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Two Essays on Cash Holdings: The Compensation Benefits of Corporate Cash Holdings and the Impact of Cash Holdings Volatility on Firm Value

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TWO ESSAYS ON CASH HOLDINGS:

THE COMPENSATION BENEFITS OF CORPORATE CASH HOLDINGS AND THE IMPACT OF CASH HOLDINGS VOLATILITY ON FIRM VALUE

By

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ABSTRACT

Corporate cash holdings have a significantly positive impact on executive compensation, distinct from the well-documented relation between performance and compensation. An increase of cash holdings by 10% of assets corresponds to about $2.7 million additional CEO total compensation. This relation is driven primarily by discretionary compensation components such as bonus and option-based compensation. In companies with weaker governance, the relation between cash holdings and executive compensation is even stronger. Using awards and losses associated with corporate litigation as exogenous shocks to the firms' cash, I show that CEO compensation readily responds to these changes in cash holdings.

Prior studies postulate that the optimal level of firms' cash holding is dynamic and, thereby, managers should actively adjust cash holdings. I find that the more volatile a firm's cash holdings, the higher its firm value. The correlation is more pronounced in smaller firms, younger firms, and firms in high tech industries. The findings are robust when controlling for the level of cash holdings and cash flow volatility, among other factors. The positive connection between cash holdings volatility and firm value is consistent with the need for active management of cash. Specialized managers who actively adjust the amount of cash holdings help enhance the firm value more than generalist managers, consistent with the idea that specialized management has a better understanding of the firm's cash needs.

CHAPTER 1

COMPENSATION BENEFITS OF CORPORATE CASH HOLDINGS

1.1 Introduction

The sentiment that managers are quick to exploit the firms they run for personal gains has received a lot of attention in both the financial press and academic literature. Firms flush with cash are particularly vulnerable to self-serving behavior of their executives. In a seminal paper, Jensen (1986) argues that abundant free cash flow is the main source of the agency problems between managers and shareholders as managers tend to divert this cash surplus to sub-par investments or other organizational inefficiencies. Since then, the empirical literature has highlighted multiple examples of the agency problems brought about by excess cash such as overinvestment (Bates, 2005; Richardson, 2006), poor acquisition choices (Harford, 1999), and misallocation of funds within diversified firms (Lamont, 1997; Berger and Hann, 2007). In addition to investment in projects that increase resources under their control, executives commonly benefit indirectly from high free cash flows via perk consumption (Grinstein, Weinbaum and Yehuda, 2011) and bonuses for completion of merger deals (Grinstein and Hribar, 2004).

In this paper I examine another and likely wide-spread agency cost of high cash holdings, namely executives' ability to divert it toward their personal compensation. To the best of my knowledge, my paper is the first to quantify the positive impact of high cash reserves on the compensation of CEOs and other top executives. I find that the effect of cash holdings on executive compensation is highly economically significant. An increase of cash holdings by 10% of book assets corresponds to an increase of about $2.7 million in total CEO compensation. I show that the relation between cash holdings and compensation is distinct from the well-documented effect of performance on compensation by controlling for several contemporaneous and lagged measures

of operating and stock performance. Furthermore, I find that the relationship between cash and compensation is driven primarily by discretionary compensation components such as bonus and option-based compensation. My results are robust to unobservable CEO characteristics, for example, ability, as the results still hold when I control for CEO fixed effects.

Moreover, I alleviate potential concerns about endogeneity and reverse causality: it is possible that another endogenous firm characteristic can simultaneously determine both cash holdings and CEO compensation, or the causality can flow from compensation to cash holdings if compensation affects managers' risk preferences. I employ several empirical approaches to address endogeneity and establish a causal relation between cash holdings and compensation. In addition to change-on-change regressions and regressions with firm fixed effects, I rely on a natural experiment that results in an exogenous shock to the firms' cash. My natural experiment arises from the resolution of litigation that leads to either a financial award or loss. To ensure that the shock is exogenous, I construct a sample of litigation events with wrongdoing occurring prior to a CEO's tenure to minimize the effect of litigation on compensation through the performance channel. I show that the exogenous cash shock corresponds to a significant change in CEO compensation.

The observed relation between cash holdings and executive compensation is consistent with an agency problem where managers are able to divert cash toward their personal compensation by convincing the board that cash is a measure of superior performance. It is also consistent with the possibility that executives are able to extract more compensation when the firms have more financial flexibility and are able to afford more pay to the executives. These two explanations are not mutually exclusive. My results show that in firms with weaker governance, CEOs are able to derive greater personal benefits from corporate cash holdings. For example, I

find that the positive impact of cash on CEO compensation is more pronounced when institutional holdings, insider ownership, or CEO ownership is smaller. Therefore the evidence suggests that agency problems certainly play a role in explaining the relation between cash holdings and executive compensation.

My paper contributes to the literature by examining the agency costs of cash holdings in the context of executive compensation. Several studies have demonstrated that managers are able to manipulate their option-based compensation (Yermack, 1997; Lie, 2005; and Cicero, 2009). I show that managers have the ability to use corporate cash holdings to influence their salary, bonus, and option-based compensation.

My paper also adds to the literature on the determinants of cash. A number of studies have examined how agency problems affect cash holdings, arriving at mixed conclusions that are indicative of significant cross-sectional variation (Dittmar et al., 2003; Gao, Harford, and Li, 2013; Mikkelson and Partch, 2003; Bates, Kahle, and Stulz, 2009; Harford, 1999; and Harford, Mansi, and Maxwell, 2008). My results suggest that executives derive direct compensational benefits from increasing cash holdings.

Furthermore, my work adds to the studies on the bargaining between firms and stakeholders. Klasa, Maxwell, and Ortiz-Molina (2009) show that firms strategically hold smaller cash reserves to improve their bargaining positions with the unions. Bronars and Deere (1991), Hanka (1998), and Matsa (2006) suggest that firms can improve their bargaining power with unions by issuing more debt. While prior work focuses on labor unions, I examine the potential bargaining power of CEOs vis-à-vis the board. My study suggests that, in the presence of large amounts of cash, it is difficult for the board to prevent the CEO from bargaining for an increased pay level.

The remainder of the paper is organized as follows: I review related literature and develop my hypotheses in Section 2; in Section 3, I describe the data sources; I report empirical analysis and results in Section 4, and I conclude in Section 5.

1.2 Literature Review and Hypothesis Development

1.2.1 Related Literature

My paper is mainly related to two strands of finance literature: cash holdings and CEO compensation. In this section I provide a brief review and connect these lines of literature to my work.

1.2.1.1 Cash Holdings. Several studies have documented the effect of cash on a variety of corporate policies, consistent with the presence of agency costs. In particular, the effect of cash on over-investment has gathered a lot of empirical evidence. Using acquisitions as a measure of investment, Harford (1999) finds that cash-rich firms are more likely to acquire, carry out large acquisitions and experience poor post-acquisition operating performance. Opler, Pinkowitz, Stulz, and Williamson (1999) provide similar evidence that companies with excess cash have higher capital expenditures and spend more on acquisitions even when they appear to have poor investment opportunities. Bates (2005) finds that firms which retain proceeds from subsidiary sales tend to invest more, relative to their industry peers. Richardson (2006) reports higher comprehensive measures of over-investment in firms with the highest levels of free cash flow. In summary, the literature provides convincing evidence that large cash holdings are often associated with agency problems and result in a value loss for the shareholders (Dittmar and Smith, 2007; Harford, 1999; Liu and Mauer, 2011).

1.2.1.2 Executive Compensation. The optimality of executive compensation, its structure and size in particular, has been questioned in a number of recent studies which demonstrate that

executive compensation has a significant discretionary component managers can successfully influence. Option-based compensation is particularly vulnerable to such manipulation. For example, Yermack (1997), Lie (2005), Heron and Lie (2007), and Cicero (2009) all show that executives are able to manipulate both the dates of option grants and exercises to maximize their net gains. There is also evidence that executives affect exercise prices of options that are set based on stock prices around their awards. This is accomplished by delaying the release of good news and accelerating the disclosure of bad news (Aboody and Kasznik, 2000).

More broadly, a series of recent studies document a positive correlation between CEOs' equity incentives and earnings manipulation (Bergstresser and Philippon, 2006, Burns and Kedia, 2006, Peng and Roell, 2008). Furthermore, executives are able to affect their bonuses by manipulating earnings to meet bonus performance benchmarks, especially if realized earnings are close to the lower and upper bounds in the bonus schedule (Healy, 1985; Holthausen, Larcker, and Sloan, 1995; Cheng, Harford, and Zhang, 2015).

In addition to attempting to manipulate compensation outcomes, CEOs can also influence compensation setting. Bertrand and Mullainathan (2001) show that the CEO may affect the composition of the compensation committee. Studies that document shocks to CEO power are also suggestive of rent extraction: CEO pay increases after exogenous reductions in takeover threats (Bertrand and Mullainathan 1998) and decreases after regulatory demands to strengthen board oversight (Chhaochharia and Grinstein 2009).

In this paper I connect these strands of literature to show how corporate cash holdings can facilitate rent-extraction by executives through higher executive compensation. Therefore, cash leads to a direct form of agency cost, outside the realm of corporate empire building and investment misallocation.

1.2.2 Hypotheses

In a neoclassic framework without the divergence of managers' and shareholders' objectives, the level of cash holdings should not have an impact on executive compensation. CEO pay is determined by the firm's operating performance. Cash holdings are the accumulation of the retained earnings for which the current CEO and/or his predecessors were already rewarded for generating. Therefore the level of cash should not matter for CEO pay. [1]

However, in the presence of agency problems, a CEO can extract more pay from the board by using the firm's cash stockpile as evidence of superior performance. In their proxy statements filed with SEC, firms often specify the criteria that the board uses to evaluate the CEO performance and determine the CEO pay. Among more than 20,000 proxies that I read through, some of them explicitly mention that the board uses cash balances as one of the factors in CEO compensation.[2] Although most of firms do not explicitly use the firm's cash level in evaluating CEO performance, a CEO can still convince a board to reward him in presence of excess cash, using the high cash level as an indicator of a superb performance. While contracts are officially set ex ante, there is ex post bargaining at the end of the compensation period to determine how to implement the contract.[3] Ex post, the CEO can argue that he has managed the firm to provide substantial balance sheet flexibility and that he should be paid more.

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[1] Multiple studies have documented a significant relation between excess cash and perk consumption of the CEO or inefficient corporate investment decisions that serve to increase resources under his control (Grinstein, Weinbaum, and Yehuda, 2011; Harford, 1999), but they don't examine annual CEO pay.

[2] For example, ENSCO International Incorporated (in the proxy dated as of March 15, 2006) says it "rewards generation of cash and effective balance sheet management."

[3] In the context of Garvey and Milbourn (2006), the CEO can argue that any poor performance was industry or economy driven and any good performance was firm-specific.

In addition, research on the relation between financial policies and union bargaining have shown that labor unions make fewer concessions in the presence of large profits, high cash, and good stock performance (e.g., Klasa, Maxwell, and Ortiz-Molina, 2009).[4] Similarly, when bargaining with the board, the CEO can also note that the firm's strong financial position (excess cash) makes higher compensation easily affordable.

Based on both scenarios discussed above, I should observe a positive relationship between cash holdings and CEO compensation and, in particular, discretionary components of the compensation such as bonus and stock options, that are more likely to be subject to ex post bargaining than salary.

Hypothesis 1: CEO compensation and, in particular, discretionary components of the compensation, are positively related to the firm's cash holdings.

The agency problem explanation predicts that rent-seeking CEOs in firms with weaker governance will be more successful at extracting additional compensation: they have more bargaining power and thus are more likely to persuade the board to regard excess cash as a measure of superior performance, when the governance is weaker. That is, the ex post bargaining with the board can be more fruitful for a CEO in presence of weaker governance. Therefore, I expect that, in firms with weaker governance, the relation between compensation and cash holdings will be stronger.

Hypothesis 2: In firms with weaker governance, the CEO will extract more compensation in the presence of larger cash holdings.

[4] Klasa, Maxwell, and Ortiz-Molina (2009) find supporting evidence that firms facing more powerful unions strategically hold smaller cash reserves to improve their bargaining position and shelter income from unions' demands.

In the next two sections, I document the construction of the dataset and discuss the empirical test of my hypotheses.

1.3 Data Description

I obtain compensation data for the top executives, including the CEO, from Execucomp. Since Execucomp coverage begins in 1992, my sample covers the period of 1992-2012. Execucomp provides total compensation and the individual components of compensation for the top five executives of S&P 1,500 firms as well as their personal and professional characteristics such as age, tenure, and CEO-Chairman duality.

Firms' financial characteristics are extracted from Compustat. Monthly stock returns are obtained from CRSP. All variables are winsorized at their 1st and 99th percentiles to reduce the influence of extreme observations. I exclude utilities (SIC code between 4900 and 4949) and financial firms (SIC code between 6000 and 6999) as their cash holdings may be affected by regulation such as capital requirements. Distressed firms with negative assets or negative book value of equity are also eliminated from the sample.

I also use corporate litigation from 1992-2011 to identify exogenous shocks to the firm's cash holdings. The sample of litigation events is compiled from civil terminations in Federal district courts by the National Archive of Criminal Justice Data (NACJD) and disseminated by ICPSR (Inter-University Consortium for Political and Social Research). It includes several types of common corporate lawsuits such as securities, labor, employment civil rights, environmental, antitrust, intellectual property and others. I obtain litigation awards, penalties, and dates by matching the names of defendants in the database to the names of firms in my sample. I then read

the case histories and firm filings to identify whether a firm has insurance to cover its lawsuit loss and compute the penalty net of insurance payments.

I extract insider ownership and CEO ownership from Thomson Reuters Insider Filing database. Insider ownership is calculated as the number of shares owned by insiders divided by the total number of common shares outstanding. The number of shares owned by insiders is compiled using insider activity reported on Forms 3, 4, 5, and 144. Insiders are defined as those who have "access to non-public, material, insider information". CEO ownership is defined as the number of shares owned by the CEO relative to the total number of common shares outstanding. I obtain information on institutional holdings from Thomson 13F Institutional Holdings database. The institutional common stock holdings are reported on Form 13F filed with the SEC. Any institutional investor managing more than $100 million is required to disclose this information. Institutional ownership is calculated as the proportion of common shares outstanding that are owned by institutions.

1.4 Empirical Analysis and Results

In this section, I present my main empirical results. I examine whether corporate cash holdings affect the compensation of CEOs and other top executives and test this relation using several approaches including a natural experiment to establish causality in my analyses.

1.4.1 Summary Statistics

I present summary statistics for CEO compensation, firm characteristics, CEO characteristics, and governance metrics in Table 1. All variables expressed in dollar terms are adjusted to 2012 dollars by the CPI index. My main measure of total annual compensation is the Execucomp variable "tdc1", which combines salary, bonus, payouts from long-term incentive

plans, option and stock grants, and other components. The average CEO's total annual compensation is about $5.41 million, part of which is cash compensation comprised of salary ($0.82 million) and bonus ($0.60 million). However, cash compensation is dwarfed by equity-based compensation in the form of option grants, which average $2.14 million, and restricted stock grants of $0.91 million. Long-term incentive plans and other compensation are the smallest components of the CEO pay package comprising $0.22 million and $0.28 million, respectively.[5]

In all subsequent analyses, I scale executive compensation by the book value of the firm's total assets. Firm size is the most significant factor in explaining the cross-sectional variation in executive compensation, which has been well-documented in the literature (See Murphy, 1999, and Frydman and Jenter, 2010, for a comprehensive review). Furthermore, recent theoretical and empirical research, such as Gabaix and Landier (2008), has argued that firm size can explain the increasing trend in CEO compensation. In my sample, the average ratio of total annual compensation to total assets (multiplied by 1,000 to facilitate presentation) is 3.64; the median is significantly lower at 2.00.

Additionally, I report financial characteristics of firms in my sample, including cash holdings and other controls. The average firm holds $640 million in cash, which is significantly higher than the median of $114 million and suggests the presence of firms with very large cash holdings. When I scale cash holdings by total assets, the average firm keeps 15% of its assets in cash while the median firm keeps 8% of its assets in cash.

[5] Other compensation includes perquisites and other personal benefits, termination or change-in-control payments, contributions to defined contribution plans (e.g. 401k plans), life insurance premiums, gross-ups and other tax reimbursements, discounted share purchases, etc.

The average CEO has been in the same position for 7 years, is 52 years old and is 69% likely to hold the Chairman of the Board title as well. On average, institutions own 70% of the outstanding shares, the CEO owns about 3% of the shares, and insiders have 5% of the shares. I provide the definitions of all variables in Appendix A.

In Panel B of Table 1, I report the correlation coefficients among the variables. CEO compensation (scaled by total assets) is positively related to cash holdings (scaled by total assets), with the coefficient being 0.399. It also has positive correlations with ROA and stock returns. Scaled compensation's negative correlation with size is due to the nonlinear relation between size and compensation, which becomes positive when log compensation is used.

To examine the link between cash holdings and CEO compensation, I sort firms into annual deciles based on their cash holdings (scaled by total assets) and compute average CEO compensation for firms in each decile. Figure 1 shows a monotonic and exponential increase in compensation from the lowest cash holding decile "1" to the highest "10", thus, confirming my initial conjecture. This increase is also economically significant in that CEOs of firms in the largest cash decile earn four times more than CEOs of firms from the lowest decile. The magnitude of this result is particularly impressive since I control for firm size and year effects by scaling compensation by total assets and rebalancing deciles annually.

1.4.2 Baseline Analyses

Next, I examine the determinants of CEO compensation in a multivariate setting. My key objective is to identify whether cash holdings can explain the cross-sectional differences in scaled CEO compensation beyond the known effects of firm and industry attributes. The choice of the estimation method and control variables is motivated by prior studies that focus on determinants

of executive compensation (Chhaochharia and Grinstein, 2009; Core, Guay, and Larcker, 2008; Frydman and Saks, 2010; Graham, Li, and Qiu, 2011).

In Table 2 I present the results of the three regressions in which the dependent variable is total CEO compensation scaled by total assets and multiplied by 1,000. In each column I control for year fixed effects and cluster standard errors at the firm level.

In the first column, I control for the contemporaneous financial characteristics of the firm, namely, firm size (total assets), growth opportunities measured by market to book, current and past profitability measured by the return on assets (ROA and lagged ROA), and stock performance measured by the one-year stock return. I use contemporaneous rather than lagged controls since the compensation contract is set at the beginning of the year and its components are finalized at the end of the same fiscal year in which I observe cash holdings and other financial characteristics. In unreported analysis, I use lagged control variables and the results are robust. Moreover, I control for the indicator of CEO-Chairman duality, the length of his tenure with the firm, and his age. In addition to year fixed effects, I use firm fixed effects to control for unobservable time-invariant firm characteristics that may affect cash holdings and compensation.

I find that among all independent variables with the exception of firm size, cash holdings is the most statistically significant factor in determining CEO compensation, with a positive coefficient of 4.04 and a t-statistic of 7.81, indicating that cash is associated with higher CEO compensation. In economic terms, an increase in cash holdings of 10% of assets (less than one standard deviation) translates into a $2.7 million increase in total CEO compensation (holding the total assets at the mean value of $6,608 million), which is an economically large effect.

The other determinants have signs consistent with the existing literature. The coefficient on firm size is significant and positive. Those on return on assets and stock return are positive and

significant, consistent with the idea that CEOs are rewarded for better accounting and market performance. CEO duality is also positive and significant. Market-to-book ratio is positive and significant, implying that growth firms tend to pay their CEOs more (relative to the firm size) than value firms.

In Column (2), I introduce CEO fixed effects to control for unobservable personal characteristics such as talent or education, and the impact of cash on CEO compensation continues to hold. In addition to year fixed effects, Column (3) also incorporates the combination of firm and CEO fixed effects, and the results remain the same. Note that the effect of CEO tenure and age on compensation is negative in Column (1), but those coefficients are not significant once I control for CEO fixed effects in Column (2) and Column (3). Overall, my results in Table 2 demonstrate a strong relation between cash holdings and CEO compensation even after accounting for other factors known to affect compensation, including past performance. They provide strong support for my hypothesis that there exists a robust positive relation between cash holdings and compensation.

1.4.3 Corporate Governance

Since poorly governed firms are more likely to be subject to agency problems, I focus on the interaction between cash holdings and three proxies for corporate governance: institutional ownership, insider ownership, and CEO ownership. Greater institutional ownership represents more external monitoring and thus better governance. Larger insider ownership and CEO ownership can be more effective in aligning the interests of executives with those of the shareholders than otherwise (Jensen and Meckling, 1976; Jensen 1993; and Shleifer and Vishny 1986). Those three variables have been used as indicators of governance in the literature. For example, Harford, Mansi, Maxwell (2008) use greater insider and institutional ownership as

measures of better governance; Core, Holthausen, Larcker (1999) use larger CEO ownership as an indicator of better governance; Core and Larcker (2002) show that, when there is a mandatory ownership by managers, firm performance increases due to better governance. If the relation between cash holdings and CEO pay is an outcome of an agency conflict, then it will be weakened in firms with greater institutional ownership, insider ownership, or CEO ownership.

The results are reported in Column 1, 2, and 3 of Table 3 respectively. I find that the interaction term between cash holdings and institutional ownership is negative and significant, indicating that cash holdings translates into higher CEO compensation when institutions own fewer shares. The interaction terms between cash holdings and insider ownership, and between cash holdings and CEO ownership, are also negative and significant. The fact that the relation between cash and compensation varies predictably with markers of the agency conflict strongly suggests that the relation results from an agency conflict. The results are consistent with my hypothesis that, in a better governed firm, the CEO is less likely to be able to use high cash holdings to justify higher compensation.

1.4.4 The Individual Components of CEO Compensation

I further examine the relationship between CEO compensation and cash holdings by separating CEO compensation into individual components: salary, bonus, option awards, restricted stocks, long-term incentive plans, and other compensation. In Table 4 I report the results from the regressions of the individual compensation components, where the compensation components are scaled by total assets and multiplied by 1,000. I follow the same specification with firm fixed effects as in Column 1 of Table 2.

All the components of CEO pay, with the exception of restricted stock grants, are positively affected by cash holdings. For example, the relation between cash holdings and the bonus is

statistically and economically significant (coefficient=0.58 and t-statistic=5.57). In economic terms, an increase in cash holdings of 10% of assets increases the CEO's bonus by $0.39 million. I find that bonus is also positively affected by ROA and stock returns, consistent with common compensation practices. The scaled value of option grants is positively related to cash holdings, which is unlikely to be due to past performance as I control for current and past financial and market performance. In summary, while bonus and option grants are expected to reward past performance and ensure future performance, respectively, they both are independently affected by cash holdings. The coefficient on salary is also positive, but its magnitude is smaller than those of the bonus and option grants. This fits with the agency explanation: it is easier to justify higher performance-linked pay than higher base salary, and CEOs may extract value from the company through the discretionary compensation component (i.e., the bonus) and option grants which can be used to create an appearance of performance-related compensation.

1.4.5 Excess Cash Holdings

Previous research has demonstrated that corporate cash holdings are determined by a variety of considerations such as investment opportunities, precautionary savings, and others. Therefore, some firms, despite their large cash holdings, may have very little discretionary cash and would not be viewed by their boards as "cash rich." To adjust for this, I follow the approach of Dittmar and Mahrt-Smith (2007) to compute a measure of discretionary or excess cash holdings that is more likely to be expropriated by executives. First, I compute the difference between the natural log of observed cash divided by net assets and the predicted cash level. The expected cash is estimated using the following equation:

$$Ln\left(\frac{Cash_{i,t}}{NA_{i,t}}\right) = \beta_0 + \beta_1 Ln(NA_{i,t}) + \beta_2 \frac{FCF_{i,t}}{NA_{i,t}} + \beta_3 \frac{NWC_{i,t}}{NA_{i,t}} + \beta_4 (Industry\ Sigma)_{i,t} + \beta_5 \left(\frac{\widetilde{MV}_{i,t}}{NA_{i,t}}\right) + \beta_6 \frac{RD_{i,t}}{NA_{i,t}} + Year\ Dummies + Firm\ Fixed\ Effects + \varepsilon_{i,t}$$

where *NA* is the net assets, *FCF* is the free cash flow, *NWC* is the net working capital, *Industry sigma* is the standard deviation of the industry average of *FCF/NA* in the past ten years, *MV* is the market value of equity, and *RD* is the research and development expenditures. The detailed definitions of variables used in this calculation are provided in Appendix B. To be consistent with other analysis in my paper, I take the exponential of this excess cash measure from Dittmar and Mahrt-Smith (2007), multiply it by net assets, and then scale it by total assets. This ensures that the excess cash variable in my tests is the excess cash holdings scaled by total assets.

In Table 5, I report the results from the regressions of total compensation and its individual components where excess cash serves as the key independent variable. Consistent with my prior findings, the amount of excess cash is positively and significantly related to total annual compensation. With the exception of restricted stock grants and long term incentive plans, I find that there is a strong and significant positive relationship between a firm's excess cash holdings and total CEO compensation and its components. The effect of control variables on compensation components remains similar. Overall, the results in Table 5 confirm my findings in Tables 2-4 and support my hypothesis: when a firm is holding excess cash, the CEO benefits through high overall compensation and, in particular, its discretionary components such as bonus and option awards.

1.4.6 Endogeneity

So far I have established a strong correlation between CEO compensation, including its components, and corporate cash holdings. Moreover, this relation is robust to firm characteristics including past performance, CEO characteristics, and year and firm fixed effects. However, it is

possible that compensation is positively influenced by other unobservable attributes that are not captured by the fixed effects and can simultaneously affect cash. Alternatively, the causal relation between cash and compensation can flow in the opposite direction if current compensation of the CEO affects his risk preferences and, therefore, determines cash holdings.

I address the above concerns and conduct several tests to further demonstrate that cash holdings have a direct effect on CEO compensation. First, I use the change-on-change approach, which allows us to capture a marginal change in compensation due to the change in cash holdings. Second, to establish causality, I use an exogenous shock to the firm's cash and examine its effect on compensation.

1.4.6.1. Change-on-Change Analysis. In the change-on-change analysis, I regress annual changes in total compensation and individual compensation components on annual changes in cash holdings and changes in several other firm attributes. This analysis allows us to reduce stickiness in cash holdings and compensation due to the factors that stay constant overtime such as the board's preference for a certain level of cash holdings and a certain level of compensation.

The results reported in Column 1 of Table 6 show a significant and positive relationship between the change in cash holdings and the change in CEO compensation (coefficient=6.00 and t-statistic=11.05), which is consistent with my prior findings. The relationship between cash holdings and salary, bonus, option awards, and restricted stock grants is positive and significant. Long-term incentive plans and other compensation are not significantly related to cash. In summary, the results of Table 6 show that the relationship between CEO compensation and cash holdings holds even when I identify it using yearly changes in both dependent and independent variables. These regressions control for changes in total assets, market-to-book, return on assets,

and stock returns. For the purposes of this analysis, I omit control variables with predictable one-unit annual changes such as firm age and CEO age or infrequent changes such as CEO duality.

1.4.6.2. A Natural Experiment. Next, I examine the effects of an exogenous shock to the firm's cash on its CEO compensation. I expect that CEO compensation is going to increase (decrease) after a positive (negative) shock to the firm's cash. My exogenous event is based on won and lost corporate litigation events, which result in cash inflows or outflows due to awards or penalties. I expect CEO compensation to increase in response to cash increases from litigation wins and to decrease in response to cash decreases from litigation losses.

To construct the sample, I match the names of firms in my sample to the names of plaintiffs and defendants in corporate lawsuits resolved in a given year. For the lost lawsuits, I are careful to include only those that were filed before the beginning of the current CEO's tenure to ensure that the change in compensation does not reflect the board's and shareholders' dissatisfaction with the CEO who may be guilty of wrongdoing (the exclusion restriction). Moreover, I net insurance payments out of the litigation loss to obtain a clean net effect on cash holdings.

The resulting sample includes 205 firm-years with litigation awards or penalties. I scale the litigation award (a positive value) or penalty (a negative value) by the firm's cash in the prior year to capture the effect of litigation on the firm's cash holdings. All other control variables remain largely the same as in previous analyses. The models also include firm fixed effects because some firms experience resolution of litigation in multiple fiscal years. I report the effect of litigation awards and penalties on total compensation in Table 7. In column 1, I include the dummy variable "Litigation award" which is one if the company gains from winning the lawsuit and zero if it loses the lawsuit. In column 2, I include the scaled litigation award/penalty (the amount won

or lost by firms as a result of corporate lawsuits, scaled by the amount of cash in the prior year). The sample in Column 3 comprises of only the subset of firms who win lawsuits. I continue to find the positive effect of cash holdings on compensation in all three columns. In addition, I observe the positive effect of receiving an award in column 1. The scaled litigation award/penalty has a positive coefficient of 3.968 with the t-statistic of 2.85 in column 2. On the subset of firms who have positive shocks (column 3), the impact of the scaled award is significantly positive. In summary, the results indicate that positive exogenous shocks to cash result in increases in executive compensation, which confirms that cash has a direct and causal effect on compensation.

1.4.7 Compensation of Other Top Executives

I study the relationship between cash holdings and the compensation of non-CEO top executives. This will enable us to see if the relationship between cash holdings and compensation is captured solely by CEOs or is one that benefits all top executives.

I first examine the effect of cash holdings on CFO compensation by regressing CFO total compensation (scaled by total assets) on cash holdings and control variables in the first column of Table 8. In the second column, I expand the analysis to include all top five executives less the CEO. The dependent variable is the sum of the compensation of the top five executives (excluding CEO) scaled by total assets and multiplied by 1,000 similar to previous analyses. In both cases I find a positive relationship between cash holdings and top executive compensation with the coefficients significant at the 1-percent level. Thus, the executive team broadly benefits from its firm's high cash levels.

1.4.8 Cash Holdings in Different Fiscal Quarters

If the CEO uses cash holdings in his compensation bargaining, he may be motivated to focus on the end-of-year amount when his annual compensation is finalized. I thus examine whether the cash holdings are higher in the fourth quarter of the fiscal year. Table 9 summarizes the quarterly cash holdings of firms who have quarterly cash data in all four quarters of a fiscal year. Panel A includes all the public firms from Compustat in the sample period, and Panel B has the firms in my sample. I report the mean and standard deviation of cash holdings, measured as cash scaled by total assets, for each fiscal quarter. I use a t-test to determine if cash holdings in the fourth quarter are statistically different from average cash holdings in the first three quarters. The results show that the cash holdings in the fourth quarter are significantly higher than the average of the previous three quarters.[6] While a focus on fiscal year-end balance sheet numbers is consistent with many motivations, it is important to note that the higher cash numbers are not inconsistent with my inference so far. That is, if CEOs know that higher cash leads to higher pay, it would be odd to find that they would manage cash down at the end of the year.

1.4.9 Additional Robustness Tests

1.4.9.1. Eliminating CEO Turnover Years. To eliminate the effects of incomplete compensation data during the years surrounding CEO turnover, I eliminate both the first and last year of a CEO's tenure with a particular firm.[7] Moreover, this exclusion affects the years where a

[6] Due to the differences in quarterly cash holdings, I repeat all of our previous tests using the average of quarterly cash holdings for each firm's fiscal year as opposed to the fiscal year end or Q4 amount. All results are robust to this alternative cash holdings measurement.

[7] The data in the first year is unreliable as some CEOs may work for 7 months in the first year of appointment while others work for the whole 12 months as the first year is the transition year. I look at the first "full"

new CEO may lack bargaining power vis-à-vis the board over his annual compensation contract. After the exclusion of these transitional years, I find that cash holdings still have a positive and significant effect on CEO compensation (Table 10).

1.4.9.2. Fama-MacBeth Estimation. Further, I replicate my main result using the Fama-MacBeth procedure. In Table 11 I report the time series of the coefficients on cash holdings from annual regressions of CEO compensation, as specified in Column 1 of Table 2. I find that the Fama-MacBeth procedure confirms my main results, as demonstrated by the positive and significant coefficient on cash holdings (mean=7.95, t-statistic=19.14).

1.5 Conclusions

I find that corporate cash holdings have a positive and significant effect on the compensation of the CEO and other top executives. An increase of cash holdings by 10% of assets corresponds to an increase of about $2.7 million in CEO total compensation. The results are robust to various empirical specifications such as controls for past financial and market performance, CEO and firm fixed effects, change-on-change regressions and excess cash regressions. The relation between cash and executive compensation is stronger in firms with weaker governance. I further mitigate concerns of endogeneity by showing that CEO compensation readily responds to these changes in cash holdings in a natural experiment setting of corporate litigation resolution associated with financial awards or penalties.

To the best of my knowledge, my paper is the first one to provide comprehensive empirical evidence of the positive impact of cash holdings on executive compensation. I also explore the

year of the CEOs. I find that the relation between cash and CEO compensation is still positive and significant.

reason for the effect of cash on executive compensation and the evidence suggests that agency problems play a role. My paper thus documents a likely wide-spread agency cost of high cash holdings outside the realm of corporate empire building and investment misallocation, namely the executives' ability to divert it toward or use it to justify higher personal compensation.

CHAPTER 2

VOLATILITY OF CASH HOLDINGS AND FIRM VALUE

2.1 Introduction

Theory postulates that the net costs and benefits of a firm's liquid cash holdings yield an optimal cash level that maximizes the firm value[8]. Ensuring that cash holdings remain at the optimal level can increase firm value by preventing underinvestment, overinvestment, and outright stealing by entrenched managers[9]. Given that the costs and benefits of cash holdings are time varying, the optimal cash level should also be dynamic, and the dynamic nature of optimal cash holdings require firms to adjust cash regularly. Thus, for a firm that actively chases the optimal level of cash holdings, the volatility of the firm's cash holdings (henceforth, cash volatility) would be greater and so would its firm value. Though ample empirical evidence suggests that cash holdings are valuable, few studies exist that examine the importance of cash volatility on firm value.

In this paper I investigate the relationship between cash volatility and firm value. To begin, I measure firm value using Tobin's Q and a firm's cash volatility as the 3 year quarterly standard deviation of cash holdings to account for within year adjustments to cash holdings. I obtain a sample of 11,758 firms during the period of 1992 to 2013. I first find that cash volatility is positively correlated with Tobin's Q after controlling for the level of cash holdings and other factors that prior literature shows to be correlated with firm value. The result is consistent with

[8] Myers and Majluf (1984), Jensen (1986), and Myers and Rajan (1998)
[9] Harford (1999), Pinkowitz and Williamson (2005), Mikkelson and Partch (2003), and Kalcheva and Lins (2007)

the notion that active adjustment of cash holdings to the dynamic optimal cash target is value-increasing.

I further hypothesize that the positive correlation between cash volatility and firm value should not be homogenous across firms. The relationship should be more pronounced in younger firms, smaller firms, high-tech firms, and firms managed by specialized CEOs. First, younger and smaller firms have limited access to affordable external capital, making cash a valuable commodity. At the same time, younger and smaller firms also tend to be less profitable. Due to the high demand and limited supply of cash, adjusting cash to its optimal level is important and therefore warrants a stronger relationship between cash volatility and firm value for smaller and younger firms. I find a stronger association between cash volatility and firm value for younger firms compared to older firms. In addition, as firm size increases the magnitude and significance of the relationship between cash volatility and firm value decreases monotonically.

Second, high-tech firms need to take advantage of opportunities quickly due to the speed of their competitors and the creation of new products. This rapidly changing environment and availability of investment opportunities in high tech industries demands that firms are careful in choosing their cash levels. High-tech firms that actively adjust cash to its optimal level should benefit more in the way of firm value than low-tech firms where the optimal cash level is not as volatile. By splitting firms based on the technological level of their corresponding industries I am able to determine whether or not cash volatility is related to firm value in both of these two industry classifications. While cash volatility is positively related to firm value in both low-tech and high-tech firms, the benefit for high-tech firms is significantly larger than low-tech firms. Overall, by analyzing different subsamples of firms, my results report a stronger relationship

between cash volatility and firm value for younger, smaller, and high-tech firms than their respective counterparts.

Third, CEOs who are experienced in their firms have in-depth knowledge of its industry and financials. Specialized CEOs of this type should have a good understanding of the optimal level of cash for their firm. Due to their knowledge of optimal cash levels, specialist CEOs have the ability to accurately adjust cash holdings to meet this optimal level and in turn add value to the firm. Specialists are defined as CEOs with their experience focused on a minimal number of firms and industries[10]. A CEO who has worked extensively for one firm, such as a founder, would be included in the specialist definition. Alternatively, generalist CEOs have a broad range of experience from working in multiple industries and firms therefore they have accumulated general business skills and knowledge. My results support the benefit of specialized CEOs by presenting a positive association between firm value and cash volatility when the CEO is a specialist. On the other hand, when a firm with high cash volatility is managed by a generalist CEO, firm value is actually lower. This is an important result, especially in light of the observations of Custodio, Ferreira, and Matos (2013) who document a pay premium for generalist CEOs over specialist CEOs, but find no rise in firm value.

The positive relationship between cash volatility and firm value continues to hold even when cash flow volatility is used as an additional determinant of firm value. Cash flow volatility provides information on the riskiness of a firm via the variability in a firm's cash flows. The robustness of the relationship between cash volatility and firm value highlights the importance of the movement of cash holdings in addition to the impact of cash flow volatility.

[10] I use the Generalist Ability Index, or GA Index, of Custodio, Ferreira, and Matos (2013) to classify a CEO as either a generalist or specialist.

Although cash volatility should be important to firm value, as I have proposed and established in this paper, the literature has been lacking in this area. To the best of my knowledge, my study is the first one to examine the importance of cash volatility in determining firm value. My paper contributes to the literature by filling the void in the literature. I study the connection between the movement of cash and firm value which provides insight into the role of actively managing cash. My findings suggest that an informed and active management of cash should be beneficial to shareholders. The relation between cash volatility and firm value are strongest in small, young, and high-tech firms. CEOs' industry-specific experience also helps to generate a stronger impact of cash adjustment on firm value.

The rest of the paper is as follows: Section 2 reviews the literature and develops the hypotheses. Section 3 describes the data and methods used in the analysis. Section 4 reports the empirical results on the relationship between cash volatility and firm value. Section 5 presents the results of additional robustness checks. Section 6 concludes by summarizing the contributions of the paper and discussing potential further research in this area.

2.2 Literature Review and Hypothesis Development

2.2.1 Related Literature

The focus of this paper is centered on the cash holdings strand of finance literature. Many studies have examined the impact of cash holdings on different aspects of the firm, however none have looked at the volatility of cash holdings. Analyzing the level of cash holdings alone tells only some of the story. Understanding the variability of cash holdings within a firm can give further insight into the benefits of proactive cash management.

The increase in cash holdings literature over the past two decades is in no doubt a response to the hoarding of cash by firms. Bates, Kahle and Stulz (2009) show that there has

been an increase in firm cash holdings over the past 20 years. Many of the findings related to increased cash levels paint a poor picture of the impact of high levels of cash holdings or excess cash on a firm. Opler, Pinkowitz, Stulz, and Williamson (1999) report that companies with excess cash partake in more acquisitions and increase their capital expenditures even when they appear to have poor investment opportunities. Expanding further on the findings of big spending by cash rich firms, Harford (1999) finds that firms with large cash reserves are not only more likely to acquire another firm, but to acquire large firms. These acquisitions are followed by poor operating performance. Both Lamont (1997) and Berger and Hann (2003) present results consistent with cash rich segments cross-subsidizing poorly performing segments in diversified firms.

From an agency standpoint, Dittmar and Mahrt-Smith (2007) present evidence that when agency problems are greater within a firm, shareholders put a lower value on dollars used to increase cash holdings. Cheng, Harford, Hutton, and Shipe (2015) show that higher levels of cash holdings lead to higher levels of executive compensation regardless of firm performance, reinforcing the arguments of Jensen (1986) that higher cash holdings lead to agency problems within the firm. The results of recent literature surrounding cash rich firms seem to indicate that firms with high levels of cash experience higher and less than optimal spending.

While the literature showing the negative effect of holding large amounts of cash is vast, Mikkelson and Partch (2003) find evidence supporting the need for large cash reserves. They find that firms with persistent high cash holdings over 5 years are accompanied by greater investment and greater growth in assets without hurting corporate performance. In addition, Dittmar and Mahrt-Smith (2007) show that the negative effects of holding cash are directly

related to the governance of a firm. They show that the negative impact of large cash holdings is canceled out in well governed firms.

In this paper, I examine cash holdings in a new way. My results indicate that high cash volatility is associated with higher firm value. Therefore, it is not only the level of cash a firm holds that is important, but how actively cash is managed.

2.2.2 Hypotheses

In testing the relationship between cash volatility and firm value there are two hypotheses. The first assumes that the amount of cash held relative to the size of the firm at any given point in time is the effect of a manager's strategic decision making and not a mechanic residual of earnings. All industries and firms are different making the optimal level of cash that should be held unique in the cross section of firms and over time. Due to this ever changing optimal cash level firms should be adjusting cash regularly to keep up. Actively managing cash and optimizing cash levels to capitalize on investment opportunities or build precautionary savings is a necessity of firm management and a major component of firm value. Therefore, the decision to adjust the amount of cash holdings and increase cash volatility should be associated with higher value to the firm. On the other hand, while prior studies have looked at the costs of holding large cash balances, keeping these balances stagnant, regardless of whether the amount is deemed high or low, should be associated with lower firm value attributed to the lack of cash adjustment to meet the optimal level.

Hypothesis 1: Higher volatility of corporate cash holdings is associated with higher firm value.

While the first hypothesis deals with the relation between cash volatility and firm value, the second looks into the experience of the managers making these decisions. Using the intuition that

the cash holdings target is dynamic, a firm should be constantly adjusting cash holdings to meet this target. In this scenario, the manager must have the knowledge to adjust to this optimal level. More specialized managers, or those with more knowledge of the firm and its industry, will have the information needed to adjust cash holdings to the correct level. Due to this information, specialized managers should be able to identify the optimal cash level and adjust cash to increase the value of the firm better than managers with more general business experience. If a manager lacks specialized knowledge in the firm, then his choosing of the optimal level of cash could be incorrect and lead to loss of firm value. While cash volatility is an important factor in determining firm value, the degree to which this volatility helps or hurts the firm should depend on the company specific knowledge the CEO holds.

Hypothesis 2: Specialized managers who actively adjust cash holdings to meet a dynamic optimal level create more value for the firm than managers with general business experience.

These two hypotheses combine to create a new way to examine how cash is treated and used within a firm. While the level of cash holdings is important, the movement of cash as proxied by its volatility, is also a key aspect of corporate decisions that can affect the firm value.

2.3 Data Description

The sample includes publically traded firms for years 1992-2013 for a total sample size of 91,015 firm-years. Firms' financial characteristics are extracted from Compustat. Firms from industries of utilities (SIC code between 4900 and 4949) and financials (SIC code between 6000 and 6999) are excluded as their cash holdings may be affected by regulations, for example, capital requirements. Distressed firms with negative assets or negative book value of equity are

also eliminated from the sample. All variables are winsorized at the 1% and 99% to reduce the influence of extreme observations.

To test the effect of CEO ability on cash volatility, I use the Generalist Ability Index of Custodio, Ferreira, and Matos (2013). This measure uses CEO characteristics of S&P 1500 firms including the number of past positions, firms, and industries as well as whether the CEO has been the CEO of another firm or worked for a conglomerate to determine how much generalist knowledge a CEO has attained. A high index number identifies a more generalist CEO whose characteristics and abilities could be beneficial to many different firms and industries. The authors show that generalist CEOs are awarded a pay premium in comparison to specialist CEOs. This premium is higher when CEOs are hired to help facilitate complicated corporate changes including acquisitions and restructurings.

Industry information used to identify the technological level of firms (i.e. high-tech vs low-tech) was collected from the industry definitions of Hall and Vopel (1997). These authors combine the 131-sector manufacturing industry classification used by the Federal Trade Commission and the 1987 4-digit industrial classification of the Census of Manufacturers with the purpose of aggregating industries based on similar competing technologies. Reported in their industry aggregation are the SIC codes and technological level of the industries (i.e. high-tech, stable-tech, low-tech). Examples of low-tech industries include food, tobacco, lumber, and apparel while high-tech industries include computers, pharmaceuticals, electrical machinery, and transportation equipment.

2.4 Empirical Analysis and Results

2.4.1 Summary Statistics

All variables used in the analyses are summarized in Table 12. Panel A reports the descriptive statistics of the variables, while Panel B shows the pair-wise correlations among them. A detailed description of all variable definitions and sources are included in Appendix A.

The average firm in the sample has assets of $2.60 billion and the average firm age is 8.77 years. The variable of interest, cash volatility, has a mean of 0.06 and a standard deviation of 0.06. This large standard deviation shows that cash volatility is far from being a static measure. Figure 2 plots the mean cash volatility of firms from 1992 to 2013. The firms in the sample have average cash holdings, defined as the ratio of cash and short term investments to total firm assets, of 0.19 and a leverage ratio of 0.16. Tobin's Q is used as a proxy for firm value. The mean Tobin's Q for the sample is 2.01 with a standard deviation of 1.81.

A glance at the results of this paper may lead one to believe that the relationship found between cash volatility and firm value is simply due to the retention of a firm's cash flows that would affect the volatility of cash holdings. The relationship between cash flow volatility and cash volatility shows a correlation 0.43. The results of additional robustness tests, detailed in Section 5, show that despite their positive correlation the results of the forthcoming analysis hold even when accounting for the influence of a firm's cash flow volatility.

2.4.2 Baseline Analysis

The first set of analyses, Table 13, reports the relationship between cash volatility and firm value, measured by Tobin's Q. I follow Coles, Lemmon, and Meschke (2012) in the choice and construction of other control variables. The controls include the natural log of assets, research and development expenses, advertising expenses, leverage, and sales growth. With the

exception of cash volatility, all independent variables and Tobin's Q are measured at the end of year t. Cash volatility is calculated as the standard deviation of firm cash holdings using quarterly data over the years in t-1, t-2, and t-3[11].

Mean cash volatility is 0.06. This is lower than the yearly standard deviation of cash holdings reported in Table 12 of 0.22. This difference is attributed to the selection of samples used in the calculation. The variable of interest, cash volatility, is measured using the 12 quarters of each individual firm while the standard deviation of cash holdings is calculated as the standard deviation of all firm years. The volatility of cash holdings in a sample of all firm years should and does have a higher standard deviation than the variation between within firm cash holdings for three years.

Column 1 of Table 13 reports the results of the regression of firm value on cash volatility. Cash volatility is shown to be positively related to firm value, significant at the 1% level (1.42, t-statistic 7.20), meaning that the higher the variability in cash holdings, the higher the value of the firm. Consistent with prior studies, coefficients on leverage and log assets are negative and significant while R&D has a positive and significant coefficient. Sales growth is added to the regression to proxy for the firm performance, the coefficient is positive and significant. The coefficient on advertising is negative, but not significant.

The importance of the cash holdings level cannot be ignored. To ensure that the results of Column 1 are not a byproduct of the effect of the level of cash holdings on firm value, the level of cash holdings is included as an additional control. While the coefficient of cash volatility drops slightly to 1.03 it remains positive and significant at the 1% level (t-statistic 5.23). The

[11]The results of these tests hold regardless of whether cash volatility is measured quarterly over 2, 3, or 4 years.

coefficient on cash holdings is positive and significant at 1.39 and t-statistic of 15.34. This result confirms that the relationship found between cash volatility and firm value cannot be explained by the level of a firm's cash holdings. The sign and significance of the remaining control variables are consistent with those in Column 1.

Larger firms are more diversified and it has been shown that increased diversification is associated with loss in firm value (Berger and Ofek 1995, Lang and Stulz 1994). Denis, Denis, and Sarin (1997) attribute this value loss of diversification to agency problems while also showing that diversified firms are larger and older. To ensure that the positive relationship between cash volatility and firm value is not capturing the increase in firm value from young, less diversified firms, Column 3 includes firm age to help explain firm value. Firm age has a negative relationship with firm value meaning that younger firms have higher Tobin's Q than older firms, consistent with prior literature. Even with this addition, the relationship between cash volatility and firm value continues to hold. The coefficient and sign of cash volatility and the other independent variables in Column 3 remain similar to the first two regressions.

When including an interaction term between cash volatility and firm age in Column 4, the coefficient is negative and significant at the 1% level. High cash volatility for an older firm will have less of an impact on firm value than a younger firm with similar high levels of cash volatility. By definition, growth firms have more opportunities than value firms which are known to be older and more likely to have exhausted internal investment opportunities (Lang and Stulz 1994). Younger firms using cash to take advantage of their vast opportunities, both internal and external, will have increased levels of cash volatility and also firm value.

The results of Table 13 confirm that cash volatility is an important determinant of firm value and firms that partake in more active cash management are rewarded with a higher value.

This relationship is strongest for younger firms that will have more investment opportunities and therefore more of a positive impact on firm value from higher cash volatility than mature firms.

To look at this relationship between cash volatility and firm value in another way, Figure 3 shows the average firm value across the cash volatility deciles of the sample. Every year *t* in the sample firms are ranked based on their cash volatility in years *t-1* to *t-3*. I then calculate the average firm value, as measured by Tobin's Q for each decile. To eliminate any year effects, the average of firm value is measured for each decile across all years in the sample. There is a clear positive monotonic relationship between cash volatility and firm value, confirming the results of Table 13.

There is little research on cash volatility in the literature, therefore I take a step back and examine firms that have high cash volatility. Table 14 examines the determinants of a firm having a higher level of cash volatility. High Cash Volatility, the dependent variable, is a binary variable equal to 1 if the firm has future cash volatility greater than the median of that year and equal to 0 for cash volatility less than the median[12]. The independent variables used in this probit analysis are similar to those in regressions with the dependent variable being firm value.

The goal is to control for firm characteristics that could explain the choice of higher cash volatility. To truly conduct a predictive analysis, all independent variables are measured as of the year prior to the computation of the dependent variable. The results show that the level of cash holdings is positively and significantly related to high cash volatility, which is not surprising. Not only is cash holdings the most significant of the independent variables, but it is also the largest in magnitude 2.303, t-statistic 24.98. The coefficients on log assets, ROA, leverage, and firm age are all negative and significant while the coefficients on cash holdings, R&D, and

[12]Defining *High Cash Volatility* by using different quartiles provided similar results.

advertising are all positive and significant. Whether or not the firm pays a dividend, dividend payer, is positive, but not significant.

2.4.3 Generalist vs. Specialist CEOs

At any given time there is a decision to be made of whether or not the firm is holding the correct amount of cash. Because this correct or optimal amount of cash is always changing as the firm and its environment change, shown in Figure 4, the actual amount of cash held by the firm should be adjusted to meet this level. Optimal cash holdings levels are calculated following Dittmar and Mahrt-Smith (2007). A description of this calculation can be found in Appendix B. When a firm has cash holdings that are optimal, then the value of the firm should increase.

Frequently moving cash holdings towards an optimal level as a way to increase firm value is one of the tasks management must complete. However, knowing when the time to adjust has come and what amount of adjustment is needed are critical to the success of cash adjustment and therefore to the value of the firm.

In Table 15, the analysis of the effect of cash volatility on firm value is expanded to include a measure of the generalist ability of the CEO. I use the Custodio, Ferreira, and Matos (2013) measure of the generalist ability of a CEO (GA Index) to classify CEO ability[13].To further investigate the strong relationship between firm value and cash volatility shown in Table 13, it is important to examine the impact that CEOs of different abilities have on this relationship. This is particularly important due to the reliance on the CEO's knowledge of the optimal cash level as a potential explanation for these findings.

Columns 1-4 determine the impact the generalist ability of a CEO has on firm value as determined by the dependent variable, Tobin's Q. The subsample created by the inclusion of the

[13]Claudia Custodio has provided the GA Index data on her website.

GA Index is mainly large firms which do not have as high of cash volatility on the average as small firms.

The coefficient on cash volatility is positive for all four of the regressions, but statistically significant in three. While the significance has dropped compared to the base regressions in Table 13 which shows a positive and significant relationship between cash volatility and firm value, this can be explained by the smaller more selective sample. Further tests in Table 16 confirm that the positive and significant relationship between cash volatility and firm value is stronger in small firms and in addition, the actual level of cash volatility decreases monotonically to increases in firm size. The results of Table 15 indicate that even in large firms where the cash volatility relationship with firm value may not be as strong, cash volatility still plays a part in firm value, but under the right circumstances, particularly the specialization of the CEO.

Column 1 shows a negative relationship, -0.068 (t-statistic -3.38), between the GA Index and firm value. This negative relationship is similar to the findings of Custodio, Ferreira, and Matos (2013) in their creation of the GA Index, where despite the positive announcement effects of the hiring of a generalist CEO and the generalist pay premium, there is no positive impact on firm value or performance. This result indicates that higher cash volatility is not always positive for the firm. Rather, the relationship between cash volatility and firm value is dependent on the management in charge of the cash volatility decisions.

To further test the impact of managerial ability on the relationship between cash volatility and firm value, the interaction between the GA Index and cash volatility is used. Confirming the previous results, in the presence of a high GA Index (more generalist) CEO, higher cash

volatility is associated with lower firm value, -1.24 (t-statistic -2.27). This brings to question what type of CEO is needed for elevated cash volatility to be positive for a firm.

In the final two columns of Table 15, I create an identifier for both generalist and specialist CEOs. Generalist is a binary variable taking the value of 1 when a CEO ranks in the top 25% of the GA Index and 0 otherwise. Specialist is a binary variable taking the value of 1 when a CEO ranks in the bottom 25% of the GA Index and 0 otherwise. In Column 3 the interaction of the newly created generalist variable and cash volatility is used as a determinant of firm value. The coefficient on this interaction term is negative and significant, -2.22 (t-statistic -2.01). However, in Column 4, when the interaction of the specialist variable and cash volatility is used, the coefficient is positive and significant, 1.97 (t-statistic 1.69). These results indicate that when high cash volatility is under the control of a CEO with more specialized knowledge of the firm and industry, there is a positive association with firm value. On the other hand, if a CEO with generalist knowledge and experience in more industries has control of high cash volatility the relationship between cash volatility and firm value is actually negative

The results of Table 15 help further explain the positive relationship between cash volatility and firm value while also identifying the potential situations that are driving the main results. The relationship between cash volatility and firm value is not homogenous across all management styles, but instead is restricted to situations where the CEO is a specialist. This result solidifies the importance of having management that understands the firm and therefore understands the timing and amount of adjustment needed to move cash holdings to an optimal level.

2.4.4 Investment Opportunities

In addition to the impact of CEO ability on the effect cash volatility can have on firm value, the amount of investment opportunities available to the firm could be a factor in determining whether or not more cash volatility is actually associated with higher firm value. Bates (2005) shows that cash retention probabilities from subsidiary sales increase with growth opportunities and expected investment. In the event that the amount of retained cash is chosen, monitored, and allocated correctly, consistent with optimal cash holdings, there should be a stronger relationship between cash volatility and firm value. To measure investment and growth opportunities available to firms, firms in the sample are separated based on size, whether or not their corresponding industry is high or low tech, and distress.

2.4.4.1 Firm Size. To determine the effect of firm size on the impact of cash volatility on firm value, the sample is split into 3 subsamples. For each of the terciles, firm value is regressed on cash volatility. The coefficient on cash volatility is significant in each of the terciles, with the strongest relationships more prevalent in these small and midsize firms. This result is consistent with the greater availability and profitability of investment opportunities for smaller firms than larger firms. Lang and Stulz (1995) report a negative relationship between firm diversification and Tobin's q. Their result is consistent with the view that as firms become larger they exhaust all internal growth opportunities and are forced to grow through diversification. In addition, Moeller, Schlingemann, and Stulz (2004) show the announcement returns for small acquirers are significantly higher than for large acquirers. Due to the large amount of investment opportunities and potential rewards for small firms, taking action to capitalize on these opportunities as indicated by high cash volatility levels has a larger impact on and is associated with higher firm

value. Table 16 reports the regression results of cash volatility on firm value for each of the 3 subsamples in Panel A.

Panel B of Table 16 shows the mean cash volatility for each of these same terciles. There is a negative monotonic relationship between average cash volatility and firm size with mean cash volatility decreasing from 0.091 in the smallest size quintile to 0.027 in the largest size quintile. This decrease in cash volatility can be attributed to two possible coexistent effects: lack of investment opportunities and the diversification of investments. Duchin (2010) finds that diversified firms hold less cash than standalone firms due to the diversification of investments. Since diversified firms are generally larger and are already diversified, they do not need cash either as a safety net or to take advantage of potential growth opportunities that are less available to large firms. Also, smaller firms have less collateral and are generally more risky than larger firms. This disincentives debt which in turn increases the use of internal financing. The higher levels of cash holdings, reliance on internal financing, and more investment opportunities by smaller firms are consistent with higher amounts of cash volatility.

2.4.4.2 High Tech Firms. An alternative measure of investment opportunities is the nature of the firm's industry. The sample is split into two subsamples based on the technicality of the industry. High-tech and low-tech industries are identified using the definitions of Hall and Vopel (1997). More technical firms, "High-Tech", tend to have more investment opportunities and a greater potential for value increasing projects due to their ability to easily substitute high-risk and low-risk projects depending on firm circumstances (Brown, Fazzari, and Peterson 2009). Being able to partake in these investments through the movement of cash is associated with high firm value. Table 17 reports the results of regressing firm value on cash volatility for firms in

industries classified as high-tech and low-tech. For high-tech firms, the coefficient on cash volatility, 1.58 (t-statistic 4.48), is almost 50% higher that of low tech firms with a coefficient of 0.72 (t-statistic 3.09). The magnitude of the relationship between cash volatility and firm value is statistically different between high and low-tech firms as shown by the coefficient of 9.30 from the chi squared test.

The results of Table 17 indicate that while cash volatility still retains a significant relationship with firm value regardless of the technical level of an industry, there is a stronger relationship between cash volatility and firm value for high-tech firms where the movement of cash holdings to an optimal level can have more of an impact on firm value due to the greater availability of value increasing projects.

2.4.4.3 Financial Distress. The objective of being at the optimal cash level is of utmost importance to firms in financial distress. Much like small and young firms, distressed firms have a need for capital, but a difficult time obtaining it. Due to this difficulty, distressed firms should have a stronger relationship between cash volatility and firm value than non-distressed firms. Non-distressed firms have the ability to bounce back from sub optimal cash volatility making the marginal impact of cash volatility on firm value less important. In addition, non-distressed firms may have access to external financing through credit lines. The availability of cash without having to hold cash directly makes chasing the optimal level less trivial.

To examine the relationship between cash volatility and firm value in firms of different distress levels, the sample is split into terciles by financial distress. Distress is measured using the KZ index of Kaplan and Zingales (1997). Higher index levels indicate higher financial distress and therefore more difficulty in finding external capital. The relationship between cash

volatility and firm value increases with increases in firm distress. In addition, this relationship is only significant in the most distressed firms. The results of these tests can be found in Table 18.

2.5 Additional Robustness Tests

2.5.1 Fama-MacBeth Regressions

To eliminate the effect of any time specific variables that cannot be controlled for in the main regression, I use the Fama-MacBeth procedure. I take the time series average of the cross sectional coefficient on cash volatility for every year in the sample. The results show that overtime the coefficient on cash volatility remains similar in magnitude, with a positive and significant time series average of 3.10 (t-statistic 8.63).

2.5.2 Cash Flow Volatility

The volatility of a firm's cash flows is commonly used as a measure of a firm or industry's riskiness. While there are no studies that I am aware of that specifically examine the impact of cash volatility on a firm, there have been studies related to the volatility and stability of cash flows. Minton and Schrand (1995) show that higher cash flow volatility is associated with lower investment in capital expenditures, advertising, and R&D. Furthermore they find that greater cash flow volatility increases the cost of accessing external capital markets and the likelihood that these markets would need to be used.

To ensure that the previous results are not being driven by the volatility of a firm's cash flows, I have included cash flow volatility, measured as the volatility of quarterly operating income scaled by total assets, using the 12 quarters of *t-1* to *t-3*, as an additional control variable in the baseline analysis. The results of this test are reported in Table 20.

While there is a strong positive relationship between cash flow volatility and firm value, the inclusion does not eliminate the previously found positive and significant relationship between cash volatility and firm value. This result is not surprising. There is no doubt that some amount of a firm's cash flows will be retained therefore increasing cash holdings and indirectly cash volatility, the correlation between these two measures is shown to be 0.43. However, the amount of cash holdings and cash volatility are affected by many other factors that are more directly controlled by the management of a company as opposed to the volatility of firm cash flows. These factors include precautionary savings, the anticipation of investment, and future M&A activity among others.

2.5.3 Generalist Ability Index, Excluding Turnover Years

In years when there is CEO turnover the interaction variables of Table 15 will include the generalist/specialist classification of the new CEO and the cash volatility established by the prior CEO, possibility a CEO of a different generalist/specialist identification. This lack of consistency is due to the use of lagged quarterly cash holdings in the calculation of cash volatility. To ensure that these specific turnover years do not affect the interpretation of my results I drop all observations that include an interaction between the generalist/specialist classification of the current CEO and the cash volatility of a prior CEO with a different generalist/specialist designation. After dropping these observations the results of the tests, shown in Table 21, are stronger than those originally displayed in Table 15. These results strengthen the importance of proactive cash management by specialist CEOs to increase firm value.

2.6 Conclusions

Cash holdings should not be treated or analyzed as a static metric or a residual of a firm's cash flows. In addition to the level of cash holdings, the movement of cash is important in the creation of firm value. The results of this paper show that cash volatility is positively and significantly related to firm value. This relationship between cash volatility and firm value can be explained by the strategic decisions of a specialized manager. Mangers should try to adjust cash holdings to an optimal target, a moving target. This constant adjustment of cash to the moving target will in turn increase the volatility of cash holdings. Managers who constantly adjust cash holdings to an optimal level, and therefore increase cash volatility, will add value to the firm. By including a measure of CEO ability, I am able to show that specialized CEOs, combined with high cash volatility, are associated with higher firm value than CEOs with more general experience. Moreover, smaller firms, high-tech firms, distressed firms, and younger firms all display a stronger relationship between cash volatility and firm value than their respective counterparts.

APPENDIX A

VARIABLE DESCRIPTIONS

Variable	Source	Definition
Cash Volatility	Compustat	Standard deviation of the cash holdings from the 12 quarters of years t-1 to t-3
Cash Holdings	Compustat	Cash and short term investments divided by total assets, Compustat *che / at*
Cash Flow Volatility	Compustat	Standard deviation of the operating income scaled by total assets from the 12 quarters of years t-1 to t-3
Assets	Compustat	Total assets ($ Millions), Compustat *at*
Tobin's Q	Compustat	Book value of total assets minus the book value of equity plus market value of equity, divided by total assets, Compustat *(at-ceq+(prcc_f*csho))/at*
Dividend Payer	Compustat	Dummy variable, takes the value of 1 for firms that paid a dividend for a particular firm year and a value of 0 otherwise
Firm Age	Compustat	Age of the firm. If the firm was publically traded before 1950, then 1950 is used as the first year.
Leverage	Compustat	The sum of current and long term debt divided by total assets, Compustat *(dltt+dlc)/at*
Market to Book	Compustat	Market value of firm (share price at the end of the fiscal year multiplied by shares outstanding) divided by the book value of assets, Compusat *ceq*. Negative ratios were dropped from sample.
Research and Development (R&D)	Compustat	Annual amount spent by the firm on research and development expenses. Missing data are set to zero.Compustat *rnd*
Advertising	Compustat	Annual amount spent by the firm in advertising expenses, Compustat *adv*
Sales Growth	Compustat	The change in sales from year t-1 to year t divided by sales in year t-1
GA Index	Custodio, Ferreira, Matos (2012)	Generalist Ability Index, measures how much of a generalist a CEO is. This index is created using variables that proxy for industry and firm experiences (i.e., the number of past positions the CEO has held, the number of industries the CEO has worked in, etc.).

Variable	Source	Definition
High Tech	Hall & Vopel (1997)	Dummy variable that takes the value of 1 if firms are included in industries classified by their SIC codes as "high tech" and a value of 0 for firms in "low tech" industries.
Return on Assets	Compustat	EBITDA divided by total assets, Compustat *ebitda / at*
Free Cash Flow	Compustat	Operating income before depreciation minus income taxes, interest and related expenses all divided by total assets, Compustat *(oibdp-xint-txt)/at*
Stock Return	CRSP	Fiscal year stock return
CEO tenure	Execucomp	Number of years that the current CEO has held the CEO position for the firm
CEO Age	Execucomp	Age of the CEO
Duality	Execucomp	Dummy variable that takes the value of 1 when the CEO is also the Chairman of the Board.
Firm Age	Compustat	Age of the firm using 1950 as the first year for older firms
Salary	Execucomp	CEO base salary during the fiscal year, Execucomp *salary*
Bonus	Execucomp	CEO's bonus during the fiscal year, Execucomp *bonus*
Current Compensation	Execucomp	Total current compensation, salary + bonus
Option Awards	Execucomp	Value of option awards, Execucomp *option_awards_blk_value (pre 2006), option_awards_fv (post 2006)*
Restricted Stock Granted	Execucomp	The value of restricted stock granted during the year, Execucomp *rstkgrnt (pre 2006), stock_awards_fv (post 2006)*
Other Compensation	Execucomp	Value of other annual compensation not properly categorized as salary or bonus, Execucomp *othann*
Long Term Incentive Plan	Execucomp	The amount paid out to the executive under the company's long-term incentive plan, Execucomp *ltip*
Insider Ownership	Thomson Reuters Insider Filings (IFDF) database	The number of shares owned by insiders divided by the total number of common shares outstanding. The number of shares owned by insiders is compiled using insider activity reported on Forms 3, 4, 5, and 144. Insiders are defined as those who have "access to non-public, material, insider information".

Variable	Source	Definition
CEO Ownership	Thomson Reuters Insider Filings (IFDF) database	The number of shares owned by the CEO divided by the total number of common shares outstanding.
Institutional Ownership	Thomson 13F Institutional Holdings	The institutional common stock holdings as reported of Form 13F filed with the SEC. Any institutional investor managing more than $100m is required to disclose this information. Calculated as the proportion of common shares outstanding that are owned by institutions.
Total Compensation	Execucomp	Total compensation for the fiscal year including salary, bonus, option grants, restricted stock grants, long term incentive payouts, and all other compensation. Execucomp *tdc1*
CEO Compensation	Compustat & Execucomp	Total compensation of CEO divided by total assets, *tdc1 / at*
CFO Compensation	Compustat & Execucomp	Total compensation of CFO divided by total assets, *tdc1 / at*
Top Executives Compensation (non CEO)	Compustat & Execucomp	Sum of the total compensation of reported top five executives (excluding CEO) divided by total firm assets, *sum of tdc1 / at*
Litigation Award	ICPSR (Inter-University Consortium for Political and Social Research)	It is a dummy with the value of 1 if the company gains money from winning the lawsuit and zero if the company loses money from losing the lawsuit.
Scaled Litigation award/penalty	ICPSR (Inter-University Consortium for Political and Social Research)	The amount won or lost by firms as a result of corporate lawsuits, scaled by the amount of firm cash in the prior year. Loss is net of insurance coverage.

APPENDIX B

OPTIMAL CASH HOLDINGS

Optimal cash holdings is computed following Dittmar and Smith (2007). In their paper they calculate excess cash as the difference between the observed cash holdings (natural log of cash divided by net assets) and expected cash holdings estimated using the equation below:

$$Ln\left(\frac{Cash_{i,t}}{NA_{i,t}}\right) = \beta_0 + \beta_1 Ln(NA_{i,t}) + \beta_2 \frac{FCF_{i,t}}{NA_{i,t}} + \beta_3 \frac{NWC_{i,t}}{NA_{i,t}} + \beta_4 (Industry\ Sigma)_{i,t} + \beta_5 \left(\frac{\widetilde{MV}_{i,t}}{NA_{i,t}}\right) + \beta_6 \frac{RD_{i,t}}{NA_{i,t}} + Year\ Dummies + Firm\ Fixed\ Effects + \varepsilon_{i,t}$$

I use the exponential of this expected cash measure, multiply it by net assets, and then scale by total assets so that the new measure reflects the optimal cash holdings of a firm in a given year.

Variable	Source	Definition
Cash	Compustat	Cash and cash equivalents
NA	Compustat	Net assets, total assets minus cash and cash equivalents
FCF	Compustat	Operating income minus interest minus taxes
NWC	Compustat	Current assets minus current liabilities minus cash and cash equivalents
Industry Sigma	Compustat	Standard deviation of the past 10 year industry average of FCF/NA
MV	Compustat	Market value of equity, stock price multiplied by common shares outstanding plus total liabilities
RD	Compustat	Research and development expenditures (0 if missing)

APPENDIX C

TABLES

Table 1: Chapter 1 Summary Statistics

Panel A reports the descriptive statistics for the variables used in my analysis. All dollar values are inflation adjusted using yearly CPI measures. Panel B contains the correlations of the variables along with the *p* values. "CEO Compensation" is total CEO compensation scaled by total assets and "Cash Holdings" is the level of cash holdings scaled by total assets. All variables are winsorized at the 1st and 99th percentiles. Detailed variable definitions are provided in Appendix A.

Panel A: Summary of the variables

	Mean	Std. Dev.	25%	50%	75%	No. Obs.
CEO Compensation (in $ millions)						
Total CEO Compensation	5.41	6.79	1.50	3.08	6.42	22,529
CEO Bonus	0.60	1.05	0	0.20	0.76	22,529
CEO Salary	0.82	0.40	0.53	0.75	1.04	22,529
CEO Current Compensation	1.42	1.29	0.67	1.02	1.68	22,529
CEO Option Awards	2.14	4.20	0	0.68	2.26	22,529
CEO Restricted Stock Grants	0.91	2.17	0	0	0.73	22,529
CEO Long Term Incentive Plan	0.22	1.25	0	0	0	14,789
CEO Other Compensation	0.28	1.78	0.01	0.05	0.19	22,529
CEO Compensation/Total Assets x 1000	3.64	4.93	0.91	2.00	4.21	22,529
Firm Characteristics						
Total Assets ($ millions)	6,607.97	20,000.00	532.40	1,402.85	4,403.01	22,529
Cash Holdings ($ millions)	640.73	2,795.68	34.64	113.56	361.60	22,529
Cash Holdings/Total Assets	0.15	0.17	0.02	0.08	0.22	22,529
Market to Book	3.29	3.14	1.55	2.35	3.76	21,966
ROA	0.14	0.10	0.09	0.14	0.19	22,529
Stock Return	0.15	0.53	-0.17	0.08	0.36	22,529
Firm Age (years)	24.34	16.17	11	19	38	22,529
CEO Characteristics						
CEO Tenure (years)	7.18	7.13	2	5	10	22,529
CEO Age (years)	52.05	7.39	47	52	57	22,495
CEO Duality	0.69	0.46	0	1	1	22,529

Governance						
Institutional Ownership	0.70	0.31	0.57	0.78	0.91	13,925
Insider Ownership	0.05	0.07	0.01	0.02	0.05	8,066
CEO Ownership	0.03	0.05	0.003	0.01	0.02	8,123

Panel B: Correlation coefficients (p values are reported in the parentheses)

	CEO Comp.	Total Assets	Cash Holdings	Market to Book	ROA	Stock Return	Firm Age	CEO Tenure	CEO Age	CEO Duality	Inst. Own.	Insider Own.	CEO Own.
CEO Compensation	1												
Total Assets	-0.188	1											
	(0.000)												
Cash Holdings	0.399	-0.116	1										
	(0.000)	(0.000)											
Market to Book	0.201	0.014	0.193	1									
	(0.000)	(0.037)	(0.000)										
ROA	0.088	0.012	-0.151	0.288	1								
	(0.000)	(0.062)	(0.000)	(0.454)									
Stock Return	0.096	-0.019	0.108	0.311	0.141	1							
	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)								
Firm Age	-0.300	0.272	-0.280	-0.063	0.034	-0.057	1						
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)							
CEO Tenure	-0.019	-0.028	0.044	-0.033	0.045	0.009	-0.059	1					
	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.195)	(0.000)						
CEO Age	-0.146	0.083	-0.152	-0.088	0.043	-0.028	0.203	0.403	1				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)					
CEO Duality	-0.090	0.100	-0.146	0.029	0.099	0.015	0.136	0.191	0.209	1			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.029)	(0.000)	(0.000)	(0.000)				
Institutional Ownership	-0.076	-0.040	0.029	-0.076	0.092	-0.006	0.003	0.008	-0.008	-0.065	1		
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.501)	(0.725)	(0.341)	(0.367)	(0.000)			
Insider Ownership	0.116	-0.119	0.101	-0.021	-0.004	(0.000)	-0.189	0.335	0.054	0.118	-0.229	1	
	(0.000)	(0.000)	(0.000)	(0.063)	(0.729)	(0.970)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
CEO Ownership	0.111	-0.087	0.114	0.006	-0.001	0.008	-0.163	0.443	0.123	0.189	-0.205	0.841	1
	(0.000)	(0.000)	(0.000)	(0.587)	(0.584)	(0.462)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

Table 2: The Effect of Cash Holdings on CEO Compensation

This table reports the results from the OLS regressions of total CEO compensation (scaled by total assets) on firm and CEO characteristics. All regressions control for year fixed effects. Column (1) includes year and firm fixed effects. Column (2) includes year and CEO fixed effects. Column (3) includes year, firm, and CEO fixed effects. The dependent variable is CEO total compensation ("tdc1" as reported in Execucomp) divided by total assets and multiplied by 1,000. Definitions for the independent variables can be found in Appendix A. The t-statistics are reported in parentheses. Standard errors are adjusted for clustering at the firm level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
Cash Holdings (scaled by Total Assets)	4.044***	4.705***	4.266***
	(7.809)	(8.572)	(7.738)
Total Assets ($ billions)	0.005*	0.005	0.009*
	(1.728)	(1.314)	(1.752)
Market to Book	0.225***	0.248***	0.243***
	(8.813)	(8.655)	(8.067)
ROA	3.619***	4.020***	4.236***
	(4.736)	(5.407)	(5.512)
Lagged ROA	-0.998	-0.231	-0.125
	(-1.569)	(-0.356)	(-0.184)
Stock Return	0.259***	0.161*	0.158*
	(3.368)	(1.949)	(1.917)
Firm Age	0.085	-0.022	0.186
	(0.281)	(-1.085)	(0.586)
CEO Tenure	-0.031***	-0.044	0.062
	(-3.910)	(-1.228)	(0.603)
CEO Age	-0.026***	0.016	-0.029
	(-3.273)	(0.146)	(-0.253)
CEO Duality	0.365***	0.683**	0.888***
	(2.725)	(2.321)	(2.882)
Constant	2.056	1.384	0.593
	(0.494)	(0.309)	(0.090)
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	No	Yes
CEO fixed effects	No	Yes	Yes
Observations	21,933	21,933	21,933
R-squared	0.55	0.59	0.59

Table 3: Corporate Governance

This table reports the results from the OLS regressions of total CEO compensation (scaled by total assets) on corporate governance variables and their interaction with cash holdings. All regressions control for year and firm fixed effects. Columns (1,2,3) include an interaction term between cash holdings and Insider Ownership, Institutional Ownership, and CEO Ownership, respectively. The dependent variable is CEO total compensation ("tdc1" as reported in Execucomp) divided by total assets and multiplied by 1,000. Definitions for these governance variables can be found in Appendix A. The t-statistics are reported in parentheses. Standard errors are adjusted for clustering at the firm level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
Cash Holdings (scaled by Total Assets)	3.543***	6.813***	3.251***
	(3.789)	(5.182)	(3.663)
Insider Ownership	0.686		
	(0.665)		
Cash Holdings * Insider Ownership	-12.688*		
	(-1.941)		
Institutional Ownership		0.318	
		(0.818)	
Cash Holdings * Inst. Ownership		-4.128***	
		(-2.825)	
CEO Ownership			-0.167
			(-0.100)
Cash Holdings * CEO Ownership			-13.809*
			(-1.782)
Total Assets ($ billions)	-0.007*	0.005	-0.005
	(-1.675)	(0.811)	(-1.258)
Market to Book	0.147***	0.227***	0.140***
	(4.361)	(6.327)	(4.265)
ROA	1.993**	3.710***	2.100**
	(2.044)	(3.928)	(2.163)
Lagged ROA	-1.165	-0.659	-1.219
	(-1.435)	(-0.787)	(-1.514)
Stock Return	0.096	0.184*	0.108
	(0.978)	(1.748)	(1.101)
Firm Age	0.068	-0.070	0.122
	(0.394)	(-0.206)	(0.716)
CEO Tenure	-0.012	-0.049***	-0.014
	(-0.837)	(-4.142)	(-1.024)
CEO Age	-0.026*	-0.022*	-0.021
	(-1.954)	(-1.949)	(-1.620)
CEO Duality	0.561**	0.407**	0.517**
	(2.383)	(2.129)	(2.242)
Constant	1.884	4.333	2.097
	(0.771)	(0.390)	(1.163)
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	7,811	12,036	7,872
R-squared	0.65	0.58	0.66

Table 4: The Effect of Cash Holdings on Components of CEO Compensation

This table reports the results from the regressions of CEO compensation components. All compensation components are scaled by total assets and multiplied by 1,000. Cash compensation is the sum of salary and bonus. Option awards is the fair value of the options granted to the CEO in a given year. The *t*-statistics are reported in parentheses. Standard errors are adjusted for clustering at the firm level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1) CEO Salary	(2) CEO Bonus	(3) CEO Cash Compensation (Salary + Bonus)	(4) CEO Option Awards	(5) CEO Restricted Stock Grants	(6) CEO Long Term Incentive Plan	(7) CEO Other Compensation
Cash Holdings (scaled by Total Assets)	0.362*** (3.156)	0.583*** (5.569)	0.945*** (5.031)	3.129*** (5.216)	0.289 (1.530)	0.040 (1.323)	0.235** (2.125)
Total Assets ($ billions)	0.002*** (3.623)	0.005*** (7.406)	0.007*** (7.436)	0.018*** (5.766)	-0.006*** (-4.271)	-0.001** (-1.996)	-0.001*** (-2.840)
Market to Book	0.021*** (5.181)	0.009* (1.861)	0.030*** (3.805)	0.252*** (6.762)	0.027* (1.668)	0.001 (0.405)	0.004 (1.016)
ROA	0.018 (0.142)	2.118*** (12.932)	2.136*** (8.875)	1.174 (1.341)	0.616* (1.739)	0.234*** (4.532)	-0.129 (-0.689)
Lagged ROA	-0.735*** (-5.511)	-0.499*** (-3.907)	-1.234*** (-5.849)	0.676 (0.836)	-0.323 (-1.067)	0.017 (0.291)	-0.232 (-0.925)
Stock Return	0.021** (2.074)	0.181*** (12.396)	0.202*** (10.281)	-0.000 (-0.005)	0.025 (0.828)	0.015** (1.996)	-0.028 (-1.352)
Firm Age	0.032 (0.684)	0.012 (0.247)	0.044 (0.608)	0.300 (0.631)	0.211 (0.942)	0.005 (0.502)	-0.022 (-0.683)
CEO Tenure	-0.000 (-0.053)	-0.001 (-0.316)	-0.001 (-0.245)	-0.037*** (-5.774)	-0.007** (-2.258)	0.003*** (3.952)	0.000 (0.041)
CEO Age	-0.000 (-0.129)	-0.004* (-1.950)	-0.004 (-1.322)	-0.027*** (-3.846)	-0.002 (-0.600)	-0.001* (-1.847)	0.008 (1.559)
CEO Duality	-0.006 (-0.251)	0.022 (0.890)	0.016 (0.384)	0.493*** (3.797)	-0.041 (-0.956)	0.012 (1.017)	0.004 (0.133)
Constant	0.594 (0.926)	0.145 (0.218)	0.738 (0.747)	-2.640 (-0.404)	-2.600 (-0.841)	-0.079 (-0.449)	0.019 (0.046)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21,933	21,933	21,933	21,933	21,933	14,438	21,933
R-squared	0.78	0.46	0.69	0.31	0.22	0.20	0.11

Table 5: The Effect of Excess Cash Holdings on CEO Compensation

This table reports the results from the regression of CEO compensation and its components on excess cash holdings. The calculation details of excess cash holdings are provided in Appendix B. "Cash compensation" is the sum of salary and bonus. "Option awards" is the fair value of the options granted to the CEO in a given year. All compensation components are scaled by total assets and multiplied by 1,000. The t-statistics are reported in parentheses. Standard errors are adjusted for clustering at the firm level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1) Total CEO Compensation	(2) CEO Salary	(3) CEO Bonus	(4) CEO Cash Compensation	(5) CEO Option Awards	(6) CEO Restricted Stock Grants	(7) CEO Long Term Incentive Plan	(8) CEO Other Compensation
Excess Cash Holdings	4.099***	0.306***	0.511***	0.817***	2.835***	0.172	0.057	0.361**
(scaled by Total Assets)	(7.178)	(2.799)	(4.619)	(4.551)	(4.580)	(0.871)	(1.517)	(2.422)
Total Assets ($ billions)	0.003	0.001***	0.005***	0.006***	0.016***	-0.005***	-0.001*	-0.001**
	(1.226)	(3.124)	(7.002)	(6.875)	(5.365)	(-3.407)	(-1.821)	(-2.025)
Market to Book	0.203***	0.021***	0.010*	0.031***	0.202***	0.027	0.001	0.003
	(8.142)	(4.649)	(1.943)	(3.465)	(6.177)	(1.423)	(1.044)	(0.756)
ROA	3.163***	-0.070	1.999***	1.929***	1.567*	0.398	0.242***	-0.274
	(3.967)	(-0.560)	(12.204)	(8.093)	(1.773)	(1.346)	(4.549)	(-1.232)
Lagged ROA	-0.820	-0.757***	-0.580***	-1.337***	0.734	0.153	0.044	-0.198
	(-1.245)	(-5.027)	(-4.040)	(-5.655)	(0.946)	(0.730)	(0.773)	(-0.645)
Stock Return	0.274***	0.028***	0.168***	0.195***	0.028	0.039	0.016*	-0.023
	(3.509)	(2.666)	(13.366)	(10.649)	(0.302)	(1.118)	(1.717)	(-1.055)
Firm Age	-0.170	0.004	-0.008	-0.004	0.017	0.274	-0.004	-0.037
	(-0.534)	(0.096)	(-0.153)	(-0.052)	(0.041)	(1.146)	(-0.353)	(-1.009)
CEO Tenure	-0.028***	0.000	-0.001	-0.001	-0.033***	-0.009***	0.003***	0.000
	(-3.570)	(0.019)	(-0.641)	(-0.408)	(-4.869)	(-3.238)	(3.483)	(0.107)
CEO Age	-0.026***	-0.001	-0.004**	-0.005*	-0.021***	-0.001	-0.001	0.008
	(-3.228)	(-0.484)	(-2.294)	(-1.774)	(-2.644)	(-0.535)	(-1.331)	(1.260)
CEO Duality	0.389***	-0.023	0.021	-0.001	0.506***	-0.022	0.009	-0.006
	(2.953)	(-0.938)	(0.925)	(-0.039)	(3.504)	(-0.472)	(0.727)	(-0.210)
Constant	8.205	0.588	0.144	0.733	-0.634	-8.344	0.234	0.905
	(0.764)	(0.424)	(0.084)	(0.298)	(-0.045)	(-1.031)	(0.643)	(0.817)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,326	18,326	18,326	18,326	18,326	18,326	11,977	18,326
R-squared	0.56	0.79	0.47	0.70	0.36	0.19	0.21	0.12

Table 6: Change-on-change Analysis

This table reports the results from the regressions of the annual changes in CEO compensation and its components on the annual changes in the independent variables. CEO compensation is total compensation divided by total assets. "Cash compensation" is the sum of salary and bonus. "Option awards" is the fair value of the options granted to the CEO in a given year. All compensation components are scaled by total assets and multiplied by 1,000. The t-statistics are reported in parentheses. Standard errors are adjusted for clustering at the firm level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1) Δ CEO Compensation	(2) Δ CEO Salary	(3) Δ CEO Bonus	(4) Δ CEO Cash Compensation	(5) Δ CEO Option Awards	(6) Δ CEO Restricted Stock Grants	(7) Δ CEO Long Term Incentive Plan	(8) Δ CEO Other Compensation
Δ Cash Holdings	6.003***	1.080***	0.570***	1.650***	3.871***	0.485**	-0.040	0.084
	(11.052)	(11.174)	(6.813)	(11.175)	(5.751)	(2.197)	(-1.162)	(0.724)
Δ Total Assets	-0.022***	-0.007***	-0.002***	-0.009***	-0.008***	-0.003***	0.000	-0.002***
($ billions)	(-7.954)	(-8.476)	(-6.046)	(-8.411)	(-4.730)	(-4.721)	(0.238)	(-4.788)
Δ Market to Book	0.258***	0.025***	0.009	0.034***	0.280***	0.019	-0.000	0.014*
	(8.107)	(3.954)	(1.349)	(2.736)	(4.713)	(1.285)	(-0.342)	(1.906)
Δ ROA	0.528	-0.841***	1.705***	0.865***	-0.046	0.339	0.224***	-0.256
	(0.656)	(-4.454)	(11.202)	(3.060)	(-0.049)	(0.968)	(3.154)	(-1.369)
Δ Stock Returns	0.002	-0.026***	0.137***	0.111***	-0.097	-0.005	0.016	-0.043**
	(0.030)	(-2.602)	(10.951)	(6.284)	(-1.124)	(-0.178)	(1.536)	(-2.218)
Constant	-0.121	-0.006	0.144***	0.138	-0.109	0.213*	0.004	-0.027
	(-0.507)	(-0.119)	(2.630)	(1.589)	(-0.745)	(1.745)	(0.102)	(-0.643)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,305	17,305	17,305	17,305	17,305	17,305	10,078	17,305
R-squared	0.25	0.15	0.15	0.20	0.10	0.10	0.06	0.06

Table 7: The Effect of a Major Cash Shock on CEO Compensation in the Litigation Sample

This table reports the results from the regressions of CEO compensation in the subset of firms with resolved litigations. "Litigation Award" is a dummy with the value of 1 if the company gains money from winning the lawsuit and zero if the company loses money from losing the lawsuit. "Scaled Litigation award/penalty" variable is the amount won or lost by firms as a result of corporate lawsuits, scaled by the amount of cash in the prior year and winsorized at the 1st and 99th percentiles. Loss is net of insurance coverage. The scaled CEO compensation is multiplied by 1,000. Column (3) includes only the subset of firms who win the lawsuit. The *t*-statistics are reported in parentheses. Standard errors are adjusted for clustering at the firm level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	CEO compensation	CEO compensation	CEO compensation
	(1)	(2)	(3)
Cash Holdings (scaled by Total Assets)	6.644*	6.996*	8.912**
	(1.78)	(1.88)	(2.13)
Litigation Award	2.004**	--	--
	(2.19)		
Scaled Litigation Award/Penalty	--	3.968***	3.552***
		(2.85)	(3.35)
Total Assets ($ billions)	0.012	0.018*	0.013
	(1.14)	(1.70)	(1.61)
Market to Book	0.074*	0.094**	0.086
	(1.82)	(2.08)	(1.58)
ROA	9.452	8.397	9.289
	(1.36)	(1.29)	(1.47)
Lagged ROA	-14.040**	-5.653	-9.320**
	(-2.47)	(-0.99)	(-2.54)
Stock Return	0.709	1.888**	2.130***
	(1.05)	(2.32)	(3.89)
Firm Age	-0.085**	-0.074**	-0.025
	(-2.13)	(-2.11)	(-0.60)
CEO Tenure	-0.031	-0.091	-0.098*
	(-0.41)	(-1.06)	(-1.85)
CEO Age	-0.087*	-0.050	-0.003
	(-1.91)	(-1.15)	(-0.06)
CEO Duality	0.510	1.627	0.363
	(0.55)	(1.18)	(0.40)
Constant	6.153**	3.236	-0.046
	(2.01)	(1.02)	(-0.01)
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	205	205	139
R-squared	0.06	0.02	0.06

Table 8: The Compensation of Non-CEO Top Executives

This table reports the results from the regressions of CFO and top (non-CEO) executives' compensation on cash holdings. The top five executives' compensations are obtained from Execucomp. Column (1) examines CFO's compensation. Column (2) examines the sum of the compensation of top five executives (excluding the CEO) scaled by total assets. The scaled measures of compensations are multiplied by 1,000. The *t*-statistics are reported in parentheses. Standard errors are adjusted for clustering at the firm level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1) Total CFO Compensation	(2) Top Executives (excluding CEO) Compensation
Cash Holdings (scaled by Total Assets)	1.719*** (7.078)	5.153*** (6.859)
Total Assets ($ billions)	0.005*** (3.763)	0.016*** (4.036)
Market to Book	0.102*** (9.221)	0.362*** (11.123)
ROA	0.336*** (5.091)	2.575*** (2.589)
Lagged ROA	-0.265*** (-4.660)	-1.058 (-1.140)
Stock Return	0.134*** (4.150)	0.253** (2.539)
Firm Age	0.234** (2.260)	0.021 (0.064)
Constant	-1.787 (-1.397)	3.475 (0.728)
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	18,406	20,474
R-squared	0.61	0.67

Table 9: Quarterly Cash Holdings

This table reports the quarterly cash holdings of all publically traded firms from Compustat in the sample period (Panel A) and of the firms in my sample (Panel B). Firms need to have all four quarters' data in a year to be included. I report the mean and standard deviation of cash holdings, measured as cash scaled by total assets, for each fiscal quarter. I use a t-test to determine if cash holdings in the fourth quarter are statistically different than average cash holdings in the first three quarters. *** indicates the difference is statistically significant at the 1% level.

Panel A: All public firms in the sample period

Fiscal Quarter	**Mean**	**Standard Deviation**	**Number of observations**
1	0.176	0.235	213,090
2	0.174	0.233	213,090
3	0.174	0.233	213,090
4	0.181	0.235	213,090
Average of all quarters	*0.177*		
Average of Q1, Q2, Q3	0.175		
μ(Q4) – μ(Q1,2,3)	0.006		
t-test of difference	t = 12.05***		

Panel B: Firms in my sample

Fiscal Quarter	**Mean**	**Standard Deviation**	**Number of observations**
1	0.148	0.177	22,633
2	0.146	0.175	22,633
3	0.147	0.175	22,633
4	0.153	0.175	22,633
Average all quarters	*0.149*		
Average of Q1, Q2, Q3	0.147		
μ(Q4) – μ(Q1,2,3)	0.006		
t-test of difference	t = 15.97***		

Table 10: The Effect of Cash Holdings on CEO Compensation: Excluding CEO Turnover Years

This table reports the results from the regression of CEO compensation on cash holdings after excluding the first and last year of a CEO's tenure. Total compensation is scaled total assets and multiplied by 1,000. The *t*-statistics are reported in parentheses. Standard errors are adjusted for clustering at the firm level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	CEO Compensation
Cash Holdings (scaled by Total Assets)	3.910***
	(6.650)
Total Assets ($ billions)	0.006*
	(1.780)
Market to Book	0.252***
	(7.531)
ROA	3.890***
	(4.335)
Lagged ROA	-0.056
	(-0.079)
Stock Return	0.349***
	(3.833)
Firm Age	-0.838
	(-0.839)
CEO Tenure	-0.029***
	(-2.637)
CEO Age	-0.016
	(-1.457)
CEO Duality	0.145
	(0.869)
Constant	15.378
	(1.010)
Year effects	Yes
Firm fixed effects	Yes
Observations	13,851
R-squared	0.59

Table 11: The Effect of Cash Holdings on CEO Compensation: the Fama-MacBeth Procedure

This table reports the time series of the yearly coefficients from the regression of CEO compensation on cash holdings, also known as the Fama-MacBeth procedure. The *t*-statistic of whether or not the mean is equal to zero is reported in parentheses. *** indicates the coefficient is statistically significant at the 1% level.

Year	The Coefficient on Cash Holdings
1992	6.625
1993	7.080
1994	8.021
1995	5.956
1996	7.609
1997	9.542
1998	7.638
1999	10.736
2000	12.245
2001	12.463
2002	7.131
2003	6.306
2004	6.997
2005	7.148
2006	7.427
2007	7.221
2008	7.606
2009	6.459
2010	6.667
2011	8.163
Mean	7.952*** (19.142)

Table 12: Chapter 2 Summary Statistics

This table reports the summary statistics of the variables used in the analysis. Panel A reports the descriptive statistics for the variables and Panel B reports the correlation matrix. *p*-value for the correlation coefficient are reported below the correlation. Variable definitions can be found in Appendix A. All variables are winsorized at the 1st and 99th percentiles.

Panel A: Summary of the Variables

	Mean	Std. Dev.	Min	Max	Obs
Cash volatility	0.06	0.06	0.00	0.32	95,005
Tobin's Q	2.01	1.81	0.51	13.76	91,373
Cash Holdings	0.19	0.22	0.00	0.95	94,982
Log Assets	5.38	2.36	-0.04	10.92	95,005
Total Assets ($ millions)	2,597.48	8,003.41	0.96	55,424.00	95,005
Sales Growth	0.21	0.92	-1.00	8.16	95,005
R&D	0.05	0.11	0	0.67	95,005
Advertising	0.01	0.03	0	0.19	95,005
Leverage	0.16	0.17	0	0.69	94,728
Firm Age	8.77	5.50	0	23	95,005
Dividend Payer	0.05	0.24	-1.34	0.40	94,636
GA Index	3.51	5.62	0.21	46.12	91,363

Panel B: Correlation matrix

	Cash Volatility	Tobin's Q	Cash Holdings	Log Assets	Total Assets	Sales Growth	R&D	Advertising	Leverage	Firm Age	Cash Flow Volatility	GA Index
Cash Volatility	1.000											
Tobin's Q	0.274	1.000										
	0.000											
Cash Holdings	0.405	0.341	1.000									
	0.000	0.000										
Log Assets	-0.340	-0.190	-0.260	1.000								
	0.000	0.000	0.000									
Total Assets	-0.157	-0.060	-0.131	0.581	1.000							
	0.000	0.000	0.000	0.000								
Sales Growth	0.115	0.124	0.036	0.009	-0.027	1.000						
	0.000	0.000	0.000	0.041	0.000							
R&D	0.268	0.329	0.481	-0.265	-0.090	0.009	1.000					
	0.000	0.000	0.000	0.000	0.000	0.034						
Advertising	0.013	0.028	-0.015	-0.018	-0.013	-0.016	-0.041	1.000				
	0.002	0.000	0.000	0.000	0.002	0.000	0.000					
Leverage	-0.253	-0.207	-0.398	0.323	0.098	0.027	-0.247	-0.052	1.000			
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000				
Firm Age	-0.210	-0.111	-0.062	0.280	0.204	-0.104	-0.062	-0.006	0.008	1.000		
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.145	0.072			
Cash Flow Volatility	0.431	0.311	0.224	-0.296	-0.088	0.023	0.212	0.031	-0.133	-0.149	1.000	
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
GA Index	-0.051	-0.046	-0.045	0.313	0.256	-0.045	0.017	0.036	0.080	0.067	-0.045	1.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.118	0.001	0.000	0.000	0.000	

Table 13: The Effect of Cash Volatility on Firm Value

This table reports the results from regressing firm value, as measured by Tobin's Q in year *t*, on cash volatility. *Cash Volatility* is measured as the quarterly standard deviation of cash holdings over the twelve quarters of years *t-1* to *t-3*. *Cash Holdings* is the ratio of cash and short term investments to total firm assets in year *t*. With the exception of *Cash Volatility*, all independent variables are measured at time *t*. To eliminate any issues with overlapping data due to the rolling cash volatility measure, the sample uses data from every other year for every firm in the sample. All variables are winsorized at the 1st and 99th percentiles. The t-statistics are reported in parentheses. Robust standard errors are adjusted for clustering at the firm-level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1) Tobin's Q	(2) Tobin's Q	(3) Tobin's Q	(4) Tobin's Q
Cash Volatility	1.424***	1.025***	1.025***	2.621***
	(7.200)	(5.230)	(5.230)	(7.945)
Cash Holdings		1.390***	1.390***	1.380***
		(15.338)	(15.338)	(15.217)
Log Assets	-0.307***	-0.282***	-0.282***	-0.283***
	(-14.676)	(-13.695)	(-13.695)	(-13.775)
R&D	1.952***	2.123***	2.123***	2.084***
	(7.819)	(8.534)	(8.534)	(8.415)
Advertising	0.175	0.485	0.485	0.437
	(0.337)	(0.931)	(0.931)	(0.836)
Leverage	-0.867***	-0.640***	-0.640***	-0.625***
	(-13.364)	(-9.859)	(-9.859)	(-9.649)
Sales Growth	0.138***	0.143***	0.143***	0.141***
	(12.968)	(13.586)	(13.586)	(13.404)
Firm Age			0.007***	0.019***
			(3.170)	(7.318)
Firm Age * Cash Volatility				-0.224***
				(-5.763)
Constant	3.482***	3.089***	3.098***	3.013***
	(33.895)	(29.887)	(29.696)	(29.076)
Observations	91,123	91,113	91,113	91,113
R-squared	0.084	0.098	0.098	0.100
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Table 14: Probability of High Cash Volatility

This table reports the results of a probit regression of high cash volatility. High Cash Volatility is a binary variable equal to 1 if a firm has future cash volatility greater than the median and equal to 0 if less than the median. Due to the predictive nature of this analysis, all independent variables are measured in the year prior to the start of the data used for the cash volatility measurement. To eliminate any issues with overlapping data due to the rolling cash volatility measure, the sample uses data from every other year for every firm in the sample. All variables are winsorized at the 1st and 99th percentiles. The t-statistics are reported in parentheses. Robust standard errors are adjusted for clustering at the firm-level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1) High Cash Volatility
Cash Holdings	2.303***
	(24.983)
Log Assets	-0.123***
	(-27.170)
R&D	-0.488***
	(-9.159)
Advertising	0.016***
	(10.041)
Leverage	-0.112
	(-0.779)
Dividend Payer	0.753***
	(2.721)
Firm Age	-0.731***
	(-15.043)
Sales Growth	-0.175
	(-1.593)
Constant	0.532***
	(2.802)
Observations	90,772
Year Fixed Effects	Yes
Industry Fixed Effects	Yes

Table 15: Generalist Ability Index

This table reports the regressions of firm value with the Generalist Ability Index as one of the explaining factors. *GA Index* measures the generalist ability of the CEO (from Custodio, Ferreira, and Matos 2013). Higher values of *GA Index* mean the CEO is more of a generalist and lower values indicate the CEO being a specialist. Generalist is a dummy variable with a value of 1 if the CEO has a GA Index measure above the 75th percentile and 0 otherwise. Specialist is a dummy variable with a value of 1 if the CEO has a GA Index measure below the 25th percentile and 0 otherwise. All variables are winsorized at the 1st and 99th percentiles. The t-statistics are reported in parentheses. Robust standard errors are adjusted for clustering at the firm-level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1) Tobin's Q	(2) Tobin's Q	(3) Tobin's Q	(4) Tobin's Q
Cash Volatility	0.932*	0.846*	1.456***	0.334
	(1.880)	(1.694)	(2.627)	(0.573)
Cash Holdings	1.617***	1.611***	1.615***	1.616***
	(6.840)	(6.825)	(6.763)	(6.858)
Log Assets	-0.403***	-0.404***	-0.411***	-0.390***
	(-8.676)	(-8.685)	(-8.794)	(-8.687)
R&D	0.640	0.623	0.598	0.651
	(0.676)	(0.657)	(0.632)	(0.683)
Advertising	0.478	0.552	0.422	0.245
	(0.491)	(0.563)	(0.430)	(0.255)
Leverage	-1.427***	-1.423***	-1.444***	-1.445***
	(-9.207)	(-9.179)	(-9.242)	(-9.341)
Firm Age	-0.003	-0.001	-0.003	-0.005
	(-0.438)	(-0.250)	(-0.549)	(-0.799)
Sales Growth	0.509***	0.508***	0.503***	0.505***
	(7.647)	(7.653)	(7.555)	(7.586)
GA Index	-0.068***	-0.019		
	(-3.383)	(-0.736)		
GA Index * High Cash Vol		-1.241**		
		(-2.269)		
Generalist			-0.022	
			(-0.458)	
Generalist * High Cash Vol			-2.222**	
			(-2.010)	
Specialist				-0.062
				(-1.182)
Specialist * High Cash Vol				1.966*
				(1.693)
Constant	4.664***	4.664***	4.738***	4.614***
	(14.792)	(14.768)	(14.996)	(15.076)
Observations	16,383	16,383	16,178	16,338
R-squared	0.158	0.160	0.160	0.156
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Table 16: Large vs. Small Firms

This table reports the effect of cash volatility on firm value for small, median, and large firms. Panel A reports the results of regressing firm value on cash volatility in each of the sample terciles. A chi squared test is used to test if these coefficients on Cash Volatility of the largest and smallest terciles are statistically different. Mean cash volatility for each of these subsamples is reported in Panel B. The t-statistics are reported in parentheses. Robust standard errors are adjusted for clustering at the firm-level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

Panel A: Quintile Regressions of Firm Size

	(1) Tobin's Q (Small firms)	(2) Tobin's Q (Median firms)	(3) Tobin's Q (Large firms)
Cash Volatility	0.948***	0.629**	0.788**
	(2.891)	(2.523)	(2.331)
Cash Holdings	1.360***	1.410***	1.295***
	(9.596)	(11.373)	(7.108)
Log Assets	-0.519***	-0.123***	-0.337***
	(-10.649)	(-3.999)	(-10.024)
R&D	2.083***	0.850**	2.297**
	(6.607)	(2.325)	(2.142)
Advertising	1.240	-0.860	0.453
	(1.460)	(-1.357)	(0.527)
Leverage	-0.471***	-0.867***	-0.939***
	(-3.318)	(-9.195)	(-8.893)
Sales Growth	0.130***	0.163***	0.153***
	(7.749)	(10.142)	(8.990)
Firm Age	-0.009	0.003	0.017***
	(-1.614)	(0.831)	(7.011)
Constant	3.218***	2.281***	4.224***
	(21.704)	(14.223)	(16.639)
Observations	30,511	30,809	29,793
R-squared	0.097	0.098	0.141
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Chi Squared Test (Q1-Q3)	66.69***		

Panel B: Mean Cash Volatility by Terciles

	Small (1)	(2)	Large (3)
Mean Cash Volatility	.088	.063	.037

Table 17: High Tech Firms

This table reports the relationship between cash volatility and firm valuein high-tech and low-tech firms. The sample is split into two sub samples based on whether or not a firm is classified as High-tech or Low-tech. High-tech and Low-tech firms are defined as by Hall and Vopel (1997). A chi squared test reporting the statistical difference between the coefficient on Cash Volatility for high and low-tech firms is included at the bottom of the table. The t-statistics are reported in parentheses. Robust standard errors are adjusted for clustering at the firm-level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1)	(2)
	Tobin's Q (High-tech firms)	Tobin's Q (Low-tech firms)
Cash Volatility	1.581***	0.721***
	(4.484)	(3.089)
Cash Holdings	1.298***	1.458***
	(8.616)	(12.844)
Log Assets	-0.315***	-0.272***
	(-8.099)	(-11.336)
R&D	2.459***	1.434***
	(8.004)	(3.433)
Advertising	1.782	0.263
	(0.940)	(0.523)
Leverage	-0.903***	-0.519***
	(-6.006)	(-7.926)
Sales Growth	0.148***	0.138***
	(8.576)	(10.445)
Firm Age	0.003	0.010***
	(0.564)	(3.898)
Constant	3.246***	3.036***
	(16.892)	(24.781)
Observations	26,977	64,136
R-squared	0.120	0.092
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Chi Squared Test (high-tech – low-tech)	9.30***	

Table 18: Distressed Firms

This table reports the effect of cash volatility on firm value for firms split based on the distress levels of firms. Firm distress is calculated using the KZ-index from Kaplan and Zingales (1997) . Panel A reports the results of regressing firm value on cash volatility in each of the sample terciles. The t-statistics are reported in parentheses. Robust standard errors are adjusted for clustering at the firm-level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1) Tobin's Q (Not distressed)	(2) Tobin's Q	(3) Tobin's Q (Distressed)
Cash Volatility	0.241	0.105	1.667**
	(0.645)	(0.288)	(2.129)
Cash Holdings	0.709***	1.950***	3.031***
	(4.464)	(9.797)	(5.792)
Log Assets	-0.122**	-0.165***	-0.365***
	(-2.368)	(-3.601)	(-4.260)
R&D	0.560	-1.437***	1.502*
	(0.839)	(-3.268)	(1.891)
Advertising	0.927	-0.175	2.227
	(1.032)	(-0.119)	(0.521)
Leverage	-1.110***	-2.018***	-1.710***
	(-2.793)	(-10.664)	(-6.593)
Sales Growth	0.115***	0.081***	0.085**
	(4.493)	(3.980)	(2.445)
Firm Age	0.043***	0.023**	0.013
	(5.922)	(2.312)	(1.504)
Constant	1.663***	2.553***	4.452***
	(7.004)	(10.222)	(8.591)
Observations	8,241	8,243	8,242
R-squared	0.100	0.200	0.140
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Chi Squared Test (Distressed-Non Distressed)	18.50***		

Table 19: The Effect of Cash Volatility on Firm Value: The Fama-MacBeth Procedure

This table reports the time series of the yearly coefficients from the regression of firm value on cash volatility, also known as the Fama-MacBeth procedure. The *t*-statistic of whether or not the mean is equal to zero is reported in parentheses. *** indicates the coefficient is statistically significant at the 1% level.

Year	Cash Volatility Coefficient
1993	5.113
1994	5.177
1995	3.214
1996	3.250
1997	1.817
1998	1.835
1999	1.836
2000	2.655
2001	1.518
2002	1.468
2003	1.035
2004	4.369
2005	5.309
2006	4.365
2007	4.206
2008	3.608
2009	2.563
2010	2.924
2011	3.206
2012	2.397
2013	3.305
Average	3.10*** (8.627)

Table 20: Cash Flow Volatility

This table reports the impact the addition of cash flow volatility has on the relationship between cash volatility and firm value. Using the same time frame as the calculation of Cash Volatility, Cash Flow Volatility is measured as the quarterly standard deviation of cash flow over the eight quarters of years *t-1* and *t-2*. Cash flow is measured as operating income of the firm scaled by total assets. The *t*-statistics are reported in parentheses. *** indicates the coefficient is statistically significant at the 1% level.

	Tobin's Q
Cash Volatility	0.366*
	(1.821)
Cash Holdings	1.339***
	(14.384)
Log Assets	-0.266***
	(-12.656)
R&D	2.125***
	(8.311)
Advertising	0.530
	(0.965)
Leverage	-0.678***
	(-10.242)
Sales Growth	0.132***
	(12.246)
Firm Age	0.008***
	(3.267)
Cash Flow Volatility	2.814***
	(9.873)
Constant	2.983***
	(27.812)
Observations	86,133
R-squared	0.107
Firm Fixed Effects	Yes
Year Fixed Effects	Yes

Table 21: Generalist Ability Index: Excluding Turnover Years

This table repeats the Table 4 regressions of firm value with the Generalist Ability Index as one of the explaining factors, but now excludes management turnover years when there was a change in CEO identification from a specialist to a generalist or vice versa. Definitions for GA Index, Generalist, and Specialist can be found in the description of Table 4. All variables are winsorized at the 1st and 99th percentiles. The t-statistics are reported in parentheses. Robust standard errors are adjusted for clustering at the firm-level. ***, **, * indicate the coefficient is statistically significant at the 1%, 5%, and 10% level, respectively.

	(1) Tobin's Q	(2) Tobin's Q	(3) Tobin's Q	(4) Tobin's Q
Cash Volatility	0.956*	0.860*	1.456***	0.346
	(1.872)	(1.673)	(2.609)	(0.585)
Cash Holdings	1.645***	1.636***	1.637***	1.642***
	(6.826)	(6.806)	(6.738)	(6.835)
Log Assets	-0.405***	-0.406***	-0.414***	-0.393***
	(-8.529)	(-8.538)	(-8.665)	(-8.562)
R&D	0.797	0.777	0.756	0.811
	(0.858)	(0.834)	(0.814)	(0.869)
Advertising	0.461	0.526	0.386	0.201
	(0.467)	(0.529)	(0.388)	(0.206)
Leverage	-1.451***	-1.448***	-1.468***	-1.471***
	(-9.169)	(-9.148)	(-9.215)	(-9.304)
Firm Age	-0.002	-0.001	-0.003	-0.004
	(-0.315)	(-0.114)	(-0.456)	(-0.699)
Sales Growth	0.508***	0.507***	0.502***	0.504***
	(7.572)	(7.572)	(7.478)	(7.505)
GA Index	-0.086***	-0.035		
	(-3.804)	(-1.249)		
GA Index * High Cash Vol		-1.246**		
		(-2.262)		
Generalist			-0.038	
			(-0.748)	
Generalist * High Cash Vol			-2.196**	
			(-2.027)	
Specialist				-0.053
				(-0.925)
Specialist * High Cash Vol				2.014*
				(1.756)
Constant	4.665***	4.666***	4.753***	4.621***
	(14.505)	(14.491)	(14.762)	(14.820)
Observations	16,092	16,092	15,887	16,047
R-squared	0.160	0.161	0.161	0.157
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

APPENDIX D

FIGURES

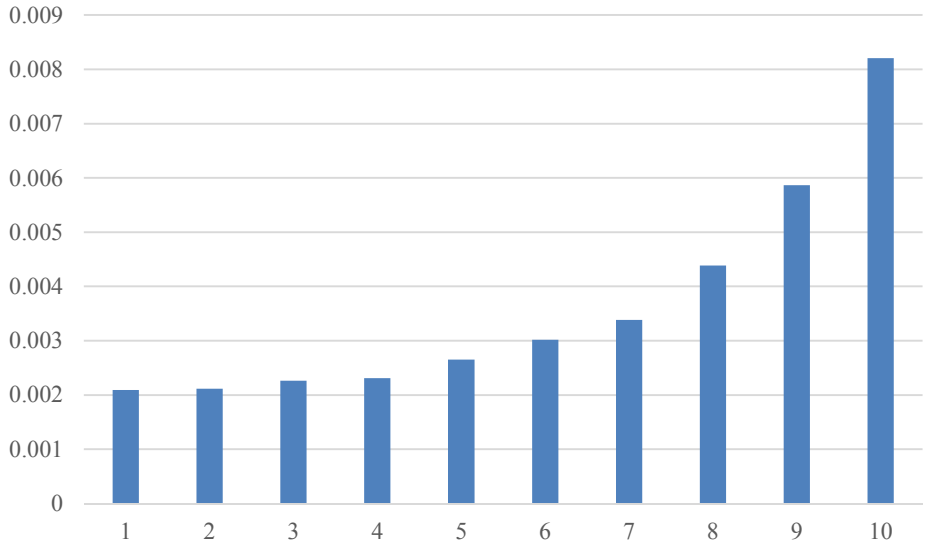

Figure 1: Average CEO compensation by cash holdings decile

This figure reports average CEO compensation (scaled by total assets) in annually-constructed cash holdings (scaled by total assets) deciles. Cash holdings deciles range from 1 (lowest) to 10 (highest).

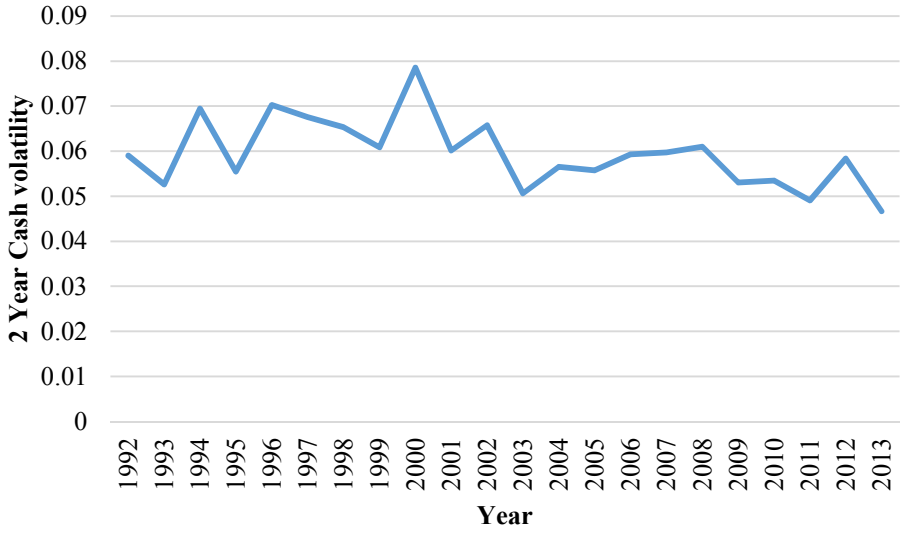

Figure 2: Cash volatility through time

This graph shows the mean of cash volatility for all firms across the sample period of 1992-2013.

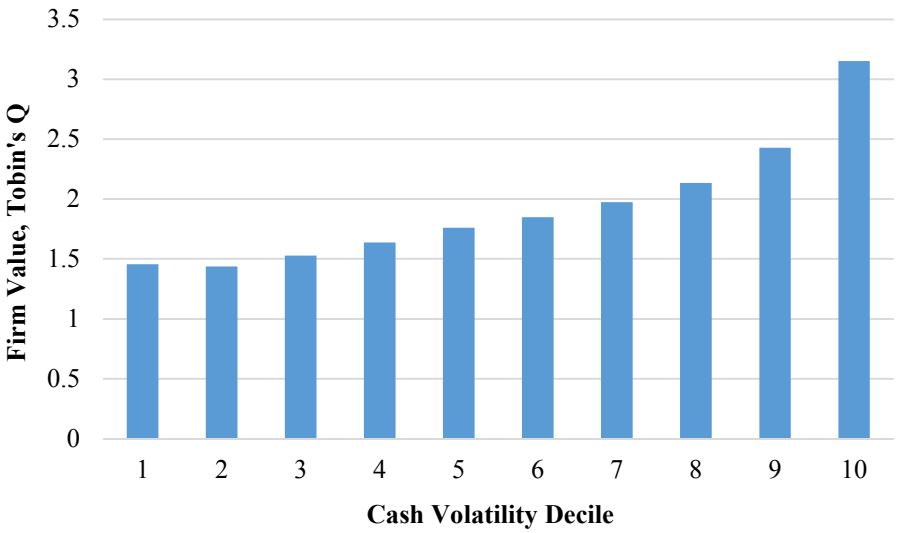

Figure 3: Firm value and cash volatility deciles

For each year, the sample firms are ranked into cash volatility deciles based on the standard deviation of their quarterly cash holdings for years *t-3* to *t-1*. The average Tobin's Q across each of the deciles is then calculated. The graph shows this average measure of firm value for each of these cash volatility deciles.

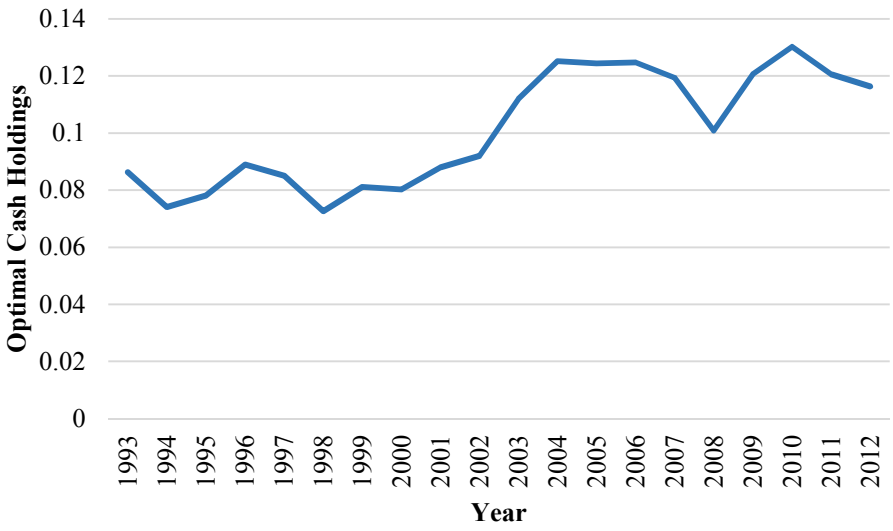

Figure 4: Optimal cash holdings through time

This graph plots the optimal cash holdings in each year from 1993 to 2012 highlighting the dynamic optimal level and the need for regular cash adjustment. The computation of optimal cash holdings is detailed in Appendix B.

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BIOGRAPHICAL SKETCH

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