agnostic as to whether these balance sheet cash buffers allow for more *optimal* investment. My results indicate that high cash holding firms facing increasing cash flow volatility will forgo the option to wait, and instead increase investment. However, forgoing the real option to wait may be equivalent to investing in less favorable projects. Looking at the implications on future firm performance would help further assess whether, for firms facing increasing financing constraints in the form of cash flow volatility, holding cash is a value increasing response. I leave this as an avenue for future work.

List of Variable definitions with Compustat data codes (Appendix A)

Variable	Description	Measurement
<i>CASH</i>	Cash and short-term investments in period t divided by the book value of total assets at the beginning of period t .	CHE_t / AT_{t-1}
<i>CFV_{CF}</i>	Cash flow volatility measured as the standard deviation of cash flow (CF) divided by total assets at the beginning of period t , from years $t-5$ to $t-1$; at least three observations are required for the standard deviation to be calculated. Cash flow (CF) is calculated as cash from operations (OCF) plus research and development expenditure minus depreciation and amortization expense.	$\sigma([(OCF_t + XRD_t - DP_t) / AT_{t-1}])$
<i>CFV_{EBD}</i>	Cash flow volatility measured as the standard deviation of cash flow (EBD) divided by total assets at the beginning of period t , from years $t-5$ to $t-1$; at least three observations are required for the standard deviation to be calculated. EBD is the sum of earnings before extraordinary items and depreciation in period t divided by the book value of total assets at the beginning of period t .	$\sigma([(IB_t + DP_t) / AT_{t-1}])$
<i>DEBT</i>	Total debt in period t divided by the book value of total assets at the beginning of period t , where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt.	$(DLC_t + DLTT_t) / AT_{t-1}$
<i>EMPGWTH</i>	Growth in the number of employees between period t and $t-1$.	$(EMP_t - EMP_{t-1}) / EMP_{t-1}$
<i>INV_{NEW}</i>	New firm-level investment equal to the sum of capital expenditure _{t} , research & development _{t} , and acquisitions _{t} , minus sale of PPE _{t} and depreciation & amortization _{t} , all of which is scaled by the book value of total assets at the beginning of period t .	$(XRD_t + CAPX_t + AQC_t - SPPE_t - DPC_t) / AT_{t-1}$ where CAPXV is used when CAPX is unavailable; and DP is used when DPC is unavailable.

Variable	Description	Measurement
<i>INV_{TOT}</i>	Total firm-level investment equal to the sum of capital expenditure _t , research & development _t , and acquisitions _t , minus sale of PPE _t all of which is scaled by the book value of total assets at the beginning of period <i>t</i> .	$(XRD_t + CAPX_t + AQC_t - SPPE_t) / AT_{t-1}$ where CAPXV is used when CAPX is unavailable.
<i>OCF</i>	Operating cash flow taken directly from the cash flow statement. However, since the cash flow statement is only available post-1988, I calculate OCF using income statement and balance sheet line items (e.g., Sloan 1996) when cash flow statement data is unavailable.	When available: $OANCF_t / AT_{t-1}$ Otherwise: $[OIADP_t - (\Delta ACT - \Delta CHE) + (\Delta LCT - \Delta DLC - \Delta TXP) + DP] / AT_{t-1}$
<i>Q</i>	Tobin's Q which is proxied by the market value of assets in period <i>t-1</i> divided by the book value of total assets in period <i>t-1</i> , where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity.	$[(CSHO * PRCC_F)_{t-1} + AT_{t-1} - CEQ_{t-1}] / AT_{t-1}$
<i>SALESGWTH</i>	Log change in net sales between period <i>t</i> and <i>t-1</i> .	$\ln(SALE_t) - \ln(SALE_{t-1})$

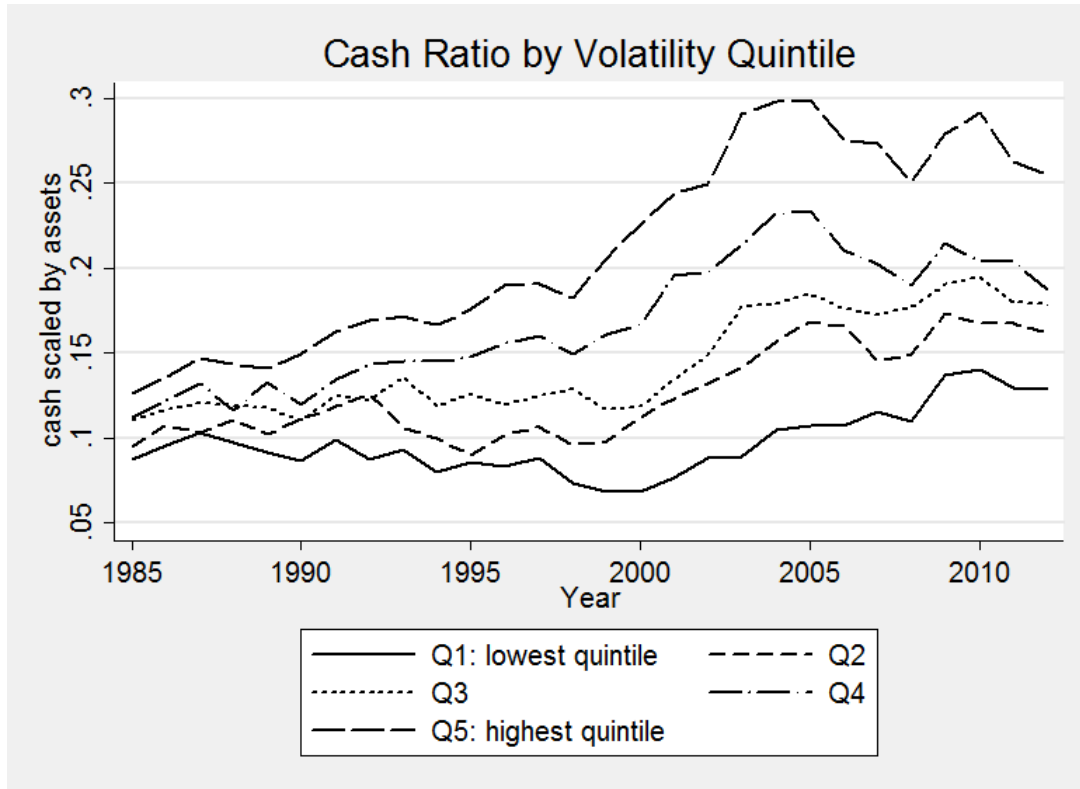
FIGURE 1: Cash ratio by firm size quintile



The sample comprises of firm-year observations from 1970 to 2012 for firms incorporated in the United States, and with positive values for total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC codes 4900-4999) are excluded from the sample. The cash ratio is measured as the ratio of cash and marketable securities to the book value of total assets. Firms are sorted into quintiles based on the book value of total assets in the prior fiscal year. The first quintile includes the smallest firms in the sample, while the fifth quintile includes the largest firms in the sample.

FIGURE 2: Cash ratio by firm cash flow volatility

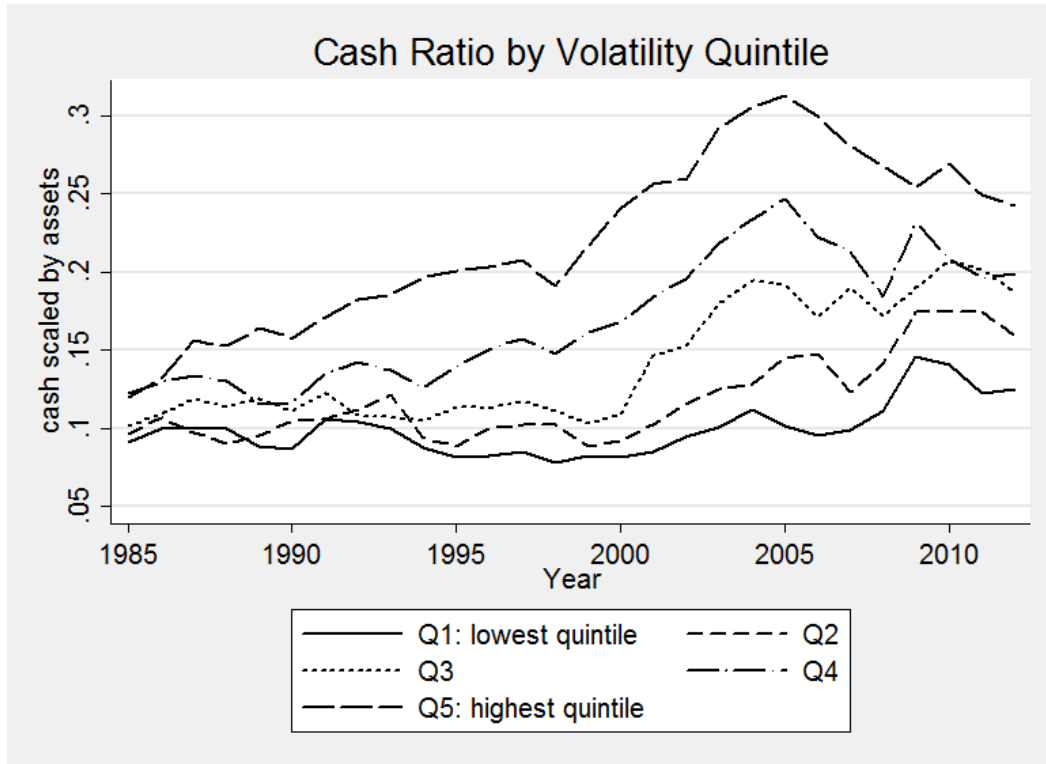
Panel A: cash flow volatility measure based on cash flow available for investment (*CF*)



The sample comprises of firm-year observations from 1985 to 2012 for firms incorporated in the United States, and with positive values for total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC codes 4900-4999) are excluded from the sample. The cash ratio is measured as the ratio of cash and marketable securities to the book value of total assets. Firms are sorted into quintiles based on the cash flow volatility as measured over the prior five years. *CF* is used as the basis for the cash flow volatility measure (see Appendix A for variable calculation). The first quintile includes firms characterized by the lowest volatility, while the fifth quintile includes firms in the highest volatility quintile.

FIGURE 2 continued: Cash ratio by firm cash flow volatility

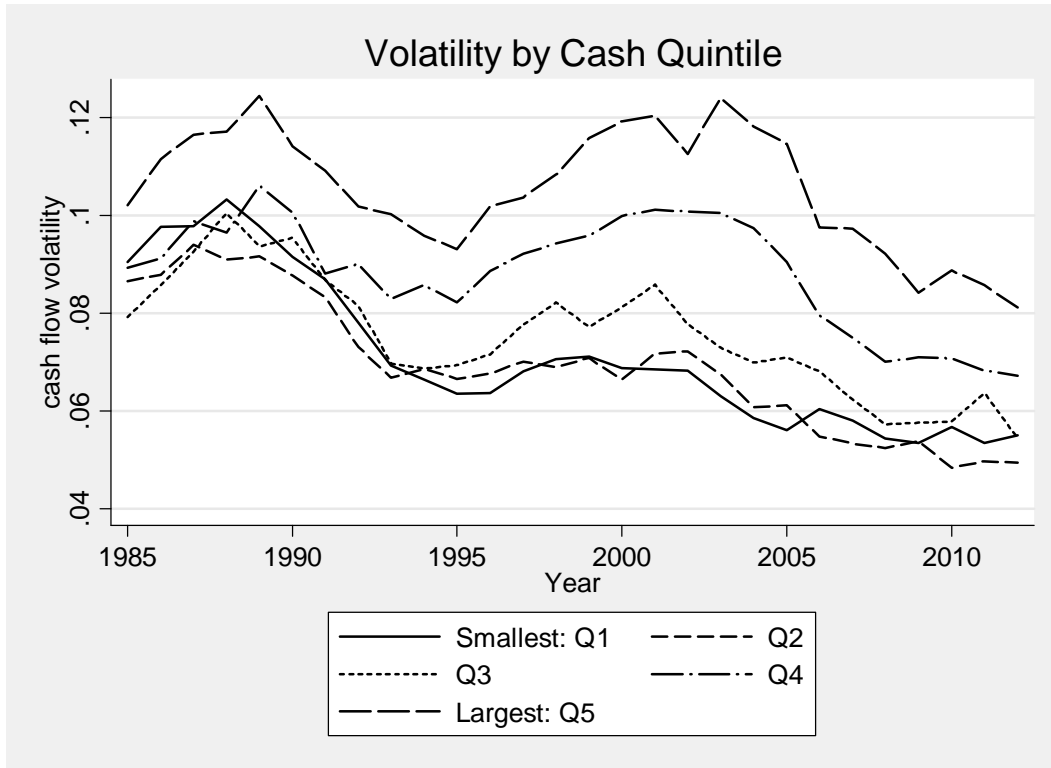
Panel B: Cash flow volatility measure based on earnings before depreciation (*EBD*)



The sample comprises of firm-year observations from 1985 to 2012 for firms incorporated in the United States, and with positive values for total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC codes 4900-4999) are excluded from the sample. The cash ratio is measured as the ratio of cash and marketable securities to the book value of total assets. Firms are sorted into quintiles based on the cash flow volatility as measured over the prior five years. *EBD* is used as the basis for the cash flow volatility measure (see Appendix A for variable calculation). The first quintile includes firms characterized by the lowest volatility, while the fifth quintile includes firms in the highest volatility quintile.

FIGURE 3: Cash flow volatility by firm cash holdings

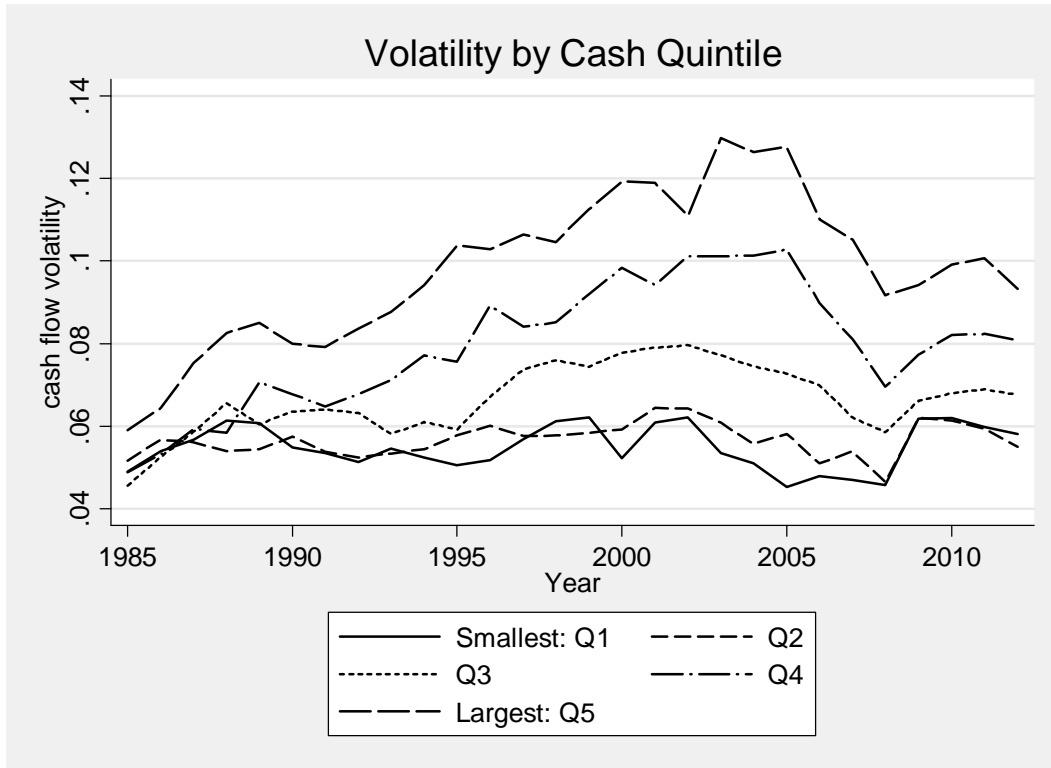
Panel A: cash flow volatility measure based on cash flow available for investment (*CF*)



The sample comprises of firm-year observations from 1985 to 2012 for firms incorporated in the United States, and with positive values for total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC codes 4900-4999) are excluded from the sample. Cash flow volatility is measured using *CF* as its basis (see Appendix A for variable calculation). Firms are sorted into quintiles based on the firm cash holdings (cash and marketable securities) in the current fiscal year. The first quintile includes the smallest firms in the sample in terms of cash holdings, while the fifth quintile includes the largest firms in the sample.

FIGURE 3 continued: Cash flow volatility by firm cash holdings

Panel B: cash flow volatility measure based on earnings before depreciation (*EBD*)



The sample comprises of firm-year observations from 1985 to 2012 for firms incorporated in the United States, and with positive values for total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC codes 4900-4999) are excluded from the sample. Cash flow volatility is measured using *EBD* as its basis (see Appendix A for variable calculation). Firms are sorted into quintiles based on the firm cash holdings (cash and marketable securities) in the current fiscal year. The first quintile includes the smallest firms in the sample in terms of cash holdings, while the fifth quintile includes the largest firms in the sample.

TABLE 1: Descriptive statistics

Panel A: Full Sample Distribution								
Variable	No.Obs	Mean	StD	P5	P25	P50	P75	P95
<i>INV_{NEW}</i>	48,132	0.079	0.130	-0.040	0.002	0.045	0.113	0.310
<i>INV_{TOTAL}</i>	48,132	0.134	0.138	0.009	0.047	0.097	0.172	0.385
<i>CAPX</i>	48,132	0.065	0.072	0.007	0.022	0.044	0.081	0.195
<i>R&D</i>	48,132	0.043	0.066	0.000	0.000	0.013	0.062	0.180
<i>ACQ</i>	48,132	0.026	0.080	0.000	0.000	0.000	0.007	0.155
<i>SALEPPE</i>	48,132	0.005	0.015	0.000	0.000	0.000	0.002	0.024
<i>MAINT</i>	48,132	0.055	0.034	0.016	0.033	0.048	0.067	0.118
<i>CASH</i>	48,132	0.164	0.198	0.005	0.027	0.088	0.229	0.575
<i>OCF</i>	48,132	0.082	0.130	-0.133	0.026	0.090	0.152	0.270
<i>CF</i>	48,132	0.070	0.133	-0.134	0.004	0.069	0.139	0.285
<i>EBD</i>	48,132	0.076	0.139	-0.177	0.038	0.094	0.147	0.252
<i>CFV_{CF}</i>	48,132	0.081	0.062	0.017	0.038	0.064	0.106	0.206
<i>CFV_{EBD}</i>	48,132	0.070	0.068	0.010	0.025	0.047	0.090	0.208
<i>DEBT</i>	48,132	0.217	0.209	0.000	0.034	0.181	0.331	0.596
<i>NETDEBT</i>	48,132	0.053	0.331	-0.529	-0.143	0.084	0.270	0.538
<i>Q</i>	48,132	1.723	1.209	0.762	1.042	1.351	1.938	3.901
<i>SALESGWTH</i>	48,132	0.073	0.240	-0.303	-0.024	0.071	0.173	0.443
<i>MTB</i>	48,132	2.504	2.739	0.536	1.093	1.746	2.875	6.793

Panel B: High Cash Holding Firms								
Variable	No.Obs	Mean	StD	P5	P25	P50	P75	P95
<i>INV_{NEW}</i>	10,959	0.096	0.142	-0.035	0.008	0.060	0.140	0.350
<i>INV_{TOTAL}</i>	10,959	0.148	0.152	0.009	0.050	0.107	0.193	0.424
<i>CAPX</i>	10,959	0.068	0.079	0.006	0.020	0.043	0.085	0.218
<i>R&D</i>	10,959	0.060	0.083	0.000	0.000	0.019	0.097	0.232
<i>ACQ</i>	10,959	0.020	0.071	0.000	0.000	0.000	0.000	0.114
<i>SALEPPE</i>	10,959	0.004	0.014	0.000	0.000	0.000	0.001	0.019
<i>MAINT</i>	10,959	0.051	0.035	0.012	0.028	0.044	0.063	0.117
<i>CASH</i>	10,959	0.415	0.243	0.112	0.226	0.380	0.546	0.886
<i>OCF</i>	10,959	0.108	0.162	-0.170	0.040	0.119	0.200	0.352
<i>CF</i>	10,959	0.118	0.162	-0.133	0.035	0.114	0.207	0.397
<i>EBD</i>	10,959	0.102	0.166	-0.191	0.052	0.119	0.187	0.329
<i>CFV_{CF}</i>	10,959	0.095	0.068	0.021	0.046	0.077	0.125	0.232
<i>CFV_{EBD}</i>	10,959	0.084	0.077	0.011	0.029	0.058	0.114	0.242
<i>DEBT</i>	10,959	0.132	0.209	0.000	0.000	0.029	0.193	0.547
<i>NETDEBT</i>	10,959	-0.283	0.340	-0.818	-0.495	-0.293	-0.081	0.266
<i>Q</i>	10,959	2.190	1.668	0.770	1.135	1.635	2.615	5.606
<i>SALESGWTH</i>	10,959	0.108	0.278	-0.318	-0.012	0.094	0.224	0.566
<i>MTB</i>	10,959	2.915	2.988	0.637	1.234	2.008	3.458	8.072

TABLE 1 continued: Descriptive statistics

Panel C: Low Cash Holding Firms								
Variable	No.Obs	Mean	StD	P5	P25	P50	P75	P95
INV_{NEW}	12,905	0.059	0.119	-0.046	-0.005	0.028	0.085	0.265
INV_{TOTAL}	12,905	0.115	0.126	0.007	0.039	0.079	0.145	0.341
$CAPX$	12,905	0.062	0.067	0.007	0.022	0.042	0.078	0.182
$R\&D$	12,905	0.026	0.047	0.000	0.000	0.005	0.033	0.118
ACQ	12,905	0.027	0.082	0.000	0.000	0.000	0.009	0.163
$SALEPPE$	12,905	0.005	0.015	0.000	0.000	0.000	0.003	0.027
$MAINT$	12,905	0.055	0.032	0.019	0.034	0.049	0.066	0.113
$CASH$	12,905	0.021	0.023	0.001	0.006	0.014	0.026	0.073
OCF	12,905	0.063	0.107	-0.115	0.015	0.073	0.124	0.212
CF	12,905	0.035	0.106	-0.137	-0.014	0.042	0.094	0.188
EBD	12,905	0.059	0.120	-0.159	0.028	0.079	0.123	0.197
CFV_{CF}	12,905	0.074	0.058	0.015	0.034	0.058	0.097	0.191
CFV_{EBD}	12,905	0.060	0.058	0.009	0.022	0.041	0.076	0.175
$DEBT$	12,905	0.299	0.188	0.025	0.170	0.280	0.400	0.624
$NETDEBT$	12,905	0.278	0.194	-0.006	0.145	0.264	0.386	0.612
Q	12,905	1.407	0.752	0.758	0.989	1.211	1.582	2.666
$SALESGWTH$	12,905	0.052	0.221	-0.304	-0.034	0.058	0.149	0.377
MTB	12,905	2.196	2.591	0.462	0.970	1.536	2.489	5.702

Table 1 reports descriptive statistics for the main variables used in the study. **Panel A** presents statistics for the full sample of firms, **Panel B** for high cash holding firms (firms in the top quartile of cash holdings by industry-year), and **Panel C** presents statistics for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. INV_{TOT} represents total firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where total investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE. $CAPX$ is capital expenditure in period t scaled by the book value of total assets at the beginning of period t . $R\&D$ is research and development expenditure in period t scaled by the book value of total assets at the beginning of period t . ACQ is acquisition expenditure in period t scaled by the book value of total assets at the beginning of period t . $SALEPPE$ is equal to the proceeds from the sale of property, plant and equipment in period t scaled by the book value of total assets at the beginning of period t . $MAINT$ is equal to depreciation & amortization in period t scaled by the book value of total assets at the beginning of period t . $CASH$ is equal to cash and short-term investments in period t scaled by the book value of total assets at the beginning of period t . OCF is cash from operations in period t scaled by the book value of total assets at the beginning of period t . CF is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . EBD is earnings before depreciation in period t scaled by the book value of total assets at the beginning of period t . the CFV_{CF} is the standard deviation of CF over the preceding five years. CFV_{EBD} is the standard deviation of EBD over the preceding five years. $DEBT$ is total debt in period t scaled by the book value of total assets at the beginning of period t , where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. $NETDEBT$ is equal to $DEBT$ minus $CASH$. Q is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. $SALESGWTH$ is the log change in net sales between period t and $t-1$. MTB is market value of equity in period $t-1$ divided by the book value of equity in period $t-1$.

TABLE 2: Correlation matrix

	<i>INV_{NEW}</i>	<i>INV_{TOTAL}</i>	<i>CAPX</i>	<i>R&D</i>	<i>ACQ</i>	<i>SALEPPE</i>	<i>MAINT</i>	<i>CASH</i>	<i>OCF</i>	<i>CF</i>	<i>EBD</i>	<i>CFV_{CF}</i>	<i>CFV_{EBD}</i>	<i>DEBT</i>	<i>NETDEBT</i>	<i>Q</i>	<i>SALESG</i>	<i>MTB</i>
<i>INV_{NEW}</i>	0.967***	0.417***	0.477***	0.681***	0.120***	0.195***	0.031***	0.250***	0.047***	0.080***	0.131***	0.206***	0.013**	0.220***	0.299***	0.166***		
<i>INV_{TOTAL}</i>	0.929***	0.502	0.478***	0.665***	0.354***	0.170***	0.059***	0.214***	0.066***	0.092***	0.160***	0.230***	0.043**	0.222***	0.313***	0.180***		
<i>CAPX</i>	0.396***	0.531***	-0.064***	0.015***	0.183***	0.445***	-0.040***	0.074***	0.244***	-0.015***	-0.033***	0.190***	0.144***	0.115***	0.243***	0.086***		
<i>R&D</i>	0.478***	0.458***	-0.111***	0.014**	0.091***	0.123***	0.394***	-0.195***	0.277***	-0.202***	0.223***	0.351***	-0.214***	-0.371***	0.289***	0.054***		
<i>ACQ</i>	0.326***	0.303***	-0.000	0.011**	0.005	0.093***	-0.019***	0.059***	0.041***	0.071***	-0.013**	-0.003	0.327***	0.219***	0.005	0.227***		
<i>SALEPPE</i>	-0.160***	-0.127***	-0.248***	-0.002	-0.077***	0.113***	-0.077***	-0.010*	-0.086**	-0.010*	0.007	-0.001	0.0921***	0.105***	-0.074**	-0.030***		
<i>MAINT</i>	0.0842***	0.386***	0.518***	0.026**	0.005	0.086***	-0.0510***	0.125***	-0.076**	0.097***	0.149***	0.137***	0.117***	0.062***	0.132***	0.096***		
<i>CASH</i>	0.217***	0.184***	-0.096**	0.315***	-0.042***	-0.182***	0.065***	0.272***	0.059***	0.200***	0.265***	-0.324***	-0.802***	0.359***	0.122***	0.168***		
<i>OCF</i>	0.112***	0.169***	0.304***	-0.076***	0.092***	0.059***	0.206***	0.139***	0.841***	-0.176***	-0.238***	-0.092***	-0.097***	0.079***	0.141***	-0.001		
<i>CF</i>	0.354***	0.319***	0.128***	0.305***	0.076***	-0.073***	0.000	0.316***	0.826***	0.547***	-0.078***	-0.092***	-0.229***	-0.307***	0.209***	0.134***		
<i>EBD</i>	0.202**	0.259***	0.410***	-0.0462**	0.106***	0.034***	0.226***	0.140***	0.680***	0.540***	-0.154***	-0.246***	-0.034**	-0.057***	0.116***	0.322***		
<i>CFV_{CF}</i>	0.0644***	0.070***	-0.088***	0.146***	-0.157***	-0.099***	0.008	0.185***	-0.057***	-0.129***	0.550***	-0.051***	-0.052***	0.117***	0.040***	0.062***		
<i>CFV_{EBD}</i>	0.0831***	0.122***	-0.137***	0.246***	-0.134***	-0.131***	0.103	0.240***	-0.202***	-0.198***	-0.086***	-0.213***	0.192***	0.006	0.189***			
<i>DEBT</i>	-0.0507***	-0.011*	0.158***	-0.240***	0.155***	0.158***	0.144***	-0.524***	-0.114***	-0.102***	-0.133***	-0.145***	0.825***	-0.181***	0.173***	0.052***		
<i>NETDEBT</i>	-0.123***	-0.081***	0.152***	-0.322***	0.138***	0.190***	0.138***	-0.781***	-0.143***	-0.337***	-0.177***	-0.210***	0.894***	-0.329***	0.036***	-0.067***		
<i>Q</i>	0.328***	0.331***	0.166***	0.231***	0.091***	-0.138***	0.076***	0.311***	0.277***	0.354***	0.416***	0.023***	-0.200***	-0.282***	0.210***	0.770***		
<i>SALESG_{WITH}</i>	0.303***	0.309***	0.263***	0.021**	0.172***	-0.037***	0.104***	0.100***	0.170***	0.156***	0.400***	0.043***	0.000	0.077***	0.310***	0.141***		
<i>MTB</i>	0.285***	0.296***	0.160***	0.187***	0.104***	-0.116***	0.096***	0.211***	0.233***	0.283***	0.345***	0.004	0.071***	-0.040***	-0.122***	0.948***		

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Table 2 reports Pearson (Spearman) correlations for the main variables used in the study are reported on the upper (lower) diagonal. Variable definitions are as follows: *INV_{NEW}* represents new aggregate firm level investment in period *t* scaled by the book value of total assets at the beginning of period *t*; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE. *INV_{TOTAL}* represents total firm level investment in period *t* scaled by the book value of total assets at the beginning of period *t*; where total investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE. *CAPX* is capital expenditure in period *t* scaled by the book value of total assets at the beginning of period *t*. *R&D* is research and development expenditure in period *t* scaled by the book value of total assets at the beginning of period *t*. *ACQ* is acquisition expenditure in period *t* scaled by the book value of total assets at the beginning of period *t*. *SALEPPE* is equal to the proceeds from the sale of property, plant and equipment in period *t* scaled by the book value of total assets at the beginning of period *t*. *CASH* is equal to cash and short-term investments in period *t* scaled by the book value of total assets at the beginning of period *t*. *OCF* is cash from operations in period *t* scaled by the book value of total assets at the beginning of period *t*. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period *t*. *EBD* is earnings before depreciation in period *t* scaled by the book value of total assets at the beginning of period *t*. The *CFV_{CF}* is the standard deviation of *CF* over the preceding five years. *CFV_{EBD}* is the standard deviation of *EBD* over the preceding five years. *DEBT* is total debt in period *t* scaled by the book value of total assets at the beginning of period *t*, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *NETDEBT* is equal to *DEBT* minus *CASH*. *Q* is a proxy for Tobin's *Q*, calculated as the market value of assets in period *t-1* divided by the book value of equity plus the market value of equity minus the book value of assets minus the book value of equity. *SALESG_{WITH}* is the log change in net sales between period *t* and *t-1*. *MTB* is market value of equity in period *t-1* divided by the book value of equity in period *t-1*.

* p<0.05 ** p<0.01 *** p<0.001

TABLE 3: Cash flow volatility and corporate investment - pooled analysis

Dependent Variable: INV_{NEW}			
Column:	I	II	III
<i>Intercept</i>	0.067*** [61.00]	0.030*** [19.47]	0.035*** [16.28]
<i>CFV</i>	0.136*** [10.02]	0.048*** [3.75]	0.033*** [2.60]
<i>Q</i>		0.023*** [31.82]	0.020*** [26.87]
<i>SALESGWTH</i>		0.040*** [11.48]	0.047*** [14.12]
<i>CASH</i>			0.046*** [7.90]
<i>OCF</i>			0.012 [1.46]
<i>DEBT</i>			-0.031*** [-7.29]
Fixed effects	Industry and Year	Industry and Year	Industry and Year
N	48,132	47,611	47,611
Adj. R ²	0.079	0.135	0.143

Table 3 presents regression results analyzing the relationship between cash flow volatility and investment. Results are reported using an OLS estimate of Eq.(1) for the full sample period. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period t scaled by the book value of total assets at the beginning of period t . *OCF* is cash from operations in period t scaled by the book value of total assets at the beginning of period t . *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . *CFV* is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by ***p<0.01, **p<0.05, *p<0.10 (two sided).

TABLE 4: Cash flow volatility and corporate investment - time period analysis

Dependent Variable: INV_{NEW}			
	<i>Full Sample</i>	<i>Pre-1995</i>	<i>Post-1995</i>
<i>Intercept</i>	0.030*** [19.47]	0.027*** [9.63]	0.032*** [16.75]
<i>CFV</i>	0.048*** [3.75]	-0.041** [-2.46]	0.101*** [5.81]
<i>Q</i>	0.023*** [31.82]	0.026*** [16.85]	0.022*** [27.39]
<i>SALESGWTH</i>	0.040*** [11.48]	0.050*** [10.56]	0.035*** [7.54]
Fixed effects	Industry and Year	Industry and Year	Industry and Year
N	47,611	17,995	29,616
Adj. R ²	0.135	0.127	0.138

Table 4 presents regression results analyzing the relationship between cash flow volatility and investment for the two sub-periods. The table presents results from the OLS estimation of a simplified version of Eq.(1), similar to the model presented in Minton and Schrand (1999), for (i) the full period, (ii) the pre-1995 period, and (iii) the post-1995 period. This modified model is used since the goal, in part, of this table is to confirm the findings presented in Minton and Schrand (1999). Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. CF is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV is the standard deviation of CF over the preceding five years. Q is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. $SALESGWTH$ is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by ***p<0.01, **p<0.05, *p<0.10 (two sided).

TABLE 5: Cash flow volatility and corporate investment partitioned by balance sheet cash holdings (full sample period)

Panel A: Low cash holdings			Panel B: High cash holdings		
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}		
Column:	I	II	Column:	I	II
<i>Intercept</i>	0.014*** [3.81]	0.033*** [7.48]	Intercept	0.038*** [11.78]	0.034*** [7.47]
<i>CFV_{CF}</i>	-0.066*** [-2.80]	-0.098*** [-4.19]	<i>CFV_{CF}</i>	0.106*** [4.37]	0.104*** [4.28]
<i>Q</i>	0.033*** [14.88]	0.026*** [12.05]	<i>Q</i>	0.019*** [15.95]	0.020*** [16.07]
<i>SALESGWTH</i>	0.034*** [5.85]	0.042*** [6.92]	<i>SALESGWTH</i>	0.040*** [5.61]	0.036*** [5.02]
<i>CASH</i>		0.280*** [7.54]	<i>CASH</i>		0.001 [0.09]
<i>DEBT</i>		-0.065*** [-9.92]	<i>DEBT</i>		0.034*** [3.11]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	12,758	12,758	N	10,845	10,845
Adj. R ²	0.113	0.152	Adj. R ²	0.184	0.186

Table 5 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) using *CF* as the basis for the *CFV* measure. **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year) using *CF* as the basis for the *CFV* measure. **Panel C** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) using *EBD* as the basis for the *CFV* measure. **Panel D** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year) using *EBD* as the basis for the *CFV* measure. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . *EBD* is earnings before depreciation in period t scaled by the book value of total assets at the beginning of period t . the CFV_{CF} is the standard deviation of *CF* over the preceding five years. CFV_{EBD} is the standard deviation of *EBD* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's *Q*, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *EMPGWTH* is the growth in the number of employees between period t and $t-1$. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 5 continued: Cash flow volatility and corporate investment partitioned by balance sheet cash holdings (full sample period)

Panel C: Low cash holdings			Panel D: High cash holdings		
Column:	Dependent Variable: INV_{NEW}		Column:	Dependent Variable: INV_{NEW}	
	I	II		I	II
<i>Intercept</i>	0.014*** [4.29]	0.033*** [8.13]	Intercept	0.034*** [10.34]	0.030*** [6.73]
CFV_{EBD}	-0.097*** [-3.82]	-0.141*** [-5.77]	CFV_{EBD}	0.203*** [8.09]	0.198*** [7.93]
Q	0.034*** [14.97]	0.027*** [12.22]	Q	0.018*** [15.44]	0.019*** [15.57]
<i>SALESGWTH</i>	0.032*** [5.62]	0.039*** [6.44]	<i>SALESGWTH</i>	0.042*** [5.92]	0.038*** [5.41]
<i>CASH</i>		0.292*** [7.72]	<i>CASH</i>		0.001 [-0.01]
<i>DEBT</i>		-0.066*** [-9.78]	<i>DEBT</i>		0.028*** [2.65]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	12,920	12,920	N	10,953	10,953
Adj. R ²	0.114	0.155	Adj. R ²	0.194	0.195

Table 5 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) using CF as the basis for the CFV measure. **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year) using CF as the basis for the CFV measure. **Panel C** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) using EBD as the basis for the CFV measure. **Panel D** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year) using EBD as the basis for the CFV measure. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. $CASH$ is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. CF is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . EBD is earnings before depreciation in period t scaled by the book value of total assets at the beginning of period t . the CFV_{CF} is the standard deviation of CF over the preceding five years. CFV_{EBD} is the standard deviation of EBD over the preceding five years. $DEBT$ is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q , calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. $EMPGWTH$ is the growth in the number of employees between period t and $t-1$. $SALESGWTH$ is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 6: Cash flow volatility and corporate investment partitioned by balance sheet cash holdings (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.044*** [6.94]	0.023*** [3.01]	<i>Intercept</i>	0.027*** [4.47]	0.039*** [7.07]
<i>CFV_{CF}</i>	-0.124*** [-3.97]	0.102*** [2.92]	<i>CFV_{CF}</i>	-0.068* [-1.92]	0.102*** [3.09]
<i>Q</i>	0.022*** [5.78]	0.023*** [7.87]	<i>Q</i>	0.028*** [10.55]	0.019*** [14.61]
<i>SALESGWTH</i>	0.047*** [5.21]	0.058*** [4.72]	<i>SALESGWTH</i>	0.040*** [4.84]	0.024*** [2.82]
<i>CASH</i>	0.288*** [5.50]	0.007 [0.56]	<i>CASH</i>	0.275*** [5.68]	-0.001 [-0.09]
<i>DEBT</i>	-0.074*** [-6.95]	-0.002 [-0.11]	<i>DEBT</i>	-0.060*** [-7.22]	0.055*** [3.70]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	4,795	4,007	N	7,963	6,838
Adj. R ²	0.148	0.193	Adj. R ²	0.152	0.183

Table 6 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for the pre-1995 period using *CF* as the basis for the *CFV* measure. **Panel B** reports results for the post-1995 period using *CF* as the basis for the *CFV* measure. **Panel C** reports results for the pre-1995 period using *EBD* as the basis for the *CFV* measure. **Panel D** reports results for the post-1995 period using *EBD* as the basis for the *CFV* measure. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . *EBD* is earnings before depreciation in period t scaled by the book value of total assets at the beginning of period t . the CFV_{CF} is the standard deviation of *CF* over the preceding five years. CFV_{EBD} is the standard deviation of *EBD* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q , calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 6 continued: Cash flow volatility and corporate investment partitioned by balance sheet cash holdings (pre- and post-1995 period)

Panel C: Pre-1995 sample			Panel D: Post-1995 sample		
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.044*** [7.35]	0.023*** [3.06]	<i>Intercept</i>	0.028*** [5.09]	0.034*** [6.07]
<i>CFV_{EBD}</i>	-0.220*** [-5.80]	0.185*** [3.97]	<i>CFV_{EBD}</i>	-0.103*** [-3.35]	0.201*** [6.85]
<i>Q</i>	0.024*** [6.25]	0.021*** [7.57]	<i>Q</i>	0.029*** [10.61]	0.018*** [14.25]
<i>SALESGWTH</i>	0.041*** [4.76]	0.060*** [4.86]	<i>SALESGWTH</i>	0.037*** [4.52]	0.027*** [3.17]
<i>CASH</i>	0.301*** [5.84]	0.009 [0.76]	<i>CASH</i>	0.287*** [5.85]	-0.004 [-0.35]
<i>DEBT</i>	-0.077*** [-7.29]	-0.004 [-0.26]	<i>DEBT</i>	-0.060*** [-7.00]	0.048*** [3.24]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	4,847	4,045	N	8,073	6,908
Adj. R ²	0.156	0.199	Adj. R ²	0.155	0.192

Table 6 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for the pre-1995 period using *CF* as the basis for the *CFV* measure. **Panel B** reports results for the post-1995 period using *CF* as the basis for the *CFV* measure. **Panel C** reports results for the pre-1995 period using *EBD* as the basis for the *CFV* measure. **Panel D** reports results for the post-1995 period using *EBD* as the basis for the *CFV* measure. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . *EBD* is earnings before depreciation in period t scaled by the book value of total assets at the beginning of period t . the CFV_{CF} is the standard deviation of *CF* over the preceding five years. CFV_{EBD} is the standard deviation of *EBD* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q , calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 7: Corporate governance tests

	Observations	Average E-Index	Standard Error
High cash holding firms	2577	2.116	0.025
Low cash holding firms	3391	2.630	0.022
Combined	5968	2.408	0.017
Difference		0.514	0.034
t test of the difference in means (unequal variances)			15.338

Table 7 presents results analyzing the difference in the sample firms' average entrenchment index (E-index) while partitioning on the level of the balance sheet cash holding. The entrenchment index ranges from 0 to 6, where a higher index score corresponds to lower corporate governance rating. E-index is only available every other year from 1990 -2006. For this time period, firm-years with missing E-index data are populated with the E-index of the prior year. **High cash holding firms** are those firms in the top quartile of cash holdings by industry-year and **Low cash holding firms** are those firms in the bottom quartile of cash holdings by industry-year. T-test for the difference in means with unequal variances is based on 5516.96 degrees of freedom (Satterthwaite) and is highly significant at the ***p<0.01 level.

TABLE 8: Multinational Firms (full sample period)

Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings
<i>Intercept</i>	0.021*** [2.65]	0.051*** [7.00]
CFV_{CF}	-0.109** [-2.27]	0.207*** [4.28]
Q	0.037*** [9.97]	0.015*** [8.10]
<i>SALESGWTH</i>	0.044*** [3.90]	0.040*** [3.48]
<i>CASH</i>	0.327*** [5.53]	-0.005 [-0.38]
<i>DEBT</i>	-0.067*** [-5.75]	0.013 [0.66]
Fixed effects	Industry and Year	Industry and Year
N	5,156	4,180
Adj. R^2	0.145	0.220

Table 8 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings for a sample of multinational firms. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q , calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *EMPGWTH* is the growth in the number of employees between period t and $t-1$. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 9: Multinational firms (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.043*** [3.79]	0.057*** [5.95]	<i>Intercept</i>	0.017* [1.93]	0.055*** [6.50]
<i>CFV_{CF}</i>	-0.104** [-2.06]	0.150** [2.17]	<i>CFV_{CF}</i>	-0.101* [-1.65]	0.230*** [4.07]
<i>Q</i>	0.031*** [5.86]	0.008** [2.22]	<i>Q</i>	0.037*** [9.75]	0.016*** [8.74]
<i>SALESGWTH</i>	0.073*** [4.37]	0.118*** [5.54]	<i>SALESGWTH</i>	0.037*** [2.97]	0.013 [1.14]
<i>CASH</i>	0.389** [2.58]	0.016 [0.74]	<i>CASH</i>	0.318*** [5.37]	-0.014 [-0.98]
<i>DEBT</i>	-0.100*** [-4.48]	-0.039 [-1.39]	<i>DEBT</i>	-0.067*** [-5.23]	0.033 [1.52]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	1,726	1,245	N	3,950	3,365
Adj. R ²	0.209	0.201	Adj. R ²	0.141	0.227

Table 9 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings for a sample of multinational firms. **Panel A** reports results for the pre-1995 period and **Panel B** reports results for the post-1995 period. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 10: Using alternative measures to capture investment opportunity (full sample period)

Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings
<i>Intercept</i>	0.074*** [24.32]	0.068*** [17.20]
<i>CFV_{CF}</i>	-0.089*** [-3.70]	0.150*** [6.08]
<i>EMPGWTH</i>	0.030*** [4.55]	0.056*** [6.69]
<i>SALESGWTH</i>	0.042*** [5.94]	0.034*** [3.98]
<i>CASH</i>	0.308*** [8.24]	0.013 [1.51]
<i>DEBT</i>	-0.088*** [-12.93]	0.009 [0.78]
Fixed effects	Industry and Year	Industry and Year
N	12,578	10,692
Adj. R ²	0.128	0.152

Table 10 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *EMPGWTH* is the growth in the number of employees between period t and $t-1$. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 11: Using alternative measures to capture investment opportunity (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.080*** [21.03]	0.063*** [10.47]	<i>Intercept</i>	0.071*** [16.52]	0.071*** [14.02]
<i>CFV_{CF}</i>	-0.112*** [-3.40]	0.138*** [3.73]	<i>CFV_{CF}</i>	-0.065* [-1.84]	0.157*** [4.77]
<i>EMPGWTH</i>	0.033*** [3.13]	0.056*** [4.11]	<i>EMPGWTH</i>	0.028*** [3.38]	0.055*** [5.23]
<i>SALESGWTH</i>	0.042*** [4.23]	0.059*** [3.82]	<i>SALESGWTH</i>	0.042*** [4.34]	0.022** [2.19]
<i>CASH</i>	0.282*** [5.76]	0.012 [0.94]	<i>CASH</i>	0.318*** [6.42]	0.014 [1.27]
<i>DEBT</i>	-0.097*** [-9.74]	-0.038*** [-2.89]	<i>DEBT</i>	-0.083*** [-9.28]	0.036** [2.36]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	4,697	3,947	N	7,881	6,745
Adj. R ²	0.133	0.164	Adj. R ²	0.125	0.147

Table 11 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for the pre-1995 period and **Panel B** reports results for the post-1995 period. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. $CASH$ is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. CF is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of CF over the preceding five years. $DEBT$ is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q , calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. $EMPGWTH$ is the growth in the number of employees between period t and $t-1$. $SALESGWTH$ is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 12: Using total investment as an alternative measure for corporate investment (full sample period)

Dependent Variable: INV_{TOTAL}		
	Low cash holdings	High cash holdings
<i>Intercept</i>	0.083*** [18.24]	0.143*** [5.61]
CFV_{CF}	-0.079*** [-3.19]	0.022*** [17.38]
Q	0.030*** [13.61]	0.045*** [5.77]
<i>SALESGWTH</i>	0.040*** [6.17]	-0.046*** [-5.25]
<i>CASH</i>	0.287*** [7.49]	0.045*** [4.06]
<i>DEBT</i>	-0.072*** [-10.35]	0.091*** [19.54]
Fixed effects	Industry and Year	Industry and Year
N	12,758	10,845
Adj. R^2	0.175	0.201

Table 12 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{TOT} represents total aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where total aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q , calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 13: Using total investment as an alternative measure for corporate investment (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
	Dependent Variable: INV_{TOTAL}			Dependent Variable: INV_{TOTAL}	
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.102*** [15.71]	0.084*** [10.35]	<i>Intercept</i>	0.073*** [11.75]	0.095*** [16.50]
<i>CFV_{CF}</i>	-0.125*** [-3.64]	0.122*** [3.43]	<i>CFV_{CF}</i>	-0.031 [-0.83]	0.155*** [4.41]
<i>Q</i>	0.025*** [6.46]	0.024*** [8.16]	<i>Q</i>	0.033*** [12.09]	0.021*** [16.11]
<i>SALESGWTH</i>	0.048*** [5.20]	0.072*** [5.44]	<i>SALESGWTH</i>	0.035*** [3.97]	0.031*** [3.30]
<i>CASH</i>	0.283*** [5.23]	-0.041*** [-3.19]	<i>CASH</i>	0.286*** [5.70]	-0.048*** [-4.12]
<i>DEBT</i>	-0.085*** [-7.53]	0.004 [0.25]	<i>DEBT</i>	-0.064*** [-7.31]	0.070*** [4.62]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	4,795	4,007	N	7,963	6,838
Adj. R ²	0.169	0.199	Adj. R ²	0.178	0.203

Table 13 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for the pre-1995 period and **Panel B** reports results for the post-1995 period. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{TOT} represents total aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where total aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE $CASH$ is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. CF is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . EBD is earnings before depreciation in period t scaled by the book value of total assets at the beginning of period t . the CFV_{CF} is the standard deviation of CF over the preceding five years. $DEBT$ is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. $SALESGWTH$ is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 14: Using capital expenditure as an alternative measure for corporate investment (full sample period)

Dependent Variable: INV_{CAPEX}		
	Low cash holdings	High cash holdings
<i>Intercept</i>	0.055*** [28.30]	0.052*** [23.87]
CFV_{CF}	-0.078*** [-6.37]	0.018 [1.48]
Q	0.011*** [10.04]	0.009*** [14.81]
<i>SALESGWTH</i>	0.032*** [9.49]	0.039*** [9.87]
<i>CASH</i>	0.025** [2.20]	-0.034*** [-8.20]
<i>DEBT</i>	-0.023*** [-6.81]	0.013*** [2.72]
Fixed effects	Industry and Year	Industry and Year
N	12,758	10,845
Adj. R^2	0.324	0.310

Table 14 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{CAPEX} represents capital expenditure investment in period t scaled by the book value of total assets at the beginning of period t . *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. CF is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of CF over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q , calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 15: Using capital expenditure as an alternative measure for corporate investment (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
	Dependent Variable: INV_{CAPEX}			Dependent Variable: INV_{CAPEX}	
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.066*** [17.21]	0.059*** [14.81]	<i>Intercept</i>	0.048*** [21.08]	0.047*** [18.73]
<i>CFV_{CF}</i>	-0.129*** [-7.25]	0.021 [1.13]	<i>CFV_{CF}</i>	-0.036** [-2.14]	0.012 [0.80]
<i>Q</i>	0.014*** [5.27]	0.010*** [7.33]	<i>Q</i>	0.010*** [9.43]	0.009*** [13.41]
<i>SALESGWTH</i>	0.043*** [7.83]	0.053*** [7.53]	<i>SALESGWTH</i>	0.024*** [5.85]	0.031*** [6.80]
<i>CASH</i>	0.064** [2.29]	-0.035*** [-4.47]	<i>CASH</i>	0.005 [0.46]	-0.032*** [-6.84]
<i>DEBT</i>	-0.024*** [-3.69]	0.008 [0.98]	<i>DEBT</i>	-0.021*** [-5.26]	0.016*** [2.66]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	4,795	4,007	N	7,963	6,838
Adj. R ²	0.230	0.241	Adj. R ²	0.379	0.348

Table 15 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for the pre-1995 period and **Panel B** reports results for the post-1995 period. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{CAPEX} represents capital expenditure investment in period t scaled by the book value of total assets at the beginning of period t . *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by ***p<0.01, **p<0.05, *p<0.10 (two sided).

TABLE 16: Using acquisitions as an alternative measure for corporate investment (full sample period)

Dependent Variable: INV_{ACQ}		
	Low cash holdings	High cash holdings
<i>Intercept</i>	0.021*** [7.38]	0.009*** [4.23]
CFV_{CF}	-0.089*** [-5.77]	0.016 [1.13]
Q	0.006*** [4.60]	0.001* [1.81]
<i>SALESGWTH</i>	0.019*** [4.58]	0.016*** [4.32]
<i>CASH</i>	0.170*** [6.20]	0.001 [0.20]
<i>DEBT</i>	-0.016*** [-3.59]	0.037*** [5.52]
Fixed effects	Industry and Year	Industry and Year
N	12,758	10,845
Adj. R ²	0.066	0.019

Table 16 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{ACQ} represents firm level acquisitions in period t scaled by the book value of total assets at the beginning of period t . *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 17: Using acquisitions as an alternative measure for corporate investment (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
	Dependent Variable: INV_{ACQ}			Dependent Variable: INV_{ACQ}	
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.020*** [5.89]	0.005 [1.57]	<i>Intercept</i>	0.023*** [5.68]	0.012*** [4.13]
<i>CFV_{CF}</i>	-0.056*** [-3.71]	0.022 [1.01]	<i>CFV_{CF}</i>	-0.112*** [-4.38]	0.012 [0.67]
<i>Q</i>	0.000 [0.17]	0.001 [0.51]	<i>Q</i>	0.009*** [4.74]	0.001* [1.84]
<i>SALESGWTH</i>	0.009* [1.68]	0.015*** [2.81]	<i>SALESGWTH</i>	0.026*** [4.47]	0.016*** [3.37]
<i>CASH</i>	0.171*** [4.37]	0.001 [0.21]	<i>CASH</i>	0.170*** [4.78]	0.000 [0.08]
<i>DEBT</i>	-0.017** [-2.51]	0.028*** [3.01]	<i>DEBT</i>	-0.017*** [-2.95]	0.042*** [4.63]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	4,795	4,007	N	7,963	6,838
Adj. R ²	0.077	0.004	Adj. R ²	0.053	0.022

Table 17 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for the pre-1995 period and **Panel B** reports results for the post-1995 period. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{ACQ} represents firm level acquisitions in period t scaled by the book value of total assets at the beginning of period t . $CASH$ is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. CF is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of CF over the preceding five years. $DEBT$ is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. $SALESGWTH$ is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 18: Using R&D as an alternative measure for corporate investment (full sample period)

Dependent Variable: INV_{RD}		
	Low cash holdings	High cash holdings
<i>Intercept</i>	0.011*** [5.55]	0.038*** [16.62]
<i>CFV_{CF}</i>	0.096*** [8.07]	0.097*** [7.04]
<i>Q</i>	0.011*** [9.56]	0.009*** [13.44]
<i>SALESGWTH</i>	-0.011*** [-3.70]	-0.007** [-1.98]
<i>CASH</i>	0.055*** [5.42]	-0.010** [-2.09]
<i>DEBT</i>	-0.030*** [-11.92]	-0.016*** [-4.70]
Fixed effects	Industry and Year	Industry and Year
N	12,758	10,845
Adj. R ²	0.260	0.404

Table 18 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{RD} represents firm level research and development investment in period t scaled by the book value of total assets at the beginning of period t . *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by ***p<0.01, **p<0.05, *p<0.10 (two sided).

TABLE 19: Using R&D as an alternative measure for corporate investment (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
Dependent Variable: INV_{RD}			Dependent Variable: INV_{RD}		
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.021*** [7.36]	0.030*** [8.40]	<i>Intercept</i>	0.006** [2.12]	0.042*** [13.81]
<i>CFV_{CF}</i>	0.058*** [3.24]	0.056*** [3.05]	<i>CFV_{CF}</i>	0.132*** [8.74]	0.125*** [6.44]
<i>Q</i>	0.011*** [6.03]	0.009*** [6.41]	<i>Q</i>	0.011*** [7.71]	0.008*** [12.08]
<i>SALESGWTH</i>	-0.005 [-1.15]	0.007 [1.28]	<i>SALESGWTH</i>	-0.014*** [-3.96]	-0.014*** [-3.31]
<i>CASH</i>	0.026** [2.31]	-0.004 [-0.51]	<i>CASH</i>	0.065*** [4.81]	-0.013** [-2.15]
<i>DEBT</i>	-0.036*** [-9.02]	-0.028*** [-5.40]	<i>DEBT</i>	-0.026*** [-7.99]	-0.009** [-2.07]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	4,795	4,007	N	7,963	6,838
Adj. R ²	0.271	0.370	Adj. R ²	0.257	0.413

Table 19 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for the pre-1995 period and **Panel B** reports results for the post-1995 period. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{RD} represents firm level research and development investment in period t scaled by the book value of total assets at the beginning of period t . *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by ***p<0.01, **p<0.05, *p<0.10 (two sided).

TABLE 20: Using an alternative measure for cash flow (full sample period)

Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings
<i>Intercept</i>	0.031*** [5.98]	0.035*** [6.78]
CFV_{acct}	-0.093*** [-3.04]	0.110*** [3.58]
Q	0.026*** [11.05]	0.020*** [15.25]
<i>SALESGWTH</i>	0.039*** [5.46]	0.025*** [3.11]
<i>CASH</i>	0.280*** [6.41]	0.002 [0.20]
<i>DEBT</i>	-0.064*** [-8.31]	0.045*** [3.48]
Fixed effects	Industry and Year	Industry and Year
N	9,756	8,384
Adj. R ²	0.153	0.185

Table 20 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. CF_{acct} is cash from operations adjusted for interest income and expense plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{acct} is the standard deviation of CF_{acct} over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 21: Using an alternative measure for cash flow (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.048*** [5.50]	0.018 [1.40]	<i>Intercept</i>	0.027*** [4.55]	0.040*** [7.13]
<i>CFV_{CF}</i>	-0.162** [-2.57]	0.155** [2.05]	<i>CFV_{CF}</i>	-0.074** [-2.10]	0.097*** [2.94]
<i>Q</i>	0.018*** [3.34]	0.024*** [5.81]	<i>Q</i>	0.028*** [10.56]	0.019*** [14.65]
<i>SALESGWTH</i>	0.038*** [2.69]	0.029 [1.45]	<i>SALESGWTH</i>	0.040*** [4.84]	0.024*** [2.82]
<i>CASH</i>	0.296*** [3.77]	0.019 [0.93]	<i>CASH</i>	0.276*** [5.70]	-0.001 [-0.08]
<i>DEBT</i>	-0.084*** [-4.66]	-0.003 [-0.16]	<i>DEBT</i>	-0.060*** [-7.23]	0.055*** [3.68]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	1,788	1,546	N	7,968	6,838
Adj. R ²	0.149	0.203	Adj. R ²	0.152	0.182

Table 21 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for the pre-1995 period and **Panel B** reports results for the post-1995 period. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. CF_{acct} is cash from operations adjusted for interest income and expense plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{acct} is the standard deviation of CF_{acct} over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by ***p<0.01, **p<0.05, *p<0.10 (two sided).

TABLE 22: Using an alternative measure for cash flow volatility (full sample period)

Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings
<i>Intercept</i>	0.028*** [5.23]	0.023*** [4.24]
<i>CFV_{CF}</i>	-0.099*** [-3.44]	0.183*** [5.61]
<i>Q</i>	0.030*** [11.07]	0.018*** [12.47]
<i>SALESGWTH</i>	0.044*** [5.65]	0.034*** [3.78]
<i>CASH</i>	0.340*** [7.28]	0.000 [0.03]
<i>DEBT</i>	-0.068*** [-8.59]	0.049*** [3.72]
Fixed effects	Industry and Year	Industry and Year
N	9,727	7,948
Adj. R ²	0.157	0.179

Table 22 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding ten years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 23: Using an alternative measure for cash flow volatility (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.036*** [4.17]	0.022** [2.13]	<i>Intercept</i>	0.025*** [3.66]	0.024*** [3.66]
<i>CFV_{CF}</i>	-0.095** [-2.28]	0.186*** [3.59]	<i>CFV_{CF}</i>	-0.098** [-2.48]	0.185*** [4.45]
<i>Q</i>	0.026*** [5.75]	0.017*** [4.69]	<i>Q</i>	0.032*** [9.51]	0.018*** [12.09]
<i>SALESGWTH</i>	0.053*** [4.45]	0.062*** [3.57]	<i>SALESGWTH</i>	0.040*** [4.04]	0.024** [2.31]
<i>CASH</i>	0.347*** [4.58]	-0.002 [-0.15]	<i>CASH</i>	0.336*** [5.84]	0.002 [0.16]
<i>DEBT</i>	-0.072*** [-4.39]	-0.003 [-0.19]	<i>DEBT</i>	-0.066*** [-7.20]	0.074*** [4.25]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	3,082	2,479	N	6,645	5,469
Adj. R ²	0.171	0.178	Adj. R ²	0.152	0.179

Table 23 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for the pre-1995 period and **Panel B** reports results for the post-1995 period. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding ten years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by ***p<0.01, **p<0.05, *p<0.10 (two sided).

TABLE 24: Using an alternative measure of cash to partition sample (full sample period)

Panel A: Low cash holdings			Panel B: High cash holdings		
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}		
Column:	I	II	Column:	I	II
<i>Intercept</i>	0.014*** [3.81]	0.032*** [6.96]	Intercept	0.044*** [14.03]	0.039*** [8.20]
<i>CFV_{CF}</i>	-0.069*** [-2.98]	-0.097*** [-4.25]	<i>CFV_{CF}</i>	0.116*** [4.70]	0.113*** [4.65]
<i>Q</i>	0.032*** [14.00]	0.027*** [11.88]	<i>Q</i>	0.018*** [14.31]	0.018*** [14.33]
<i>SALESGWTH</i>	0.031*** [5.40]	0.040*** [6.47]	<i>SALESGWTH</i>	0.038*** [5.23]	0.033*** [4.60]
<i>CASH</i>		0.286*** [7.20]	<i>CASH</i>		0.001 [0.11]
<i>DEBT</i>		-0.064*** [-9.58]	<i>DEBT</i>		0.038*** [3.37]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	12,841	12,841	N	10,600	10,600
Adj. R ²	0.109	0.143	Adj. R ²	0.183	0.185

Table 24 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on an alternative measure for balance sheet cash holdings, calculated as cash holdings in period t scaled by total assets net of cash holdings at the beginning of period t . **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *OCF* is cash from operations in period t scaled by the book value of total assets at the beginning of period t . *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . *CFV_{CF}* is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 25: Using an alternative measure of cash to partition sample (pre- and post-1995 period)

Panel A: Pre-1995 sample			Panel B: Post-1995 sample		
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings		Low cash holdings	High cash holdings
<i>Intercept</i>	0.042*** [6.54]	0.027*** [3.51]	<i>Intercept</i>	0.027*** [4.22]	0.045*** [7.49]
<i>CFV_{CF}</i>	-0.115*** [-3.76]	0.109*** [3.30]	<i>CFV_{CF}</i>	-0.075** [-2.17]	0.113*** [3.33]
<i>Q</i>	0.024*** [6.48]	0.021*** [7.46]	<i>Q</i>	0.028*** [9.95]	0.017*** [12.51]
<i>SALESGWTH</i>	0.047*** [5.16]	0.061*** [5.10]	<i>SALESGWTH</i>	0.035*** [4.33]	0.019** [2.18]
<i>CASH</i>	0.249*** [4.54]	0.007 [0.49]	<i>CASH</i>	0.301*** [5.68]	-0.001 [-0.07]
<i>DEBT</i>	-0.073*** [-6.68]	-0.002 [-0.16]	<i>DEBT</i>	-0.059*** [-6.95]	0.063*** [3.99]
Fixed effects	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year
N	4,834	3,930	N	8,007	6,670
Adj. R ²	0.134	0.195	Adj. R ²	0.145	0.181

Table 25 presents regression results analyzing the relationship between cash flow volatility and investment while partitioning on an alternative measure for balance sheet cash holdings, calculated as cash holdings in period t scaled by total assets net of cash holdings at the beginning of period t . **Panel A** reports results for the pre-1995 period and **Panel B** reports results for the post-1995 period. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. $CASH$ is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. CF is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of CF over the preceding five years. $DEBT$ is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. $SALESGWTH$ is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

Table 26: Implications of dividend and stock repurchase policies

Panel A: Dividend paying firms (only)			Panel B: Stock repurchasing firms (only)			Panel C: Both dividend paying and stock repurchasing firms			Panel D: Neither dividend paying nor stock repurchasing firms								
Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}			Dependent Variable: INV_{NEW}								
Low cash holdings			Low cash holdings			Low cash holdings			Low cash holdings								
High cash holdings			High cash holdings			High cash holdings			High cash holdings								
<i>Intercept</i>	0.012 [0.89]	0.025** [2.16]	0.035*** [2.97]	0.042*** [3.90]	0.017 [1.44]	0.017** [2.43]	0.039*** [5.55]	0.052*** [6.32]	<i>Intercept</i>	0.012 [0.89]	0.025** [2.16]	0.035*** [2.97]	0.042*** [3.90]	0.017 [1.44]	0.017** [2.43]	0.039*** [5.55]	0.052*** [6.32]
<i>CFV_{EBD}</i>	-0.083 [-0.84]	0.128 [1.43]	-0.033 [-0.42]	0.129*** [2.04]	-0.088 [-1.00]	0.105 [1.19]	-0.183*** [-5.26]	0.158*** [4.02]	<i>CFV_{EBD}</i>	-0.083 [-0.84]	0.128 [1.43]	-0.033 [-0.42]	0.129*** [2.04]	-0.088 [-1.00]	0.105 [1.19]	-0.183*** [-5.26]	0.158*** [4.02]
<i>Q</i>	0.038*** [4.86]	0.013*** [3.91]	0.016*** [2.64]	0.020*** [6.75]	0.029*** [6.62]	0.013*** [5.79]	0.028*** [6.88]	0.019*** [9.08]	<i>Q</i>	0.038*** [4.86]	0.013*** [3.91]	0.016*** [2.64]	0.020*** [6.75]	0.029*** [6.62]	0.013*** [5.79]	0.028*** [6.88]	0.019*** [9.08]
<i>SALESGWTH</i>	0.049** [1.98]	0.048* [1.86]	0.021 [1.15]	0.021 [1.24]	0.005 [0.24]	0.077*** [3.68]	0.042*** [4.75]	0.030*** [2.61]	<i>SALESGWTH</i>	0.049** [1.98]	0.048* [1.86]	0.021 [1.15]	0.021 [1.24]	0.005 [0.24]	0.077*** [3.68]	0.042*** [4.75]	0.030*** [2.61]
<i>CASH</i>	0.245* [1.74]	0.021 [0.86]	0.293*** [4.16]	0.000 [0.01]	0.321*** [3.68]	-0.002 [-0.12]	0.306*** [6.03]	-0.002 [-0.15]	<i>CASH</i>	0.245* [1.74]	0.021 [0.86]	0.293*** [4.16]	0.000 [0.01]	0.321*** [3.68]	-0.002 [-0.12]	0.306*** [6.03]	-0.002 [-0.15]
<i>DEBT</i>	-0.041** [-2.05]	0.029 [0.80]	-0.052** [-2.43]	-0.045* [-1.72]	-0.048** [-2.12]	0.041* [1.95]	-0.081*** [-6.87]	0.027 [1.31]	<i>DEBT</i>	-0.041** [-2.05]	0.029 [0.80]	-0.052** [-2.43]	-0.045* [-1.72]	-0.048** [-2.12]	0.041* [1.95]	-0.081*** [-6.87]	0.027 [1.31]
Fixed effects	Industry and Year	Industry and Year	Industry and Year	Industry and Year	Industry and Year	Industry and Year	Industry and Year	Industry and Year	Fixed effects	Industry and Year	Industry and Year	Industry and Year	Industry and Year	Industry and Year	Industry and Year	Industry and Year	Industry and Year
N	2,675	2,589	2,655	2,379	2,940	2,963	2,940	4,300	N	2,675	2,589	2,655	2,379	2,940	2,963	2,940	4,300
Adj. R ²	0.129	0.115	0.150	0.230	0.151	0.157	0.151	0.180	Adj. R ²	0.129	0.115	0.150	0.230	0.151	0.157	0.151	0.180

Table 26 presents regression results analyzing the relationship between cash flow volatility and investment for the full sample period while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for dividend paying firms only. **Panel B** reports results for stock repurchasing firms only. **Panel C** reports results for firms that do not engage in either dividend payout or stock repurchasing. Firms are classified as high (low) cash holding firms if they fall in the top (bottom) quartile of firm cash holdings for their respective 2-digit SIC industry classification during a given year. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *EBD* is earnings before depreciation in period t scaled by the book value of total assets at the beginning of period t . *CFV_{EBD}* is the standard deviation of *EBD* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 27: Cash flow volatility and corporate investment during the financial crisis period

Dependent Variable: INV_{NEW}			
Column:	I	II	III
<i>Intercept</i>	0.061*** [22.38]	0.026*** [6.42]	0.030*** [5.65]
<i>CFV</i>	0.211*** [4.92]	0.157*** [3.84]	0.120*** [3.04]
<i>Q</i>		0.022*** [13.02]	0.019*** [10.66]
<i>SALESGWTH</i>		0.020** [2.13]	0.024*** [2.65]
<i>CASH</i>			0.035*** [3.23]
<i>OCF</i>			0.014 [0.62]
<i>DEBT</i>			-0.030*** [-3.21]
Fixed effects	Industry and Year	Industry and Year	Industry and Year
N	6,810	6,733	6,733
Adj. R ²	0.102	0.138	0.143

Table 27 presents regression results analyzing the relationship between cash flow volatility and investment during the financial crisis period (2008-2012). Results are reported using an OLS estimate of Eq.(1) for the full sample period. Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t , where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period t scaled by the book value of total assets at the beginning of period t . *OCF* is cash from operations in period t scaled by the book value of total assets at the beginning of period t . *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . *CFV* is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. *Q* is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

TABLE 28: Using the financial crisis period to address endogeneity concerns

Dependent Variable: INV_{NEW}		
	Low cash holdings	High cash holdings
<i>Intercept</i>	0.012 [0.96]	0.027** [2.35]
CFV_{CF}	-0.167** [-2.02]	0.202** [2.40]
Q	0.034*** [5.18]	0.015*** [6.03]
<i>SALESGWTH</i>	0.022 [1.21]	-0.006 [-0.38]
<i>CASH</i>	0.301*** [4.26]	0.026 [1.02]
<i>DEBT</i>	-0.056*** [-3.56]	0.082** [2.53]
Fixed effects	Industry and Year	Industry and Year
N	1,785	1,655
Adj. R^2	0.155	0.143

Table 28 presents regression results analyzing the relationship between cash flow volatility and investment during the financial crisis period (2008-2012) while partitioning on the level of balance sheet cash holdings. **Panel A** reports results for low cash holding firms (firms in the bottom quartile of cash holdings by industry-year) and **Panel B** reports results for high cash holding firms (firms in the top quartile of cash holdings by industry-year). Variable definitions are as follows: INV_{NEW} represents new aggregate firm level investment in period t scaled by the book value of total assets at the beginning of period t ; where new aggregate investment is equal to the sum of capital expenditure, research & development and acquisitions minus the sale of PPE and depreciation & amortization. *CASH* is cash and short-term investments in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$. *CF* is cash from operations plus R&D minus depreciation & amortization all scaled by the book value of total assets at the beginning of period t . CFV_{CF} is the standard deviation of *CF* over the preceding five years. *DEBT* is total debt in period $t-1$ scaled by the book value of total assets at the beginning of period $t-1$, where total debt is equal to interest bearing long-term debt plus interest bearing short-term debt. Q is a proxy for Tobin's Q, calculated as the market value of assets in period $t-1$ divided by the book value of total assets in period $t-1$, where market value of assets is equal to the market value of equity plus the book value of assets minus the book value of equity. *SALESGWTH* is the log change in net sales between period $t-1$ and $t-2$. All regressions include industry-year fixed effects. Robust t-statistics based on standard errors clustered by industry and year are presented in parentheses under the parameter estimates. Statistical significance is indicated by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two sided).

References

- Acharya, V. V., Almeida, H., & Campello, M. (2007). Is cash negative debt? A hedging perspective on corporate financial policies. *Journal of Financial Intermediation*, 16(4), 515-554.
- Almeida, H., Campello, M., & Weisbach, M. S. (2004). The cash flow sensitivity of cash. *The Journal of Finance*, 59(4), 1777-1804.
- Bates, T. W., Kahle, K. M., & Stulz, R. M. (2009). Why do US firms hold so much more cash than they used to?. *The Journal of Finance*, 64(5), 1985-2021.
- Bebchuk, L., Cohen, A., & Ferrell, A. (2009). What matters in corporate governance?. *Review of Financial Studies*, 22(2), 783-827.
- Biddle, G. C., & Hilary, G. (2006). Accounting quality and firm-level capital investment. *The Accounting Review*, 81(5), 963-982.
- Biddle, G. C., Hilary, G., & Verdi, R. S. (2009). How does financial reporting quality relate to investment efficiency?. *Journal of Accounting and Economics*, 48(2), 112-131.
- Bolton, P., Chen, H., & Wang, N. (2013). Market timing, investment, and risk management. *Journal of Financial Economics*. 109(1), 40-62.
- Boyle, G. W., & Guthrie, G. A. (2003). Investment, uncertainty, and liquidity. *The Journal of Finance*, 58(5), 2143-2166.
- Brown, J. R., & Petersen, B. C. (2011). Cash holdings and R&D smoothing. *Journal of Corporate Finance*, 17(3), 694-709.
- Bushman, R., Smith, A., & Zhang, F. (2012). *Investment-cash flow sensitivities are really capital investment-working capital investment sensitivities*. Working paper.
- Denis, D. J., & Sibilkov, V. (2010). Financial constraints, investment, and the value of cash holdings. *Review of Financial Studies*, 23(1), 247-269.
- Dittmar, A., & Mahrt-Smith, J. (2007). Corporate governance and the value of cash holdings. *Journal of Financial Economics*, 83(3), 599-634.
- Erickson, T., & Whited, T. M. (2000). Measurement error and the relationship between investment and q. *Journal of Political Economy*, 108(5), 1027-1057.

- Erickson, T., & Whited, T. M. (2006). On the accuracy of different measures of q. *Financial management*, 35(3), 5-33.
- Fazzari, S., Hubbard, R. G., & Petersen, B. C. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, 141-195.
- Fritz Foley, C., Hartzell, J. C., Titman, S., & Twite, G. (2007). Why do firms hold so much cash? A tax-based explanation. *Journal of Financial Economics*, 86(3), 579-607.
- Goodman, T. H., Neamtiu, M., Shroff, N., & White, H. D. (2013). Management Forecast Quality and Capital Investment Decisions. *The Accounting Review*. Forthcoming.
- Gompers, P., Ishii, J., & Metrick, A. (2003). Corporate governance and equity prices. *The Quarterly Journal of Economics*, 118(1), 107-156.
- Han, S., & Qiu, J. (2007). Corporate precautionary cash holdings. *Journal of Corporate Finance*, 13(1), 43-57.
- Harford, J. (1999). Corporate cash reserves and acquisitions. *The Journal of Finance*, 54(6), 1969-1997.
- Harford, J., Mansi, S. A., & Maxwell, W. F. (2008). Corporate governance and firm cash holdings in the US. *Journal of Financial Economics*, 87, 535-555.
- Hirth, S., & Viswanatha, M. (2011). Financing constraints, cash-flow risk, and corporate investment. *Journal of Corporate Finance*, 17(5), 1496-1509.
- Hubbard, R. G. (1998). Capital-Market Imperfections and Investment. *Journal of Economic Literature*, 36(1), 193-225.
- Jensen, M. (1986). Agency cost of free cash flow, corporate finance, and takeovers. Corporate Finance, and Takeovers. *American Economic Review*, 76(2) 1-14.
- McNichols, M. F., & Stubben, S. R. (2008). Does earnings management affect firms' investment decisions?. *The Accounting Review*, 83(6), 1571-1603.
- Mikkelson, W., Partch, M., 2003. Do persistent large cash reserves hinder performance? *Journal of Financial and Quantitative Analysis*, 38, 275–294.

Minton, B. A., & Schrand, C. (1999). The impact of cash flow volatility on discretionary investment and the costs of debt and equity financing. *Journal of Financial Economics*, 54(3), 423-460.

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review*, 48(3), 261-297.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187-221.

Opler, T., Pinkowitz, L., Stulz, R., & Williamson, R. (1999). The determinants and implications of corporate cash holdings. *Journal of Financial Economics*, 52(1), 3-46.

Richardson, S. (2006). Over-investment of free cash flow. *Review of Accounting Studies*, 11(2-3), 159-189.

Sloan, R. G. (1996). Do stock prices fully reflect information in accruals and cash flows about future earnings?. *The Accounting Review*, 289-315.

Zhang, X. F. (2007). Accruals, investment, and the accrual anomaly. *The Accounting Review*, 82(5), 1333-1363.