

Bond University  
Research Repository



**Are excess cash holdings more valuable to firms in times of crisis? Financial constraints and governance matters**

Chang, Yanhao; Benson, Karen; Faff, Robert

*Published in:*  
Pacific Basin Finance Journal

*DOI:*  
[10.1016/j.pacfin.2016.05.007](https://doi.org/10.1016/j.pacfin.2016.05.007)

*Licence:*  
CC BY-NC-ND

[Link to output in Bond University research repository.](#)

*Recommended citation(APA):*  
Chang, Y., Benson, K., & Faff, R. (2017). Are excess cash holdings more valuable to firms in times of crisis? Financial constraints and governance matters. *Pacific Basin Finance Journal*, 45, 157-173.  
<https://doi.org/10.1016/j.pacfin.2016.05.007>

**General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

For more information, or if you believe that this document breaches copyright, please contact the Bond University research repository coordinator.

**Are Excess Cash Holdings more Valuable to Firms in times of Crisis?  
Financial Constraints and Governance Matters**

Yanhao Chang, Karen Benson and Robert Faff

UQ Business School, The University of Queensland

**Abstract**

This study examines the impact of cash holdings on firm value before and during the 2008 financial crisis, conditional on financial constraints and corporate governance. We show that the equity market places a higher value on corporate cash holdings during the financial crisis and cash holdings are more valuable to constrained firms, compared to unconstrained firms. However, the triple-interaction of cash with constraints and crisis shows the crisis value effect for constrained firms is weaker than for unconstrained firms. Further, the triple-interaction of excess cash with governance and constraints shows that a positive governance effect on corporate cash holdings is more pronounced for firms that are financially constrained.

*Keywords:* cash holdings; firm value; financial crisis; financial constraints; corporate governance.

## 1. Introduction

Is there a value impact of cash holdings? In a perfect market, with zero transaction costs and no impediments to financing, the level of cash holdings is irrelevant. An imperfect market will allow firms with cash to avoid transaction costs<sup>1</sup> and underinvestment (Keynes, 1936). Conversely, in an agency theoretic framework, holding excess cash will result in a reduction in firm value. Large amounts of cash enable managers to pursue their own interests and invest in potentially negative NPV projects. Hence, in theory there may be a point at which the level of cash held achieves an exact offset between the marginal benefits and costs of doing so. Consequently variation in the level of cash holdings is expected to impact the value of the firm. The key purpose of our study is to assess the impact of cash holdings on firm value. The value impact is analysed in the context of three intervening effects: financial constraints, financial crisis and corporate governance.

Studies that assess the value of cash holdings show that firm's ability to find external financing will impact the results (Faulkender & Wang, 2006). A financially constrained firm is typically smaller, younger and faces greater frictions when accessing external financing (Almeida et al. (2004); Chan et al. (2010)). Cash is therefore of more value to them (Denis & Sibilkov, 2010).

The Global Financial Crisis started in December 2007 and took a sharp downward turn in September 2008, which was characterized as a shock to the supply of credit to all firms (Gorton (2010)). However, some firms were affected more than others. We rely on this unexpected credit shock to investigate the constraint effect on the value of cash holdings. Duchin et al. (2010) show that the financial crisis induced financially constrained firms to rely more on their cash holdings to finance investments. Moreover, based on value-weighted risk-adjusted return for cash-rich and cash-poor firms around June 2007, they demonstrate that firms with more cash

---

<sup>1</sup> The relevance of transaction costs is demonstrated in Kim et al. (1998).

holdings outperform. This evidence suggests that cash holdings had a value-enhancing impact on firm performance during the crisis. However, our study is unique in that it examines the crisis effect on firm value given differential financial constraint status.

Corporate governance has a potentially material impact on the value that shareholders place on cash holdings (Dittmar & Mahrt-Smith, 2007). Poorly-governed firms are more likely to waste cash, whereas firms with good corporate governance ensure a more effective use of their cash savings. During the crisis, when outside equity and debt financing are typically more expensive and difficult to obtain, a better use of cash holdings is expected to increase firm value. Our analyses examines the governance effect on cash holdings during the crisis. We also explore the interactive relation between corporate governance and financial constraints, and in particular their joint effect on cash holdings. In theory, financially-constrained firms rely more on cash holdings to finance their positive NPV projects; and stronger corporate governance ensures firm efficiency over cash deployment. Accordingly, we expect the governance effect on cash holdings is more pronounced for financially-constrained firms.

Our work complements and neatly converges the prior literatures on cash holdings, financial constraints and governance. We investigate the interactive relation between governance, financial constraints and the crisis. We use data covering the period 2002 to 2010, with 2008-2010 being deemed the crisis period, as Kahle & Stulz (2013) state that this time window is well-suited to examine the impact of liquidity shocks. The financial crisis had substantial effects on the U.S. economy, which included an unprecedented number of regional bank failures, the collapse of Lehman Brothers and a large number of runs on financial institutions. Collectively, it all represents a shock to the supply of credit to corporations, which provides us with a unique setting to examine the change of value of cash holdings since cash provides

firms with liquidity support at any time. Moreover, we argue that not only did the financial sectors get affected by the crisis, but the non-financial sectors also suffered from induced liquidity constraints (Brunnermeier, 2009).

Following Faulkender & Wang (2006) we examine the unexpected change in cash holdings, modelling annual firm excess return as a function of the change in “excess” cash holdings. The model is assessed for constrained and unconstrained firms and for the quality of corporate governance. We predict that the impact of cash holdings on firm value will be stronger in times of financial crisis, irrespective of whether firms are financially constrained or not. However, given that constrained firms are sensitive to macroeconomic shocks (e.g., Fazzari et al. (1988)), we expect the impact to be more pronounced for constrained firms. Firms with good corporate governance are expected to display a stronger relation between cash holdings and firm value and this relation will be more pronounced if a firm is financially constrained.

In light of Farre-Mensa and Ljungqvist (2015), unique to our study is a “voting method” for determining if a firm is financial constrained. We combine a number of relevant sorting variables to construct a new “amalgam” variable based on the distribution of outcomes of all the standard classification methods, including annual payout ratio, firm size, bond rating, paper rating, life cycle and collateral assets. We consider the relevance of the quality of corporate governance using the E-Index, Executive Compensation and Institutional Ownership as our proxies. Our analysis is extended to account for endogeneity. We also employ a propensity score matching approach, following Campello et al. (2010) and Kahle & Stulz (2013) to match constrained and unconstrained firms, then assess the value of cash holdings across time and for different governance levels.

Our results provide new evidence on the value of cash holdings. In our core finding we show that the equity market places a higher value on corporate cash holdings during the financial crisis. Also, there is some evidence to show cash

holdings is more valuable to constrained firms, compared to unconstrained firms in a non-crisis period. The triple-interaction of cash with constraint and crisis effects show a strong negative effect. That is, the crisis value effect for constrained firms is less than that of unconstrained firms. Economically, we show that, in times of financial crisis, an extra dollar of cash is worth about \$1 more to a financially unconstrained firm than it does to a counterpart constrained firm. Consistent with our main findings on the crisis value effect, the difference-in-difference matching estimator shows that the constraint effect on the *level* of cash holdings does not become more significant in times of financial crisis.

Further, while the governance effect on corporate cash holdings is unclear in the pre-crisis period, it becomes more pronounced and more positive during the financial crisis. Finally, the triple-interaction of excess cash with governance and constraint effects generally show a positive effect, suggesting that the positive governance effect on corporate cash holdings becomes more pronounced for firms that are financially constrained.

The remainder of our study comprises a brief review of the literature (Section 2); a presentation of the empirical design, including sampling and data (Section 3); followed by a discussion of the results (Section 4). A concluding section summarizes the paper and considers directions for future research.

## **2. Related Literature**

The literature provides four motivations for firms to hold cash. First is the transaction cost motive where cash holdings allow the firm to avoid transaction costs when accessing external markets (Kim et al., 1998). Second is the precautionary motive suggesting that firms can meet unexpected contingencies. Third the agency motive implies entrenched managers retain cash (Jensen, 1986) and finally there is a tax motive (Foley et al., 2007). Investors place a higher value on cash holdings in firms

with greater growth opportunities (Pinkowitz & Williamson, 2007). Holding cash allows firms, with more internal liquidity, to reduce their financial distress costs (John, 1993 and Opler & Titman, 1994) and support competitive strategies against industry rivals (Fresard, 2010). The costs of cash holdings include a liquidity premium, Opler et al. (1999); tax disadvantages (Faulkender and Wang, 2006) and agency costs (Jensen, 1986).

Faulkender and Wang (2006) show that the marginal value of cash decreases when the firm's cash level increases.<sup>2</sup> Similarly, shareholders place a lower value on each additional dollar of cash when a firm's leverage increases since the value generated by cash may accrue to debtholders rather than shareholders. Moreover, Bates et al. (2011) shows that the value of cash holdings generally increases from the 1980s to 2000s.<sup>3</sup> Harford (1999) demonstrates that firms with higher levels of cash are more likely to engage in acquisitions harmful to shareholder wealth. Lee & Powell (2011) show that cash rich firms will underperform if they persistently hold excess cash for more than three years. Fresard (2012) shows that cash holdings are sensitive to stock price movements, while Kisser (2013) points out that cash flow volatility decreases the value of cash. Liu & Mauer (2011) show that CEO risk taking (vega) has a negative impact on the value of cash savings to shareholder, since excess cash savings benefit debt holders rather than shareholders due to risk-taking incentives induced by high vega compensation. In short the relative benefits and costs of holding excess cash are unclear.

Similarly the evidence is mixed as to the value of cash holding for firms with different levels of financial constraints. Denis and Sibilkov (2010) define various measures of a firm's level of financial constraints. These measures capture the firm's

---

<sup>2</sup> Chan et al. (2013) show similar findings by studying Australian companies.

<sup>3</sup> Note that Bates et al. (2011) investigates the drivers for the value of cash holdings over time (i.e. IPO and credit market risk). However, our paper focuses on the credit supply shock induced by financial crisis and studies its corresponding effect on the value of cash holdings.

sufficiency of funding, access to external markets and financial condition. Financially constrained firms are expected to have greater reliance on cash, and cash is worth more to them because it provides these firms with unconditional liquidity at any time with no transaction costs. Moreover, Almeida et al. (2004) find that constrained firms have positive cash flow sensitivity to cash, but unconstrained firms do not. Faulkender & Wang (2006) provide direct evidence that the equity markets place a higher value on cash held by constrained firms. However, Pinkowitz & Williamson (2007) find that the marginal value of cash is unaffected by firms access to the capital market which is inconsistent with Faulkender & Wang (2006). The inconsistency may arise because different models are used. However, more importantly, the difference may arise from different methods used to classify financially constrained and unconstrained firms.

To define financially constrained firms, much of the prior literature focuses on the firm's ability to access external financial markets including status according to size, bond ratings (both long term and short term), life cycle and collateral assets (see for example Almeida et al., 2004 and Denis & Sibilkov, 2010). Classification methods based on indices have been developed by Whited & Wu (2006) and Hadlock & Pierce (2010).<sup>4</sup> Farre-Mensa and Ljungqvist (2015) provide a critique of all these measures.

The level and value of cash holdings is influence by corporate governance. Harford et al. (2008) show that firms with good corporate governance typically hold more cash than firms that are poorly governed, and Dittmar & Mahrt-Smith (2007) demonstrate that the equity market places higher value on cash holdings if a firm is well governed. Moreover, Harford et al. (2008) show that poorly-governed firms dissipate cash through acquisitions which are not always value-increasing. While prior studies shed some light on the governance effect on cash holdings, no study has

---

<sup>4</sup> Kaplan & Zingales (1997) also develop an index; however, their method is criticised and shown to be problematic by Wited and Wu (2006) and Hadlock & Pierce (2010).



attempted to measure the different governance effects on cash savings under different economic conditions. Further, the evidence of an interactive relation between financial constraints and corporate governance is unknown. Financially constrained firms rely more on cash holdings to finance their investment opportunities, relative to unconstrained firms. Hence, financially constrained firms should benefit more from good corporate governance as cash deployment in well-governed firms will be more efficient.

The recent financial crisis substantially affected financial conditions and funding availability of all firms. We identify the crisis as beginning in late 2007 and taking a sharp downward turn in September 2008.<sup>5</sup> Banks substantially restricted their lending policies. In the fourth quarter of 2008, the dollar volume of lending was 47% lower than it was in the prior quarter and the associated number of loans issued was 33% lower (Ivashina and Scharfstein, 2010). McLean (2011) shows that US firms issue less debt in bad times, and Dittmar and Dittmar (2008) show that share issuance activity increases during economic expansions and falls in recessions. That is, because investor' pessimism increases during a recession, which leads to an increased unwillingness for the equity market to invest. In light of the above, Gorton (2010) argues that the recent financial crisis led to a shock to the supply of credit generally.<sup>6</sup>

While it is true that the financial crisis started in the financial sector due to the meltdown of subprime mortgages, non-financial firms were also seriously affected. Brunnermeier (2009) shows that losses from 'toxic' assets led banks to reduce the supply of liquidity to non-financial firms. Also, Ivashina & Scharfstein (2010) find

---

<sup>5</sup> It is recognized that the timing of the start of the financial crisis is open to interpretation – it varies across commentators. In this study, the window 2008 – 2010 is used as the 'financial crisis period'. This time frame is chosen because of the significant rise in the cost of corporate and bank borrowing starting from October 2008, following the failure of Lehman Brothers on September 15, 2008 (Ivashina and Scharfstein, (2010)). Moreover, Kahle & Stulz (2013) point out that the recession did not start until December 2007. Additionally, because we use annual data, it is impractical to include the second half of 2007 in the financial crisis period, unless all of 2007 is included.

<sup>6</sup> Kahle & Stulz (2013) refer to his argument more broadly as the "credit supply shock theory".

that US banks sharply reduced their lending to the corporate sector during the crisis. Further, Brunnermeier (2009) argues that corporate risk management and financing policies play a central role in the degree to which firms were affected by the financial crisis. A strong corporate governance will improve such risk management and financing policies (Erkens et al. (2012)), which implies that the impact of corporate governance would become more pronounced during the crisis.

Moreover, constrained firms are more likely to be affected by the crisis. Fazzari et al. (1988) suggest immature firms are more often denied loans than better-quality firms during periods of tight credit. Campello et al. (2010), using survey evidence, document that financially constrained firms, on average, reduced employment by 11%, capital investment by 9%, marketing expenditures by 33%, and dividend payments by 14% during the financial crisis.<sup>7</sup> Duchin et al. (2010) further show that financial constrained firms cut about two times more investments than unconstrained firms do during the crisis. As Lins et al. (2010) suggest, internal liquidity would more likely act as a buffer against economic downturn. Hence, we conjecture that financially constrained firms will benefit more from their cash holdings.

On the other hand, a counter-argument might also exist regarding the relation between financial constraints and crisis. Recall that financial crisis induced banks to substantially restrict their lending policies and generally markets decreased their willingness to lend. According to the credit supply shock theory, firms that rely on credit will be affected more during the crisis, and firms that do not depend on credit

---

<sup>7</sup> We acknowledge that managers might also alter firm's payout policies during the crisis, but the predicted behavior is unclear – reflecting tension on the demand versus supply sides. On the one hand, managers might choose to cut dividend payouts to save cash in order to cope with the tightening economic conditions (Campello et al. (2010)). Alternatively, shareholders become more demanding for liquidities during the crisis and managers could decide to increase firm's cash payouts to meet such demand. However, a comprehensive analysis of dividend payout policies with cash holdings goes beyond the scope of this paper where the focus is on financial constraints. We take the view that while simplifying our approach to ignore these issues may reduce the power of our tests, because of the countervailing nature of the possible effects, an ex-ante directional bias is not so obvious.

before the crisis should be impacted less (Kahle & Stulz (2013)). It is essentially the financially unconstrained firms who depend heavily on external financing prior to the crisis, rather than constrained firms. From this point of view, financially constrained firms would be less affected by the crisis (Campello et al., 2012). Moreover, given the tightening financial conditions, firms might use their cash savings to pay off their debt to reduce the risk of default. For instance, Kahle & Stulz (2013) show that highly levered firms reduce their net debt issuance by 171% during the crisis. Built on these facts, financially unconstrained firms might benefit more from their cash holdings, since, in theory, constrained firms will have little debt on their balance sheets.

We focus on the impact of cash holdings before and during the crisis. We expect that the firm's financing policy will materially change during the time of financial crisis. The importance of cash holdings, particularly in a crisis period, will vary between financially constrained and unconstrained firms. We also expect that the relation between (crisis) value and cash holdings will be tempered by the level of corporate governance.

### **3. Empirical Design**

#### *3.1 Proxying Financial Constraints*

Appendix A provides a summary of the methods used, in the literature, to classify firms as financially constrained or unconstrained. In this study we use 3 alternative classification methods: the Whited & We (WW) and Hadlock & Pierce (HP) index methods, plus we create a new joint identification method based on 6 non-index models.<sup>8</sup>

Critics identify a variety of problems associated with the non-index classification methods. For example, Hadlock & Pierce (2010) show that dividend payouts are unlikely to be a good predictor of financial constraints, and Bond and

---

<sup>8</sup> We follow Chen et al. (2012) in creating our measure of the HP Index.

Paper ratings are more likely to capture firm size and age rather than constraint status. Therefore, it might not be appropriate to use any one of these sorting variables as a financial constraint identifier. Most recently, Farre-Mensa and Ljungqvist (2015) provide a much broader critique of all existing alternative proxies for financial constraints, showing that to varying degrees the supposedly constrained firms are not constrained in their ability to issue debt or equity. Moreover, they point out that increasing dividend payout or obtaining a credit rating does not reliably reflect a firm's financial constraint status.

Since no current study has successfully attempted to address these issues, our strategy is to develop a voting method to incorporate the identification effects of all the popular sorting variables and construct a new amalgam proxy based on the distribution of outcomes of all the non-index classification methods. Our argument is that while each individual method in isolation is likely to have weak power to identify a firm's constraint status, the combined thrust of all these methods will bring more power to identify a firm's constraint status. Generally, our voting method is motivated by the development of the *Majority Voting Classifier* in the language of Machine Learning. It shows the intuitively appealing result that combining the output of some weak classifiers will produce better classification results than any individual classifier (Ruta and Gabrys (2005); Hastie et al. (2009)).

To develop the joint identification method we begin by temporarily classifying each firm-year observation as “constrained” or “unconstrained” based independently on each of the six non-index methods listed in Appendix A. Then, we count the number of classification methods that assign a particular observation as financially constrained, and we allocate one “vote” for each such case (zero otherwise). Given the fact that we have six sorting variables, the maximum score that an observation can receive is six. A value of ‘2’ means there are two individual constraint methods that define an observation as being financially constrained.

Then, for each given year, we construct the sample frequency distribution. For Score ‘2’, a value of ‘312’ in 2002 means that there are 312 firm-year observations identified as financially constrained by two individual methods. The full sample distribution is presented in Table 1. Based on intuition and reasonableness, we choose to use ‘4’ as a cut-off to split the sample. Specifically, if there are four or more individual methods that identify an observation as being constrained, then the observation is given “financial constraint” status according to this voting method. As shown in Table 1, across our full pooled sample there are 2,555 firm-year observations that are defined as constrained versus 8,462 observations deemed unconstrained. The rationale for our approach is simple and intuitive – the more classification methods that identify the observation as being constrained, the more likely that observation is actually financially constrained. Finally, we define a binary dummy coded as one for constrained and as zero for unconstrained.

### 3.2 Corporate Governance Specifications

Consistent with Dittmar and Mahrt-Smith (2007) and Harford et al. (2008), we employ three alternative proxies for corporate governance: *Institutional Ownership*, *E-Index* and *Executive Compensation*. While there are other variables that have been identified as potential proxies for corporate governance, most of them have problems. For instance, Bebchuk et al. (2009) show that 18 of 24 provisions included in the *G-Index* are redundant. There is a long debate regarding the real effect of *Board Size*, to the extent that while some argue that a larger board is value-enhancing, others believe the opposite.<sup>9,10</sup> We also deny *Insider ownership* as a proxy for corporate governance due to its endogenous relation with firm value which is our dependent variable.<sup>11</sup>

---

<sup>9</sup> Detailed discussion of Board Size as a corporate governance proxy can be found in Kusnadi (2011) and Harford et al. (2008).

<sup>10</sup> However, our results remain qualitatively similar if *Board Size* or the *Number of Independent Directors* are used as proxies for corporate governance.

<sup>11</sup> The endogenous relationship between firm value and insider ownership has long been a problem in the area. Details can be found in Himmelberg et al. (1999); Coles et al. (2012).

The *E-Index* is related to the anti-takeover provisions that isolate managers from the discipline of the market for corporate control. Bebchuk et al. (2009) construct an entrenchment index (E-Index) by using six of the twenty-four anti-takeover provisions: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments. A detailed description can be found in Bebchuk et al. (2009). A higher E-Index is an indication of poor corporate governance, since it provides management with more power and shareholders with weak rights.

Under the optimal contracting theory, executive pay is viewed as the product of arm's length contracting between directors and executives, which leads to contracts that provide efficient incentives for reducing agency problems (Bebchuk and Weisbach, 2010). Equity compensation aligns management' interests with shareholder' benefit and motivates managers to increase share price (Core et al., 2003). Therefore, under this view, compensation to executives minimizes opportunism and is, thus, value-increasing so that high compensation implies good governance. Following Harford et al. (2008), we use *Executive Compensation*, which is the fraction of equity compensation received by the top five managers, measured as the ratio of stock option grants (SOG) divided to the summation of SOG, salary, and bonus compensation. The sample is divided into deciles: the highest three deciles of executive compensation are coded as one (i.e. good governance) and the lowest three deciles are coded as zero (i.e. poor governance).

The presence of large shareholders plays an important role in addressing corporate agency problems. Shleifer and Vishny (1986) show that large shareholders perform a monitoring role and reduce the scope of managerial opportunism. Hence, we employ *Institutional Ownership* as the measure of large shareholder monitoring, defined as the sum of all ownership positions greater than 5% held by institutional

investors (Dittmar & Mahrt-Smith, 2007). Once again, the sample is split into deciles: the highest three deciles of institutional ownership are coded as one (i.e. good governance) and the lowest three deciles are coded as zero (i.e. poor governance).

### *3.3 Model Specification*

To examine the impact of cash holdings on value, we first follow Faulkender & Wang (2006). The change in firm value is measured by the excess return for firm  $i$  during fiscal year  $t$  less the return of stock  $i$ 's benchmark portfolio during fiscal year  $t$ . The benchmark portfolio is determined using Fama and French (1993) size and book-to-market portfolios.

For each year, we assign every firm into one of 25 size and BE/ME portfolios based on the intersection between size and book-to-market independent quintile sorts. Therefore, stock  $i$ 's benchmark return at year  $t$  is the return of the portfolio to which stock  $i$  belongs at the beginning of fiscal year  $t$ . To calculate excess return for each firm, we subtract the return of the portfolio to which it belongs from the realized return of the stock (Faulkender & Wang, 2006, Liu & Mauer, 2011).

Initially, we regress the excess return on changes in firm characteristics, focusing on the estimated coefficient that corresponds to *unexpected* change in cash. A second phase of analysis adopts a propensity score matching process to control for the difference between constrained and unconstrained firms. Finally, we use a difference-in-difference estimator on the matched sample to further analyse the impact of the financial crisis.

#### *3.3.1 Variable definitions*

##### *Unexpected change in Cash Holdings*

We use the *unexpected* change in cash holdings rather than the *actual* change in cash holdings. Assuming that the market is efficient, the expected change in cash should be impounded into the market value of the firm at the beginning of the fiscal year and

therefore the change in market value should correspond to just the portion of the change in cash that is *unexpected*. Accordingly, we follow Almeida et al. (2004) and Faulkender and Wang (2006) and estimate the following model to isolate the unexpected change in cash holdings (namely, the residual term from the estimated model):

(1)

In model (1), *Cashholdings* is cash plus marketable securities. *Cashflow* is earnings before extraordinary items and depreciation minus dividends. We include  $\Delta NWC$  and  $\Delta ShortDebt$ , defined as the change in noncash net working capital, since working capital can be a substitute for cash (Almeida et al., 2004 & Opler et al., 1999). We control for *Expenditures* and *Acquisition*, since firms can use their cash savings to finance their investment expenditures and acquisitions (Opler et al., 1999). All variables are lagged and deflated by the lagged market value of assets (Faulkender and Wang, 2006). We also include *Size* defined as the natural log of assets and *Q* measured as the market value divides by the book value of assets (Opler et al., 1999).

#### *Control Variables*

Following Faulkender and Wang (2006), we include other firm specific factors that capture the effects of changes in firms' profitability, financing policy and investment policy. To control for changes in the firm's investment policy, we include total assets net of cash and research and development expenditures. According to Faulkender and Wang (2006), if a firm's cash reserves appear to be more than sufficient to fund both the short-term liabilities and any possible profitable investments, then shareholders would place a low value on a marginal dollar of cash, due to the higher corporate tax rate and the potential agency problem. This effect is controlled by including the interaction term. A negative sign is predicted. Moreover, the value of cash holdings



could be correlated with firm's leverage. For firms with higher leverage, it is more likely that the value generated by additional cash would accrue to debt holders instead of shareholders. We interact cash with leverage and expect a negative sign. The control variable (except for excess return and leverage) are also deflated by the 1-year lagged market value of equity ( $M_{i,t-1}$ ) calculated as number of shares outstanding multiplied by the stock's closing price at the fiscal year-end.

### 3.3.2 Baseline model: Value of excess cash holdings

The baseline model is specified in Equation 2.<sup>12</sup> Of key interest is the coefficient on  $\beta_4$ . A positive coefficient is predicted to show that cash holdings are more valuable to constrained firms during the crisis.

$$\begin{aligned} & \text{---} & \text{---} & \text{---} \\ & \text{---} & & \end{aligned}$$

(2)

where :  $r_{i,t}$  = return for firm  $i$  during fiscal year  $t$ ;  $R_{i,t}^B$  = stock  $i$ 's benchmark portfolio during fiscal year  $t$  determined using Fama & French size and book to market portfolios;  $\Delta C_t$  = the change in *excess* cash calculated as the difference between the *actual* change and the *predicted* change in cash holdings (estimated from Equation 1);  $M_i$  = the market value of equity;  $Dconstraint = 1$  if a firm is identified as constrained and 0 if identified as unconstrained;  $DCrisis = 1$  is the crisis dummy and

<sup>12</sup> The variables included in Fama and French (1998) are quite similar to the variables included in our model (i.e. they also include interest expense, R&D and dividends paid in their regression model). The primary difference is the choice of dependent variable – Fama and French (1998) use market-to-book ratio. Equity returns are easier to interpret. Also, as recommend by Faulkender and Wang (2006), it is possible that the variability in market-to-book ratio detected by Fama and French (1998) results from the cross-sectional differences in accounting in terms of the book value of assets relative to the true replacement cost. If accounting methods across firms are correlated with liquidity, it might bias the estimates of the value of cash.

= 1 for the financial crisis period (2008 to 2010) and 0 for pre-crisis period (2002 to 2007); *Governance* is the corporate governance variable proxied alternatively using *Institutional Ownership*, *E-Index* and *Executive Compensation*. Our empirical setup is quite similar to a number of prior studies that also employ triple-interaction terms to gauge the crisis effect on other economic outcomes (see for example Albertazzi & Bottero (2014); Purnanandam (2009)).

### 3.3.3 Impact of corporate governance

To examine the impact of governance on the relation between cash holdings and firm value, and the change of the impact in times of financial crisis, we estimate Equation (3). A positive sign on  $\beta_4$  is predicted showing that cash is more valuable to good corporate governance firms during the crisis.

$$\begin{aligned} & \text{---} & \text{---} & \text{---} \\ & \text{---} & & \end{aligned} \tag{3}$$

The combined effect of governance and financial constraints on the relation between cash holdings and value is tested in the following equation and a positive sign on  $\beta_4$  is predicted.

$$\begin{aligned} & \text{---} & \text{---} & \text{---} \\ & \text{---} & & \end{aligned} \tag{4}$$

### 3.3.4 Propensity score matching and the difference-in-difference estimator

Problems can arise, using the baseline model. The inferences might be confounded by uncontrolled firm level heterogeneity. For instance, a firm having negative returns before the crisis may unsurprisingly perform poorly during the crisis. This firm heterogeneity can confound the estimates of the effect of cash holdings on firm value and, as such, it is difficult to isolate the crisis effect on cash holdings from the pre-crisis periods. Therefore, a causal-effect cannot be unambiguously detected. While we include a number of control variables in the baseline regression, doing so cannot address the fact that the groups being compared could have different characteristics (Heckman et al., 1998). To address these potential problems, we follow Campello et al. (2010) and Kahle & Stulz (2013), and employ the matching estimator as a robustness check to our baseline analysis.

Following Campello et al. (2010), we label financially constrained firms as “treated” and a matched unconstrained firm as the control firm. Though a different setting to ours, we follow Kahle & Stulz (2013) and employ an adapted version of propensity score matching approach – firms are matched based on *Cash Flow Volatility, M/B Ratio, Year and Industry (two digit SIC code)*.<sup>13</sup> The propensity score match uses a probit model and we regress the financial constraint variable on cash flow volatility, M/B ratio, year and industry. The nearest-neighbour method is used to match the two groups. In addition, we require common support and do not allow for replacement. Once we identify the sample of constrained firms with the matched unconstrained sample, we run a regression based on the matched sample.<sup>14</sup>

---

<sup>13</sup> In Kahle & Stulz (2013), firms are matched according to operating cash flow, M/B ratio, cash holdings, size, and leverage ratio. However, operating cash flow and leverage are the main components of the WW Index. Size is the key to calculate HP Index. And cash holdings is the key variable of interest in our study. Thus, in our setting, we use Cash Flow Volatility, M/B ratio, industry and year to match constraint and unconstraint firms.

<sup>14</sup> Our matching analysis is similar to Ozbas & Scharfstein (2010) who also perform regression analysis on a matched sample to alleviate the confounding effect induced by firm-level heterogeneity.

### *3.4 Sample selection and data*

The data for the majority of the variables in the regression models are sourced from COMPUSTAT over the period 2002 to 2010.<sup>15</sup> The stock returns are downloaded from CRSP. The two datasets are matched based on GVKEY (Cross-sectional identifier) and Datadate (Time-series Identifier). For the financial constraint classifications, data for Bond and Paper ratings are retrieved from the COMPUSTAT Ratings File. Data for the calculation of the annual payout ratio, firm size, life cycle, collateral assets, the Whited & Wu index and Hadlock & Pierce (HP) index<sup>16</sup> come from COMPUSTAT. Treasury Bill yields and the rate of Industrial Production are downloaded from the US Federal Reserve. Balance Sheet data are extracted at the end of each fiscal year, and earnings and expense data also are fiscal year end. Since the COMPUSTAT data date refers to the fiscal year end (rather than calendar year end), it is noted that that firms in our sample have different year ends. COMPUSTAT assigns the data year as the year in which the fiscal year begins if the fiscal year end is from January through May. If the fiscal year end is from June through December, then the data year is the year in which the fiscal year ends. In the estimation of regression models, fiscal year is used to refer to each sample period.<sup>17</sup>

To construct the sample, we follow Opler et al. (1999) and first exclude firms in Utility and Financial industries (with SIC codes between 4,900 and 4,999, and between 6,000 and 6,999, respectively), as these firms are subject to regulatory supervision and statutory capital requirements. American Depository Receipts (ADRs) are also excluded. Further, in light of Duchin et al. (2010), included firms have a

---

<sup>15</sup> We choose to begin our analysis in 2002 for several reasons. First, we wanted to avoid earlier multiple crisis periods that would unnecessarily complicate our analysis. Second, as discussed shortly, some of our key data (e.g. executive compensation) only are meaningfully available from this time forward.

<sup>16</sup> Note that the HP index requires firm age, which is defined as the number of years since a firm's first appearance in CRSP.

<sup>17</sup> Sixteen percent of the firms have a fiscal year end from January to May. Hence their financial statements for the year ending in 2008 will span both our pre and post crisis period. We run our core analysis excluding these firms and our results are qualitatively the same. Details are available from the authors on request.

minimum \$10 million in market capitalization, \$25 million in total book value of assets and \$0.5 million in cash holdings. Firm-year observations are excluded if cash holdings exceed the total book value of assets. Following Faulkender and Wang (2006) and Opler et al. (1999), firm-years with negative values for dividends, sales, capital expenditures or net assets are excluded.

For corporate governance variables, data needed for the E-Index are downloaded from Riskmetrics and Executive Compensation data are retrieved from both COMPUSTAT Executive Compensation File (*Execucomp*) and Riskmetrics. Data for Institutional Ownership are collected from the 13-F filings in Thomson Financial. Prior to 2007 Riskmetrics only provides annual data for the years 2002 and 2004. Following Dittmar & Mahrt-Smith (2007), Harford et al. (2008), Bebchuk et al. (2009), we collect annual data for the years 2002 and 2004 and assume that index remains unchanged in the year following the most recent report. From 2007 onwards,<sup>18</sup> we have yearly data from Riskmetrics.

To reduce the impact of outliers, we follow Dittmar & Mahrt-Smith (2007) Faulkender and Wang (2006) and winsorize all the regression variables at the 1% level. We require firms to have at least 3 consecutive firm-year observations to be included in our sample. These criteria result in a final sample with 11,017 firm-year observations and 2,031 firms.<sup>19</sup>

---

<sup>18</sup> While Riskmetrics change their methodology to collect data since 2007, this change is unlikely to affect our study.

<sup>19</sup> Notably, our sample size is comparable with Harford et al. (2008) who have 11,645 firm-year observations and 1,872 firms for the years 1993 through 2004.

## 4. Results

### 4.1 Summary Statistics

The descriptive statistics for the sample are reported in Table 2. The mean and median of risk adjusted return are 0.08 and -0.04, which are slightly higher than Faulkender & Wang (2006) who reported a -0.01 mean and -0.08 median. However, the first and third quartile of risk adjusted return in our study (-0.29 and 0.26) is at the similar magnitude to Faulkender & Wang (2006). Change of cash holdings ( $\Delta CashHoldings_t$ ) in our sample (0.02 and 0.007) are slightly greater than Faulkender & Wang (2006) who reported a 0.004 mean and a -0.001 median. But, the first and third quartile of change in cash (-0.03 and 0.05) is similar to their results (-0.03 and 0.03). The mean value of changes in R&D, interest expense and total dividends are quite small (-0.0009, -0.0005 and 0.00003, respectively). However, these figures are similar to Faulkender & Wang (2006). The average E-Index is 2.66, which is comparable to Bebchuk, Cohen, and Ferrell (2009) who reported an average of 2.24 and 2.49 for the E-Index in years 1990 and 2002, respectively. However, the total compensation in our sample is 11.85, which is slightly higher than Frydman and Saks (2010) who reported a 7.63 average total compensation for the period from 2000 to 2005.

Table 3 reports summary statistics for each subsample of the corporate governance classifications and the financial constraint classifications. As shown in the table, firms with stronger shareholder rights (i.e. low E-Index) hold more cash (0.21 mean and 0.15 median) than those with lower shareholder rights (i.e. high E-index) who have a 0.16 mean and 0.099 median, consistent with Harford et al. (2008). For executive compensation, firms with strong corporate governance (i.e. high compensation) hold more cash (a 0.224 mean and 0.180 median) than those with poor corporate governance (i.e. low compensation) (a 0.180 mean and a 0.116 median). Similar cash policies can be detected for institutional ownership subsamples, to the extent that good governance firms hold more cash than do poor governance firms.

On the other hand, firms with good corporate governance, for both E-Index and Equity Compensation, have higher positive *actual* change in cash for all the median values. These statistics suggest that firms with good corporate governance are more likely to increase their cash savings, compared to firms with poor corporate governance, which is consistent with Harford et al. (2008). In addition, better-governed firms tend to be larger (*Size*) with higher earnings ( $E_t$ ) than counterpart poorly-governed firms.

Turning to the constrained classifications, financially constrained firms have higher cash holdings than do financially unconstrained firms for all three classifications, indicating that cash holdings are more important for firms with the limited access to external capital markets. Moreover, consistent with Faulkender & Wang (2006), financially constrained firms have negative change in excess cash holdings under all three constraint classifications, but unconstrained firms have positive change in excess cash holdings. These summary statistics suggest that firms facing greater frictions in accessing external capital markets (i.e. constrained firms) are more likely to draw down their cash reserves compared to financially unconstrained firms. The intuition here is that constrained firms are more reliant on cash savings and therefore hold higher levels of cash than do firms that can easily raise funds via the capital market (Faulkender & Wang, 2006, Almeida et al., 2004).

Table 3 also shows that for all classifications, the average earnings are higher for financially unconstrained firms than for financially constrained. Also, constrained firms tend to be smaller, and unconstrained firms have more debt, suggesting that financially constrained firms indeed have greater difficulty in raising external funds relative to unconstrained firms.

## 4.2 Estimation Results

### 4.2.1 Constraint and crisis effects

Table 4 reports the results from Equation (2), which analyses the impact of change in excess cash holdings on firm value, for constrained and unconstrained firms, before and during the financial crisis. We control for corporate governance (using 3 alternative measures shown in Panels A-C), change in net assets, earnings, R&D expenditure, interest, debt, equity issuance and leverage. Each analysis is repeated for 3 alternative classifications of financially constrained firms. The coefficient on change in excess cash holdings is significant and positive for five of the nine classifications, suggesting that an increase in excess cash holdings is positively associated with firm value.

The interaction between change in excess cash and the financial crisis ( $\beta_2$ ) represents the crisis effect for unconstrained firms. The results are significant and positive for all the classifications, showing that for unconstrained firms, firm value increases for an increase in excess cash during the crisis period. The interaction terms for the cash and constraint dummy ( $\beta_3$ ) are significant and positive for most of the classifications, which is consistent with Faulkender and Wang (2006) and Denis & Sibilkov (2010). This result suggests that the equity market places a higher value on excess cash for constrained firms than for unconstrained firms in a non-crisis period.<sup>20</sup>

Turning to the triple-interaction of cash with constraint and crisis effects ( $\beta_4$ ), the coefficients are all significant and negative for the Equity Compensation and Institutional Ownership proxies but insignificant for the E-Index classification of corporate governance. These results indicate that the crisis value effect for constrained

---

<sup>20</sup> However, we recognize that our results in this case are weaker than Faulkender and Wang (2006) who find that cash is more valuable for constrained firms under all the four classifications they employ. There are several reasons for the different strength of results between the two studies. First, Faulkender and Wang (2006) use sorting variables (i.e. payout ratio, size, bond and paper ratings) as the constraint criteria to classify their sample. Second, as discussed earlier, our sample period is different from their study. Third, Faulkender and Wang (2006) did not control for corporate governance.



firms is less than that of unconstrained firms. Our results are also important economically. According to our estimates of Table 4, we show that shareholders of a financially unconstrained firm under the WW Index criterion, only place a value of \$0.34 on an extra dollar of cash in a non-crisis period.<sup>21</sup> However, the value of an additional dollar will increase to \$1.91 ( $=\$0.34+\$1.57$ ) in the time of financial crisis for an unconstrained firm. On the other hand, an extra dollar of cash is valued by shareholders of a financially constrained firm at \$2.04 ( $=\$1.70+\$0.34$ ) in the pre-crisis period, but the marginal value of cash will decrease to \$0.91 ( $=\$0.34+\$1.57+\$1.70-\$2.70$ ) during the crisis. Stated differently, in the time of financial crisis, an extra dollar of cash is worth exactly \$1 ( $=\$1.91-\$0.91$ ) more for a financially unconstrained firm than a constrained firm. This result is opposite our prediction and we offer following explanations.

As discussed in Section 2, constrained firms did not overly depend on external financing prior to the crisis, therefore they are less affected by the credit shock. Moreover, according to prior literature (Almeida et al. (2004)), constrained firms save cash to finance investments when external financing is difficult to obtain. However, according to the demand shock theory described by (Kahle & Stulz (2013)), very few positive NPV projects were available during the crisis and corporate managers were unwilling to take on new projects due to their concern over market uncertainties. Hence, the decreased demand for investment would diminish the value of cash holdings to financially constrained firms during the crisis. Further, the constrained firms saved more cash during the pre-crisis period; hence, somewhat ironically they were better prepared for the crisis than unconstrained firms.

---

<sup>21</sup> As described in section 3.3.2,  $\Delta C_t$  is divided by  $M_{i,t-1}$ , and stock return is the spread of ( $M$ ) divided by  $M_{i,t-1}$ . This standardization enables us to interpret the estimated coefficients as the dollar change in value for a one-dollar change in the corresponding independent variable (Faulkender & Wang, 2006).

On the other hand, consistent with the credit supply shock theory (Kahle & Stulz (2013)), unconstrained firms who rely heavily on external financing should be more affected during the crisis. Moreover, firms are likely heavily engaged in paying off their debt during a crisis. There is no doubt that financially unconstrained firms will have more debt outstanding than constrained firms. Hence, unconstrained firms are more likely to draw on their cash savings for debt retirement in an effort to reduce the risk of default. This means unconstrained firms can benefit more from extra cash holdings during the crisis, which would weaken the constraint effects on cash holdings for firm value.

To assist in the interpretation of the test coefficients, Table 5 summarises the key interaction effects. As shown in the table, the cash effect on firm value for both constrained and unconstrained firms are mostly significant and positive in both the crisis and pre-crisis periods. These results confirm that cash holdings are positively related to firm value. Moreover, the constraint effect on cash holdings in the non-crisis period are positive and significant for most of the classifications, which is consistent with Faulkender and Wang (2006). Turning to the crisis effect for constrained firms, the results are negative and significant for four constraint classifications but insignificant for three classifications. However, the crisis effect for unconstrained firms is significant and positive for all the constraint classifications. These results suggest that cash holdings become more important for financially *unconstrained* firms during the financial crisis, consistent with the estimates on the triple-interaction term reported in Table 4.

The control variables also present interesting results.<sup>22</sup> Firm value is positively associated with profitability ( $\Delta E_t$ ) and net financing ( $NF_t$ ), which is consistent with Faulkender and Wang (2006). Lagged cash holdings are positive and significant

---

<sup>22</sup> To conserve space and avoid repetition, we suppress discussion of the control variable estimation results for the remaining analysis.

across all classifications, but leverage is significantly negative. However, Faulkender and Wang (2006) show that significant coefficients on interactions between the change in cash with two variables, lagged cash and leverage. These two interaction terms are insignificant for most of the classifications in our study. The possible reasons for these differences relate to the discussion in the earlier footnote. Moreover, Dittmar & Mahrt-Smith (2007) employ the same model as we do and they also show that these two interactions are insignificant if corporate governance is controlled.

#### 4.2.2 Governance and crisis effects

Table 6 reports results from Equation (3), which compares/interacts governance and crisis effects on the relation between change in excess cash holdings and firm value across different classification methods.<sup>23</sup> The estimated coefficients on change in excess cash holdings are significant and positive for all the nine classifications. Economically, the estimates range from \$0.59 to \$1.43, suggesting baseline cash holdings are positively associated with firm value. Turning to the interaction between governance and excess cash ( $\Delta C_t^* Gov, \beta_3$ ), the results are insignificant for all the classifications (i.e. Governance effect in non-crisis period).

These results are inconsistent with Dittmar & Mahrt-Smith (2007) who find that the value of cash savings is greater if the firm is well-governed and we offer three possible explanations. First, our sample period (2002-2010) is different from their sample period (1990-2003). Second, Dittmar & Mahrt-Smith (2007) do not cluster standard errors by firm and year but we do. Third, when estimating the governance effect on *excess* cash savings, Dittmar & Mahrt-Smith (2007) employ the Fama-French (1998) model which is different from the model that we employ.

---

<sup>23</sup> While all models that we estimate include the full complement of control variables as outlined earlier, to conserve space, we only tabulate the results for our key test variables and interaction terms. Similarly, although not reported, we also perform a Wald test similar to that presented in Table 5.

Turning to the interaction between change in excess cash holdings and financial crisis ( $\beta_2$ ), it is insignificant for most of the classifications. This coefficient represents the relation for poorly-governed firms, hence the crisis has little impact. While  $\beta_2$  is insignificant,  $\beta_4$  is positive and significant when we use Institutional Ownership and E-Index as proxies for corporate governance. The crisis effect for well-governed firms is represented by  $\beta_2 + \beta_4$ . Considering the governance effect in pre-crisis versus crisis periods (i.e.  $\beta_3$  vs.  $\beta_4$ ), we have the following intuition: while the governance effect on corporate cash holdings is unclear in the pre-crisis period, it becomes more pronounced and more positive during the financial crisis.

The result is also economically significant. According to the first column of Table 6, shareholders place a value of \$1.65 ( $=\$1.43+\$0.22$ ) on an extra dollar of cash for a well-governed firm in the pre-crisis period, but the value will increase to \$2.82 ( $=\$1.43-\$0.07+\$0.22+\$1.24$ ) during the financial crisis. In other words, the equity market places a higher value on each dollar of cash that well-governed firms hold during times of market stress.

#### *4.2.3 Governance and constraint effects*

Table 7 reports results from Equation (4), which compares the constraint and governance effects on excess cash holdings for firm value across different classification methods. The estimated coefficient on change in excess cash and constraint dummy ( $\beta_3$ ) shows some evidence that there is a constraint effect for firms with poor corporate governance. There is a governance effect on unconstrained firms ( $\beta_2$ ) for the institutional ownership classification, suggesting that large shareholders play a role in monitoring unconstrained (i.e. large firms) firm's cash policies.

Turning to the triple-interaction of excess cash with governance and constraint effects ( $\Delta C_t^* Gov^* Dcons$ ), the estimated coefficients are positive and significant for four classifications when we use Executive Compensation and E-Index as proxies for

corporate governance. This is consistent with our prediction that the positive governance effect on cash holdings becomes more pronounced for financially constrained firms, suggesting that corporate governance plays a more important role in monitoring cash deployment for firms with limited access to external financing. However, for the institutional ownership classification, the triple-interaction ( $\Delta C_t^* Gov^* Dcons$ ) is insignificant. This possibly occurs because institutional owners are less inclined to invest in financially constrained firms (i.e. small firms) and, hence, have a limited monitoring role.

Collectively, the results provide the following intuition: while the governance effect on corporate cash holdings is unclear for unconstrained firms, it becomes more pronounced for financially constrained firms. Hence, investors are more likely to place a higher value on each dollar of excess cash for constrained firms with good corporate governance.

#### *4.3 Propensity Score Matching Analysis*

Table 8, Panel A reports the results of estimating Equation (2), using the matched sample, excluding the control variables since firm heterogeneity is captured by the matching process. Panels B and C include the governance control. The financially constrained firms are defined as treated firms and unconstrained firms as control firms.

The interaction between change in excess cash and financial crisis ( $\beta_2$ ) is significant and positive for most of the classifications. The value of cash increases for unconstrained firms in a financial crisis. This result is consistent with the baseline regression results presented in Table 4. Moreover, the estimated coefficient on the interaction term on cash and constraint dummy ( $\beta_3$ ) is significant and positive for most of the classifications, showing that cash is of higher value to constrained firms. Again this result is consistent with the baseline model and Faulkender and Wang

(2006) and Denis & Sibilkov (2010).

Turning to the triple-interaction of cash with constraint and crisis effects (i.e.  $\Delta Ct * Dcrisis * Dcons$ ), the coefficients are significant and negative for most of the classifications. These results suggest that the impact of cash on firm value becomes less positive for constrained firms in times of financial crisis. According to the first column of Panel B in Table 8, the value of an extra dollar of cash for constrained firms will decrease from \$1.58 in the pre-crisis period to \$0.35 in the crisis period. Although inconsistent with our initial expectations the result is consistent with the baseline regression estimations. We conclude that there is no additional value of extra cash holding for constrained firms in a financial crisis.<sup>24</sup>

Panel D of Table 8 shows results where corporate governance is measured using the EE Index. The triple-interaction becomes positive and significant. Recall that the triple-interaction for E-Index in Table 4 was insignificant. Moreover,  $\beta_3$  ( $\Delta Ct * Dcons$ ) becomes insignificant on the matched sample in Table 8. The positive effects shown on the triple-interaction term (i.e. the constraint effects in the crisis period) are possibly induced from losing the constraint effects from the non-crisis period ( $\beta_3$ ).<sup>25</sup>

## 5. Summary and Conclusion

In this paper we examine the impact of excess cash holdings on firm value in the context of financial constraints, the financial crisis and corporate governance. The economic rationale underlying the relevance of cash flows is based on market

---

<sup>24</sup> Given the weaker constraint effect we found, we perform additional difference-in-difference estimation of cash holdings for financially constrained and unconstrained firms on a matched sample. The difference-in-difference matching estimator allows us to avoid the problem of omitted time trends and enables us to control unobserved differences between firms by looking at the matched pairs before and during the crisis. In unreported analysis, the test shows that the change of cash holdings between constrained and unconstrained firms are indistinguishable during the crisis, suggesting that the constraint effect on cash holdings do not become more pronounced. Details are available from the authors upon request.

<sup>25</sup> We also test the constrained and governance effect using the matching sample. In unreported analysis we find there is some evidence showing that the governance effect on cash holdings is more significant for constrained firms (i.e. consistent with earlier results reported in Table 7), suggesting that financially constrained firms benefit more from a well-governed cash deployment. Details are available from the authors upon request.

imperfections. The financial crisis represents a credit supply shock and changes the access to external capital markets for firms, potentially changing the relevance of the amount of cash holdings to firm value. Our research examines financially constrained versus unconstrained firms, and the impact of corporate governance. The pre-crisis time frame examined is 2002-2007, while the crisis period is defined as 2008-2010.

Generally, we find that excess cash holdings are positively related to firm value. Further, there is some evidence to show cash holdings is more valuable to constrained firms, compared to unconstrained firms. The value impact is also more pronounced during the crisis. The triple-interaction of cash with constraint and crisis effects show a strong negative effect for the total compensation proxy for corporate governance. That is, the crisis value effect for constrained firms is less than that of unconstrained firms. We offer following explanations. On the one hand, constrained firms have lower reliance on external financing prior to the crisis and, hence, are less affected by the financial crisis. On the other hand, unconstrained firms rely heavily on external financing and therefore should be more affected by the crisis. Moreover, the decreased in demand for investment would diminish the value of cash holdings to financially constrained firms. Nevertheless, unconstrained firms are more likely to draw on their cash savings for debt retirement in an effort to reduce the risk of default. This means unconstrained firms can benefit more from extra cash holdings during the crisis. Therefore, constraint effects on cash holdings for firm value will be weakened.

Our analysis also shows that while the governance effect on corporate cash holdings is unclear in the pre-crisis period, it becomes more pronounced and more positive during the financial crisis. The equity market places a higher value on each dollar of cash that well-governed firms hold during times of market stress. Finally, the triple-interaction of excess cash with governance and constraint effects generally show a positive effect, suggesting that the positive governance effect on corporate cash holdings becomes more pronounced for firms that are financially constrained.





## References

- Albertazzi, U, and M Bottero, 2014, Foreign bank lending : Evidence from the global financial crisis, *Journal of International Economics* 92, S22–S35.
- Almeida, H, M Campello, B Laranjeira, and S Weisbenner, 2011, Corporate debt maturity and the real effects of the 2007 credit crisis, *Critical Finance Review* 1, 3–58.
- Almeida, H, M Campello, and M. Weisbach, 2004, The cash flow sensitivity of cash, *The Journal of Finance* 59, 1777–1804.
- Bates, T, Chang, CH and JX Chi, 2011 Why has the value of cash increased over time?, Working Paper.
- Bebchuk, L, A Cohen, and A Ferrell, 2009, What Matters in Corporate Governance?, *Review of Financial Studies* 22, 783–827.
- Bebchuk, L, and M Weisbach, 2010, The state of corporate governance research, *Review of Financial Studies* 23, 939–961.
- Brunnermeier, M, 2009, Deciphering the liquidity and credit crunch 2007-08, *Journal of Economic Perspectives* 23, 77–100.
- Campello, M, JR Graham, and CR Harvey, 2010, The real effects of financial constraints: Evidence from a financial crisis, *Journal of Financial Economics* 97, 470–487.
- Campello, M, E Giambona, JR Graham, and CR Harvey, 2012, Access to liquidity and corporate investment in Europe during the financial crisis, *Review of Finance* 16, 323–346.
- Chan, H, X Chang, R Faff, and G Wong, 2010, Financial constraints and stock returns — Evidence from Australia, *Pacific-Basin Finance Journal* 18, 306–318.
- Chan, HWH, Y Lu, and HF Zhang, 2013, The effect of financial constraints, investment policy, product market competition and corporate governance on the value of cash holdings, *Accounting & Finance* 53, 339–366.
- Chen, T, J Harford, and C Lin, 2012, Do Financial Analysts Play a Monitoring Role ? Evidence from Natural Experiments, working paper .
- Coles, JL, ML Lemmon, and J Felix Meschke, 2012, Structural models and endogeneity in corporate finance: The link between managerial ownership and corporate performance, *Journal of Financial Economics* 103, 149–168.
- Core, J, W Guay, and D Larcker, 2003, Executive equity compensation and incentives: A survey, *Economic policy review* 9, 27–50.
- Denis, DJ, and V Sibilkov, 2010, Financial Constraints, Investment, and the Value of Cash Holdings, *Review of Financial Studies* 23, 247–269.
- Dittmar, a, and R Dittmar, 2008, The timing of financing decisions: An examination of the correlation in financing waves, *Journal of Financial Economics* 90, 59–83.

- Dittmar, A, and J Mahrt-Smith, 2007, Corporate governance and the value of cash holdings, *Journal of Financial Economics* 83, 599–634.
- Duchin, R, O Ozbas, and B a. Sensoy, 2010, Costly external finance, corporate investment, and the subprime mortgage credit crisis, *Journal of Financial Economics* 97, 418–435.
- Erkens, DH, M Hung, and P Matos, 2012, Corporate governance in the 2007–2008 financial crisis: Evidence from financial institutions worldwide, *Journal of Corporate Finance* 18, 389–411.
- Farre-Mensa, J and Ljungqvist, A, 2015, Do Measures of Financial Constraints Measure Financial Constraints? *Review of Financial Studies*, forthcoming.
- Faulkender, M, and R Wang, 2006, Corporate financial policy and the value of cash, *The Journal of Finance* 61, 1957–1990.
- Fazzari, S, R Hubbard, and B Petersen, 1988, Financing constraints and corporate investment, *Brookings Papers on Economic Activity*, 1, 141–206.
- Fama, E. F., and K.R. French, 1998, Taxes, financing decisions, and firm value. *Journal of Finance*, 53, 819-843.
- Foley, CF, JC Hartzell, S Titman, and G Twite, 2007, Why do firms hold so much cash? A tax-based explanation, *Journal of Financial Economics* 86, 579–607.
- Fresard, L, 2010, Financial strength and product market behavior: The real effects of corporate cash holdings, *The Journal of finance* 65, 1097–1122.
- Fresard, L, 2012, Cash savings and stock price informativeness, *Review of Finance* 16, 985–1012.
- Frydman, C, and RE Saks, 2010, Executive Compensation: A New View from a Long-Term Perspective, *Review of Financial Studies* 23, 2099–2138.
- Gorton, G., 2010. Slapped by the Invisible Hand: The Panic of 2007. Oxford University Press, USA.
- Hadlock, CJ, and JR Pierce, 2010, New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index, *Review of Financial Studies* 23, 1909–1940.
- Harford, J, 1999, Corporate cash reserves and acquisitions, *The Journal of Finance* LIV.
- Hastie, T, Tibshirani, R and Friedman, J.H., *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, SpringerVerlag, Heidelberg, 2001
- Harford, J, S a. Mansi, and WF Maxwell, 2008, Corporate governance and firm cash holdings in the US, *Journal of Financial Economics* 87, 535–555.
- Heckman, JJ, H Ichimura, and P Todd, 1998, Matching As An Econometric Evaluation Estimator, *Review of Economic Studies* 65, 261–294.

Himmelberg, CP, RG Hubbard, and D Palia, 1999, *Understanding the Determinants of Managerial Ownership and the Link between Ownership and Performance*, *Journal of Financial Economics*. Vol. 53.

Ivashina, V, and D Scharfstein, 2010, Bank lending during the financial crisis of 2008, *Journal of Financial Economics* 97, 319–338.

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

John, T, 1993, Accounting measures of corporate liquidity, leverage, and costs of financial distress, *Financial Management* 22, 91–100.

Kahle, K, and R Stulz, 2013, Access to capital, investment, and the financial crisis, *Journal of Financial Economics*.

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

Keynes, J.M., 1936. *The General Theory of Employment. In: Interest and Money*. Harcourt Brace, London.

Kim, C., DC Mauer, and AE Sherman, 1998, The determinants of corporate liquidity: Theory and evidence, *Journal of Financial and Quantitative Analysis* 33, 335–359.

Kisser, M, 2013, The real option value of cash, *Review of Finance* 17, 1649–1697.

Kusnadi, Y, 2011, Do corporate governance mechanisms matter for cash holdings and firm value?, *Pacific-Basin Finance Journal* 19, 554–570.

Lins, K V., H Servaes, and P Tufano, 2010, What drives corporate liquidity? An international survey of cash holdings and lines of credit, *Journal of Financial Economics* 98, 160–176.

Lee, E, and R Powell, 2011, Excess cash holdings and shareholder value, *Accounting and Finance* 51, 549–574.

Liu, Y, and DC Mauer, 2011, Corporate cash holdings and CEO compensation incentives, *Journal of Financial Economics* 102, 183–198.

McLean, R., 2011, Share issuance and cash savings, *Journal of Financial Economics* 99, 693–715.

Opler, T, L Pinkowitz, R Stulz, and R Williamson, 1999, The determinants and implications of corporate cash holdings, *Journal of Financial Economics* 52.

Opler, T, and S Titman, 1994, Financial distress and corporate performance, *The Journal of Finance* 49.

Ozbas, O, and DS Scharfstein, 2010, Evidence on the dark side of internal capital markets, *Review of Financial Studies* 23, 581–599.

Pinkowitz, L, and R Williamson, 2007, What is the market value of a dollar of corporate cash?, *Journal of Applied Corporate Finance* 19, 74–81.

Purnanandam, A, 2009, “Originate-to-Distribute Model and the Subprime Mortgage Crisis”, *Review of Financial Studies* 24, 1881–1915.

Ruta, D, and B Gabrys, 2005, Classifier selection for majority voting, *Information Fusion* 6, 63–81.

Shleifer, A, and R Vishny, 1986, Large shareholders and corporate control, *The Journal of Political Economy* 94, 461–488.

Whited, T, and G Wu, 2006, Financial constraints risk, *Review of Financial Studies* 19, 531–559.

## Appendix A

### Summary of methods for classifying firms as constrained or unconstrained

Method	Reference/s	Description
1. Annual Payout Ratio	Faulkender & Wang, 2006; Denis & Sibilkov, 2010	High payout ratios show that the firm has funds to meet debt obligations and finance investments. Payout ratio is defined as the ratio of dividends and common stock repurchases to operating income. Firms are ranked annually based on the payout ratio and those in the bottom (top) three deciles are assigned to the financially constrained (unconstrained) group.
2. Firm Size	Faulkender & Wang, 2006; Almeida et al., 2004	Small firms tend to be younger and less well known, and therefore have limited access to external financial markets. Firms are ranked annually based on their total assets and assigned to the financially constrained (unconstrained) group those firms in the bottom (top) three deciles.
3. Bond Rating	Denis & Sibilkov, 2010; Almeida et al., 2004	Firms with a debt rating are assumed to have a stronger financial position. Therefore, firms are classified as financially unconstrained if their bonds have been rated during the sample period and their debt is not in default. Firms are classified as constrained if they have never had their debt rated during our sample period or if their long-term debt rating is unavailable. Observations are only categorized in the constrained subsample when the firms report positive debt.
4. Paper Rating.	Denis & Sibilkov, 2010; Almeida et al., 2004	Similar to bond rating firms are sort firms according to their commercial paper ratings. Firms are classified as financially constrained if they have never had their issues rated during our sample period, and they have debt outstanding that year. Firms receiving paper ratings at some point during the sample period are considered as unconstrained firms.
5. <i>Life Cycle</i>	DeAngelo, DeAngelo and Stulz (2006)	Life cycle is defined as the ratio of retained earnings to total assets. Firms with low retained earnings tend to be in the expansion stage with <i>greater</i> investment opportunities and therefore are defined as unconstrained firms. Firms with high retained earnings are more likely to be in the <i>declining</i> stage with <i>fewer</i> growth opportunities, and therefore are defined as financially constrained firms.
6. <i>Collateral Assets</i>	Almeida & Campello, 2007	Collateral assets is defined as the sum of inventory and property, plant and equipment over total assets (Inventory +PPT)/Assets. Firms with greater collateral assets are more tangible, sustain more external financing, because collateral assets increase the value that can be captured by creditors in default states. Therefore, firms with high (low) collateral assets are defined as unconstrained (constrained) firms.
7. Whited & Wu (WW) Index	Whited & Wu, 2006	The WW index uses a number of firm specific factors that capture financial conditions, converted to an index as follows:  Firms are classified as unconstrained (constrained) if they rank in the bottom (top) three deciles of the WW Index.
8. Hadlock & Pierce (HP) Index	Hadlock & Pierce, 2010	This method uses a quadratic relation between size and constraints, and a linear relation between age and constraints, to develop the following equation:  $HP\ Index = -0.737 * Size - 0.043 * Size^2 - 0.040 * Age$

**Table 1: Sample Distribution for Voting Method**

This table shows the number of observations that have been classified as financially constrained on 1 through to 6 classification methods. The 6 methods are annual payout ratio, firm size, bond rating, paper rating, life cycle and collateral assets. The numbers in the table represent the count of the number of classification methods that define a particular observation as financially constrained. For example, a count of 312 in 2002 under the score of 2 means there are 312 observations that are classified as financially constrained by 2 methods.

Number of methods where firms-year observations are classified as financial constrained							
	0	1	2	3	4	5	6
2002	72	204	312	286	212	74	1
2003	70	215	315	324	215	73	0
2004	67	236	328	321	218	78	1
2005	72	233	333	319	228	79	1
2006	66	239	331	343	227	71	0
2007	72	241	320	357	217	88	2
2008	59	259	314	342	202	71	1
2009	57	245	312	329	218	62	0
2010	62	209	292	306	159	55	2
Total	597	2081	2857	2927	1896	651	8
Total <4				8462			
Total >4				2555			

**Table 2: Summary Statistics for the whole Sample**

This table provides summary statistics for the whole sample over the period from 2002 to 2010.

is excess return where  $r_{i,t}$  is the stock return for firm  $i$  during fiscal year  $t$  and  $R_{i,t}^B$  is stock  $i$ 's benchmark portfolio during fiscal year  $t$  determined using Fama & French size and book to market portfolios;  $C_t$  is cash plus marketable securities;  $\Delta CashHoldings_t$  is the change of cash holdings.  $\Delta C_t$  is the difference between actual change in cash and the expected change in cash which is modelled based on Almeida et al. (2004).  $E_t$  is earnings before extraordinary items plus interest.  $NA_t$  is total assets minus cash holdings.  $RD_t$  is R&D expenditures.  $I_t$  is interest expense,  $D_t$  are total dividends paid,  $L_t$  is Leverage measured as total debt over the sum of total debt and the market value of equity.  $NF_t$  is total equity issuance minus repurchases plus debt issuance minus debt redemption. *Total Compensation* is the top five management total compensation. *E-Index* is the entrenchment index suggested by Bebchuk, Cohen, and Ferrell (2006).  $\Delta X_t$  is compact notation for the 1-year change,  $X_t - X_{t-1}$ . All the variables (except for excess return, leverage, *E-Index*, *Total Compensation*) are deflated by the lagged market value of equity ( $M_{i,t-1}$ ).

Variable	Mean	Median	Std Dev	1 <sup>st</sup> Quartile	3 <sup>rd</sup> Quartile
$r_{i,t}-R_{i,t}$	0.07586	-0.03813	0.66877	-0.29143	0.26174
$\Delta CashHoldings_t$	0.02053	0.00666	0.16842	-0.02775	0.05142
$\Delta C_t$	0.00913	-0.00102	0.16402	-0.03840	0.04135
$C_t$	0.24583	0.16721	0.23181	0.06176	0.37095
$C_{t-1}$	0.21346	0.12801	0.26495	0.05475	0.26452
$\Delta E_t$	0.04235	0.00738	0.29782	-0.01955	0.03798
<i>E-Index</i>	2.66104	3.00000	1.37360	2.00000	4.00000
<i>Total Compensation</i>	11.8512	7.67035	12.11729	4.14895	14.79539
$\Delta NA_t$	0.03311	0.02131	0.39047	-0.03594	0.09577
$\Delta RD_t$	-0.00088	0.00003	0.03667	-0.00088	0.00483
$\Delta I_t$	-0.00053	0.00000	0.01875	-0.00171	0.00118
$\Delta D_t$	0.00003	0.00000	0.01484	0.00000	0.00003
<i>Size</i>	3359.64	421.15	11470.00	125.13	1702.94
$L_t$	0.16131	0.09130	0.19612	0.00154	0.24631
$NF_t$	0.35656	0.03296	1.26101	0.00285	0.20622

**Table 3: Summary Statistics for each Subsample**

This table provides summary statistics for *good* and *poor* corporate governance firms, and financially *constrained* and *unconstrained* firms. Corporate governance is classified based on *Total Compensation* and *E-Index*. For *Total Compensation*, a *good* (*poor*) corporate governance firm is identified if the firm is ranked in the top (bottom) three deciles of top five total executive compensation. E-Index is the entrenchment index suggested by Bebchuk, Cohen, and Ferrell (2006). We use the medium E-Index value to split the sample each year. A *good* governance firm is identified if it has a E-Index less than the medium value. Financially constrained firms are identified by using *HP Index*, *WW Index* and the *Voting Method* (see text for definitions for each criterion). *Cash holdings* ( $C_t$ ) is cash plus marketable securities.  $\Delta CashHoldings_t$  is the change of cash holdings.  $\Delta C_t$  is the difference between actual change in cash and the expected change in cash which is modelled based on Almeida et al. (2004). Earnings ( $E_t$ ) is before extraordinary items plus interest. *Size* refers to book value of assets. *Total Debt*<sub>*t*</sub> is measured as sum of long term and short term debt. *Cash holdings*, *Earnings* and *Total Debt* are deflated by total book assets.

Variable		Corporate Governance Classifications						Financial Constraint Classifications					
		E-index		Exec. Compensation		Inst. Ownership		HP Index		WW Index		Voting Method	
		Poor	Good	Poor	Good	Poor	Good	Cons	Uncons	Cons	Uncons	Cons	Uncons
$\Delta CashHoldings_t$	Mean	0.018	0.020	0.025	0.025	0.018	0.014	0.007	0.028	-0.004	0.038	0.018	0.021
	Med	0.006	0.008	0.008	0.009	0.007	0.004	0.003	0.008	-0.001	0.008	0.005	0.007
$C_t$	Mean	0.160	0.209	0.180	0.224	0.249	0.251	0.363	0.141	0.354	0.181	0.293	0.232
	Med	0.099	0.145	0.116	0.180	0.160	0.177	0.304	0.091	0.303	0.102	0.208	0.155
$\Delta C_t$	Mean	0.011	0.012	0.017	0.016	0.008	0.002	-0.013	0.023	-0.023	0.030	0.003	0.011
	Med	0.002	0.002	0.002	0.002	0.000	-0.004	-0.016	0.005	-0.020	0.005	-0.008	0.000
$E_t$	Mean	0.043	0.050	0.041	0.068	-0.000	-0.010	-0.080	0.062	-0.110	0.045	-0.066	0.023
	Med	0.064	0.069	0.061	0.078	0.058	0.040	0.008	0.070	-0.019	0.070	0.016	0.059
<i>Size</i>	Mean	4151.59	7751.21	3717.99	8329.74	4831.19	1481.13	82.1	10924.4	114.4	9291.8	324.6	4276.0
	Med	1540.50	1307.87	829.54	2558.20	274.80	422.96	75.3	3464.2	88.4	2695.0	109.4	685.1
<i>Total Debt</i> <sub><i>t</i></sub>	Mean	0.217	0.188	0.193	0.188	0.172	0.192	0.110	0.254	0.129	0.223	0.167	0.187
	Med	0.206	0.157	0.166	0.171	0.117	0.142	0.026	0.234	0.031	0.204	0.105	0.141



**Table 4: Testing Constraint and Crisis Effects in the Value-Excess Cash Linkage**

This table presents results of estimating Equation (2). The dependent variable in all regressions is excess return ( $r_{i,t} - R_{i,t}^B$ ) where  $r_{i,t}$  is the stock return for firm  $i$  during fiscal year  $t$ , and  $R_{i,t}^B$  is stock  $i$ 's benchmark return at year  $t$ . All the variables (except for excess return and leverage) are deflated by the lagged market value of equity ( $M_{i,t-1}$ ).  $\Delta C_t$  is the realized 1-year change in cash relative to the expected change in cash (model details are provided in Section 3.3.1).  $C_t$  is cash plus marketable securities;  $NA_t$  is total assets minus cash holdings.  $E_t$  is earnings before extraordinary items plus interest.  $RD_t$  is R&D expenditures.  $I_t$  is the interest expense,  $D_t$  are total dividends paid,  $NF_t$  is total equity issuance minus repurchases plus debt issuance minus debt redemption.  $L_t$  is Leverage is measured as total debt over the sum of total debt and the market value of equity.  $\Delta X_t$  is compact notation for the 1-year change,  $X_t - X_{t-1}$ .  $D_{crisis}$  is a period dummy which equals 1 for financial crisis period (2008 to 2010) and 0 for pre-crisis period (2002 to 2007). Financially constrained and unconstrained firms are classified by using *HP Index*, *WW index* and the *Voting Method* (see text for definitions for each criteria).  $D_{cons}$  is the constraint dummy that equals 1 if a firm is identified as constrained and 0 if identified as unconstrained by the respective criterion. *Governance* is defined according to Institutional Ownership (*DOwner*), *Executive Compensation* (*DComp*) and *Eindex*. *DOwner* and *DComp* are governance dummies that equal 1 if a firm is identified as good corporate governance and 0 if identified as poor governance based on whether the firm was in the top or bottom three deciles of institutional ownership or top five executive compensation (details are provided in Section 3.2). E-Index is the entrenchment index based on Bebchuk, Cohen, and Ferrell (2006). Statistical significance is computed using standard errors robust to clustering by *firm* and *year*. Coefficient estimates are reported with *t*-statistics in parentheses. \*corresponds to significant at 10%; \*\* significant at 5%; \*\*\*significant at 1%.

		Panel A: Institutional Ownership			Panel B: Equity Compensation			Panel C: E-Index		
		HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method
<i>Intercept</i>	$\alpha$	0.09 (3.93)***	0.08 (4.29)***	0.03 (0.91)	0.07 (1.80)*	0.06 (2.65)***	0.03 (0.98)	0.03 (1.15)	0.03 (1.16)	-0.01 (-0.31)
$\Delta C_t$	$\beta_1$	0.33 (1.56)	0.34 (1.35)	1.06 (3.85)***	0.43 (0.99)	0.46 (1.62)	0.53 (2.67)***	0.58 (3.00)***	0.38 (2.90)***	0.75 (5.69)***
$\Delta C_t * D_{crisis}$	$\beta_2$	1.87 (3.44)***	1.57 (3.45)***	0.76 (1.84)*	1.41 (2.45)**	1.48 (4.22)***	1.05 (1.86)*	0.72 (2.32)**	0.76 (3.96)***	0.64 (1.77)*
$\Delta C_t * D_{cons}$	$\beta_3$	1.54 (3.10)***	1.70 (6.76)***	0.75 (4.43)***	2.50 (2.31)**	3.02 (4.21)***	1.63 (2.40)**	0.36 (0.91)	1.18 (2.54)**	0.07 (0.32)
$\Delta C_t * D_{crisis} * D_{cons}$	$\beta_4$	-2.80 (-4.87)***	-2.70 (-4.78)***	-2.11 (-5.15)***	-2.70 (-2.20)**	-3.13 (-3.27)***	-2.52 (-2.80)***	0.42 (0.85)	-0.69 (-1.50)	0.12 (0.47)
$D_{crisis} * D_{cons}$	$\beta_5$	-0.05 (-0.39)	-0.05 (-0.51)	-0.08 (-0.85)	-0.10 (-0.96)	-0.19 (-2.04)**	-0.00 (-0.07)	0.07 (0.80)	0.02 (0.18)	-0.03 (-0.83)
$D_{cons}$	$\beta_6$	-0.08 (-1.95)*	-0.10 (-3.05)***	0.02 (0.52)	0.03 (0.44)	-0.04 (-0.52)	-0.03 (-0.69)	-0.14 (-2.23)**	-0.17 (-1.69)*	-0.07 (-2.81)***
$D_{crisis}$	$\beta_7$	0.03 (0.78)	0.02 (0.70)	0.07 (1.97)**	0.04 (1.55)	0.03 (1.69)*	0.04 (1.19)	0.02 (0.99)	0.02 (0.74)	0.04 (0.96)
<i>Governance</i>	$\beta_8$	-0.06 (-2.86)***	-0.07 (-2.91)***	-0.08 (-5.47)***	-0.04 (-1.86)*	-0.03 (-1.43)	-0.01 (-0.36)	0.01 (2.06)**	0.01 (1.83)*	0.01 (1.38)

**Table 4 continued**

	Panel A: Institutional Ownership			Panel B: Equity Compensation			Panel C: E-Index			
		HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method
$\Delta NA_t$	$\beta_9$	0.15 (2.40)**	0.14 (3.54)***	0.12 (3.32)***	0.08 (1.32)	0.08 (1.46)	0.04 (0.91)	0.09 (2.81)***	0.10 (4.04)***	0.09 (4.58)***
$\Delta E_t$	$\beta_{10}$	0.39 (5.17)***	0.38 (5.74)***	0.44 (5.07)***	0.28 (3.41)***	0.33 (3.07)***	0.44 (6.36)***	0.35 (7.89)***	0.34 (15.37)***	0.44 (7.40)***
$\Delta RD_t$	$\beta_{11}$	-1.26 (-1.99)**	-1.02 (-2.19)**	-1.03 (-2.60)***	-1.57 (-1.90)*	-1.67 (-1.97)**	-1.07 (-1.27)	-0.86 (-3.19)***	-1.76 (-3.28)***	-1.10 (-1.96)*
$\Delta I_t$	$\beta_{12}$	-0.69 (-0.60)	-0.98 (-0.92)	-1.12 (-1.15)	-1.63 (-0.76)	-2.53 (-1.45)	-1.54 (-0.99)	-3.24 (-2.32)**	-3.65 (-2.69)***	-2.99 (-2.99)***
$\Delta D_t$	$\beta_{13}$	1.24 (1.92)*	1.38 (1.84)*	1.79 (2.66)***	0.89 (1.48)	1.30 (1.31)	2.10 (2.33)**	0.88 (1.24)	1.30 (2.14)**	1.30 (1.24)
$NF_t$	$\beta_{14}$	0.05 (2.28)**	0.06 (2.37)**	0.06 (2.73)***	0.05 (1.69)*	0.05 (1.66)*	0.06 (3.05)***	0.06 (5.04)***	0.06 (3.50)***	0.05 (2.50)**
$L$	$\beta_{15}$	-0.58 (-6.92)***	-0.59 (-5.37)***	-0.52 (-5.29)***	-0.45 (-4.38)***	-0.42 (-5.59)***	-0.46 (-6.11)***	-0.46 (-6.30)***	-0.41 (-8.01)***	-0.41 (-6.57)***
$C_{t-1}$	$\beta_{16}$	0.50 (2.40)**	0.51 (2.49)**	0.40 (2.20)**	0.44 (2.72)***	0.49 (5.49)***	0.41 (2.94)***	0.30 (3.45)***	0.31 (4.16)***	0.29 (2.68)***
$\Delta C_t * C_{t-1}$	$\beta_{17}$	-0.11 (-0.19)	-0.30 (-0.72)	-0.24 (-0.95)	0.41 (0.96)	-0.19 (-0.56)	0.43 (1.14)	-0.19 (-0.78)	-0.43 (-1.18)	-0.07 (-0.40)
$\Delta C_t * L$	$\beta_{18}$	-1.06 (-1.52)	-0.76 (-1.73)*	-1.22 (-2.53)**	-0.76 (-0.96)	-0.89 (-1.30)	-1.18 (-2.75)***	-0.32 (-0.64)	0.21 (0.40)	-0.70 (-1.48)
<i>Obs</i>		3,539	3,973	5,811	2,100	2,126	3,694	2,974	3,020	5,109
<i>Adj R</i> <sup>2</sup>		0.218	0.222	0.213	0.275	0.291	0.219	0.204	0.212	0.190

**Table 5: Coefficient Combinations in Estimation of Equation (2)**

This table gives a comparison of the impact of change in cash on firm value, considering financial constraints and crisis effects, across different classification methods. Wald tests are performed on various combinations of coefficients in Equation (2). The sum of coefficients and significant tests correspond to regression estimates reported in Table 4.

Panel A: Institutional Ownership				
	Test	HP Index	WW Index	Voting Method
Constrained firm in a Crisis Period	$\beta_1 + \beta_2 + \beta_3 + \beta_4 = 0$	0.94 (0.00)***	0.91 (0.00)***	0.46 (0.03)**
Unconstrained firm in a Crisis Period	$\beta_1 + \beta_2 = 0$	2.2 (0.00)***	1.91 (0.00)***	1.82 (0.00)***
Constrained Effect in a Crisis Period	$\beta_3 + \beta_4 = 0$	-1.26 (0.02)**	-1.00 (0.04)**	-1.36 (0.00)***
Constrained firm in a Non-Crisis Period	$\beta_1 + \beta_3 = 0$	1.87 (0.00)***	2.04 (0.00)***	1.81 (0.00)***
Unconstrained firm in a Non-Crisis Period	$\beta_1 = 0$	0.33 (0.11)	0.34 (0.17)	1.06 (0.00)***
Constrained effect in Non-Crisis Period	$\beta_3 = 0$	1.54 (0.00)***	1.7 (0.00)***	0.75 (0.00)***
Crisis Effect for constrained firms	$\beta_2 + \beta_4 = 0$	-0.93 (0.00)***	-1.13 (0.00)***	-1.35 (0.00)***
Crisis Effect for unconstrained firms	$\beta_2 = 0$	1.87 (0.00)***	1.57 (0.00)***	0.76 (0.06)*
Panel B: Executive Compensation				
		HP Index	WW Index	Voting Method
Constrained firm in a Crisis Period	$\beta_1 + \beta_2 + \beta_3 + \beta_4 = 0$	1.64 (0.05)**	1.83 (0.00)***	0.69 (0.35)
Unconstrained firm in a Crisis Period	$\beta_1 + \beta_2 = 0$	1.84 (0.00)***	1.94 (0.00)***	1.58 (0.00)***
Constrained Effect in a Crisis Period	$\beta_3 + \beta_4 = 0$	-0.2 (0.76)	-0.11 (0.62)	-0.89 (0.03)**
Constrained firm in a Non-Crisis Period	$\beta_1 + \beta_3 = 0$	2.93 (0.00)***	3.48 (0.00)***	2.16 (0.00)***
Unconstrained firm in a Non-Crisis Period	$\beta_1 = 0$	0.43 (0.32)	0.46 (0.10)*	0.53 (0.00)***
Constrained effect in Non-Crisis Period	$\beta_3 = 0$	2.5 (0.02)**	3.02 (0.00)***	1.63 (0.01)**
Crisis Effect for constrained firms	$\beta_2 + \beta_4 = 0$	-1.29 (0.34)	-1.65 (0.02)**	-1.47 (0.15)
Crisis Effect for unconstrained firms	$\beta_2 = 0$	1.41 (0.01)**	1.48 (0.00)***	1.05 (0.06)**

**Table 5 continued**

Panel C: E-Index				
	Test	HP Index	WW Index	Voting Method
Constrained firm in a Crisis Period	$\beta_1 + \beta_2 + \beta_3 + \beta_4 = 0$	2.08 (0.00)***	1.63 (0.00)***	1.58 (0.00)***
Unconstrained firm in a Crisis Period	$\beta_1 + \beta_2 = 0$	1.3 (0.00)***	1.14 (0.00)***	1.39 (0.00)***
Constrained Effect in a Crisis Period	$\beta_3 + \beta_4 = 0$	0.78 (0.03)***	0.49 (0.04)**	0.19 (0.27)
Constrained firm in a Non-Crisis Period	$\beta_1 + \beta_3 = 0$	0.94 (0.00)***	1.56 (0.00)***	0.82 (0.00)***
Unconstrained firm in a Non-Crisis Period	$\beta_1 = 0$	0.58 (0.00)***	0.38 (0.00)***	0.75 (0.00)***
Constrained effect in Non-Crisis Period	$\beta_3 = 0$	0.36 (0.36)	1.18 (0.01)**	0.07 (0.74)
Crisis Effect for constrained firms	$\beta_2 + \beta_4 = 0$	1.14 (0.08)*	0.07 (0.89)	0.76 (0.02)**
Crisis Effect for unconstrained firms	$\beta_2 = 0$	0.72 (0.02)**	0.76 (0.00)***	0.64 (0.08)*

**Table 6: Governance and Crisis Effects in the Value-Excess Cash Linkage**

This table presents results of estimating equation (3), which compares the different governance effects of cash holdings on firm value between the financial crisis period and pre-crisis period. The table reports the results for the key variables only – the control variables estimates are not reported to conserve space. The dependent variable in all regressions is excess return ( $\mathbf{r}_{i,t} - \mathbf{R}_{i,t}^B$ ) where  $\mathbf{r}_{i,t}$  is the stock return for firm  $i$  during fiscal year  $t$ , and  $\mathbf{R}_{i,t}^B$  is stock  $i$ 's benchmark return at year  $t$ . All the variables (except for excess return and leverage) are deflated by the lagged market value of equity ( $M_{i,t-1}$ ).  $\Delta C_t$  is compact notation for excess change in cash – namely, the realized 1-year change in cash relative to the expected change in cash (model details are provided in Section 3.3.1).  $Dcrisis$  is a period dummy which equals 1 for financial crisis period (2008 to 2010) and 0 for pre-crisis period (2002 to 2007). Financially constrained and unconstrained firms are classified by the HP Index, WW index and the Voting Method (see text for definitions for each criteria).  $Dcons$  is the constraint dummy that equals 1 if a firm is identified as constrained and 0 if identified as unconstrained by the respective criterion.  $Gov$  is defined according to (1) institutional ownership ( $DOwner$ ), (2) total compensation ( $DComp$ ) and (3)  $E$ -Index.  $DOwner$  and  $DComp$  are governance dummies that equal 1 if a firm is identified as good corporate governance and 0 if identified as poor governance based on whether the firm was in the top or bottom three deciles of institutional ownership or top five executive compensation (details are provided in Section 3.2). Statistical significance is computed using standard errors robust to clustering by  $firm$  and  $year$ . Coefficient estimates are reported with  $t$ -statistics in parentheses. \*corresponds to significant at 10%; \*\* significant at 5%; and \*\*\*significant at 1%.

		Panel A: Institutional Ownership			Panel B: Equity Compensation			Panel C: E-Index		
		HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method
<i>Intercept</i>	$\alpha$	0.05 (1.32)	0.04 (1.06)	0.04 (1.14)	0.08 (1.54)	0.04 (0.94)	0.03 (1.05)	0.00 (0.11)	0.00 (0.04)	-0.01 (-0.32)
$\Delta C_t$	$\beta_1$	1.43 (4.17)***	1.22 (4.97)***	1.27 (4.21)***	1.34 (3.87)***	1.07 (3.61)***	0.81 (4.15)***	0.64 (3.28)***	0.59 (2.90)***	0.68 (6.05)***
$\Delta C_t * Dcrisis$	$\beta_2$	-0.07 (-0.22)	-0.13 (-0.61)	0.09 (0.30)	1.08 (1.59)	1.32 (2.21)**	0.79 (1.26)	-0.09 (-0.23)	0.04 (0.11)	-0.23 (-0.85)
$\Delta C_t * Gov$	$\beta_3$	0.22 (1.10)	-0.05 (-0.41)	-0.06 (-0.60)	-0.76 (-0.95)	-0.66 (-0.92)	-0.26 (-0.75)	0.04 (0.38)	0.02 (0.31)	0.02 (0.35)
$\Delta C_t * Gov * Dcrisis$	$\beta_4$	1.24 (3.59)***	1.14 (2.52)**	0.72 (1.88)*	0.25 (0.26)	-0.00 (-0.00)	0.07 (0.13)	0.28 (2.25)**	0.20 (1.65)*	0.26 (2.59)***
$Gov * Dcrisis$	$\beta_5$	0.10 (2.25)**	0.05 (1.02)	0.07 (1.60)	0.06 (2.51)**	0.04 (2.25)**	0.05 (1.48)	-0.02 (-0.74)	-0.00 (-0.22)	-0.00 (-0.03)
<i>Governance</i>	$\beta_6$	-0.09 (-4.26)***	-0.09 (-3.91)***	-0.10 (-10.57)***	-0.05 (-2.61)***	-0.01 (-0.62)	-0.02 (-0.62)	0.02 (2.56)**	0.01 (1.67)*	0.01 (1.08)
<i>Dcrisis</i>	$\beta_7$	0.01 (0.07)	0.02 (0.33)	0.03 (0.41)	0.01 (0.42)	0.01 (0.27)	0.03 (0.70)	0.07 (1.27)	0.04 (0.86)	0.04 (0.67)
<i>Obs</i>		3,539	3,973	5,811	2,100	2,126	3,694	2,974	3,020	5,109
<i>Adj R<sup>2</sup></i>		0.205	0.194	0.210	0.255	0.239	0.212	0.199	0.187	0.190

**Table 7: Constraint and Governance Effects in the Value-Excess Cash Linkage**

This table presents results of estimating equation (4), which compares the different constraint effects of cash holdings on firm value between good and poor governance firms. The table reports the results for the key variables only – the control variables estimates are not reported to conserve space. The dependent variable in all regressions is excess return ( $\mathbf{r}_{i,t} - \mathbf{R}_{i,t}^B$ ) where  $\mathbf{r}_{i,t}$  is the stock return for firm  $i$  during fiscal year  $t$ , and  $\mathbf{R}_{i,t}^B$  is stock  $i$ 's benchmark return at year  $t$ . All the variables (except for excess return and leverage) are deflated by the lagged market value of equity ( $M_{i,t-1}$ ).  $\Delta C_t$  is compact notation for excess change in cash – namely, the realized 1-year change in cash relative to the expected change in cash (model details are provided in Section 3.3.1).  $Dcrisis$  is a period dummy which equals 1 for financial crisis period (2008 to 2010) and 0 for pre-crisis period (2002 to 2007). Financially constrained and unconstrained firms are classified by the HP Index, WW index and the Voting Method (see text for definitions for each criteria).  $Dcons$  is the constraint dummy that equals 1 if a firm is identified as constrained and 0 if identified as unconstrained by the respective criterion.  $Gov$  is defined according to (1) institutional ownership ( $DOwner$ ), (2) total compensation ( $DComp$ ) and (3) E index.  $DOwner$  and  $DComp$  are governance dummies that equal 1 if a firm is identified as good corporate governance and 0 if identified as poor governance based on whether the firm was in the top or bottom three deciles of institutional ownership or top five executive compensation (details are provided in Section 3.2). Statistical significance is computed using standard errors robust to clustering by *firm* and *year*. Coefficient estimates are reported with are reported in parentheses for the OLS regressions. Coefficient estimates are reported with *t-statistics* in parentheses. \*corresponds to significant at 10%; \*\* significant at 5%; and \*\*\*significant at 1%.

	Panel A: Institutional Ownership			Panel B: Equity Compensation			Panel C: E-Index			
		HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method
<i>Intercept</i>	$\alpha$	0.09 (3.19)***	0.09 (3.87)***	0.05 (2.34)**	0.09 (2.36)**	0.08 (2.84)***	0.05 (1.66)*	0.03 (1.55)	0.02 (1.13)	0.00 (0.07)
$\Delta C_t$	$\beta_1$	0.54 (1.32)	0.57 (2.23)**	1.22 (4.68)***	0.91 (1.66)*	0.74 (2.67)***	0.88 (3.69)***	0.37 (2.12)**	0.29 (1.55)	0.43 (3.81)***
$\Delta C_t * Gov$	$\beta_2$	0.89 (3.68)***	0.56 (3.31)***	0.22 (1.58)	-0.54 (-1.07)	-0.34 (-0.57)	-0.35 (-1.34)	0.13 (1.52)	0.07 (1.08)	0.19 (2.11)**
$\Delta C_t * Dcons$	$\beta_3$	1.08 (1.27)	1.26 (2.05)**	0.25 (0.44)	1.52 (1.59)	2.12 (3.00)***	0.81 (1.35)	-0.23 (-0.70)	0.37 (0.58)	0.30 (0.50)
$\Delta C_t * Gov * Dcons$	$\beta_4$	-0.59 (-0.75)	-0.66 (-1.05)	0.04 (0.05)	14.62 (2.57)**	6.33 (2.73)***	1.09 (0.73)	0.35 (2.36)**	0.31 (2.48)**	-0.07 (-0.30)
$Gov * Dcons$	$\beta_5$	-0.05 (-1.31)	-0.05 (-1.61)	0.05 (1.46)	0.31 (2.66)***	0.23 (3.01)***	-0.01 (-0.08)	0.01 (0.20)	-0.02 (-0.29)	-0.01 (-0.59)
<i>Dcons</i>	$\beta_6$	-0.08 (-2.12)**	-0.09 (-3.17)***	-0.02 (-0.63)	-0.02 (-0.43)	-0.12 (-1.79)*	-0.03 (-0.99)	-0.15 (-1.28)	-0.12 (-0.58)	-0.06 (-2.29)**
<i>Governance</i>	$\beta_7$	-0.05 (-2.31)**	-0.05 (-3.16)***	-0.09 (-7.05)***	-0.04 (-1.78)*	-0.03 (-1.96)*	-0.01 (-0.23)	0.02 (2.51)**	0.02 (2.68)***	0.01 (1.43)
<i>Obs</i>		3,539	3,973	5,811	2,100	2,126	3,694	2,974	3,020	5,109
<i>Adj R<sup>2</sup></i>		0.209	0.209	0.206	0.262	0.265	0.206	0.200	0.209	0.186

**Table 8: Matching Analysis Testing Constraint and Crisis Effects in the Value-Excess Cash Linkage**

This table presents results of estimating Equation (2) on a matched sample. Following Campello et al. (2010) and Kahle & Stulz (2013), financial constrained and unconstrained firms are matched according cash flow volatility, M/B Ratio, industry and year.  $\Delta C_t$  is compact notation for the realized 1-year change in cash relative to the expected change in cash.  $D_{crisis}$  is a period dummy which equals 1 for financial crisis period (2008 to 2010) and 0 for pre-crisis period (2002 to 2007).  $D_{constraint}$  is the constraint dummy that equals 1 if a firm is identified as constrained and 0 if identified as unconstrained by the respective criterion. Governance is defined according to Institutional Ownership ( $D_{Owner}$ ), Executive Compensation ( $D_{Comp}$ ) and  $Eindex$ .  $D_{Owner}$  and  $D_{Comp}$  are governance dummies that equal 1 if a firm is identified as good corporate governance and 0 if identified as poor governance based on whether the firm was in the top or bottom three deciles of institutional ownership or top five executive compensation (details are provided in Section 3.2). E-Index is the entrenchment index based on Bebchuk, Cohen, and Ferrell (2006). Statistical significance is computed using standard errors robust to clustering by *firm* and *year*. Coefficient estimates are reported with are reported in parentheses for the OLS regressions. Coefficient estimates are reported with *t-statistics* in parentheses. \*corresponds to significant at 10%; \*\* significant at 5%; and \*\*\*significant at 1%.

	Panel A: Without CG Variables			Panel B: Institutional Ownership			Panel C: Equity Compensation			Panel D: E-Index			
		HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method	HP Index	WW Index	Voting Method
<i>Intercept</i>	$\alpha$	0.04 (2.72)***	0.05 (2.76)***	0.04 (1.60)	0.07 (3.68)***	0.08 (4.01)***	0.10 (3.43)***	0.04 (2.90)***	0.06 (4.33)***	-0.01 (-0.46)	0.02 (0.52)	0.04 (1.33)	0.01 (0.16)
$\Delta C_t$	$\beta_1$	0.62 (2.68)***	0.68 (4.21)***	0.71 (5.75)***	0.44 (2.03)**	0.63 (3.03)***	0.81 (4.34)***	0.94 (2.65)***	0.68 (3.44)***	0.31 (1.03)	0.59 (3.26)***	0.45 (5.04)***	0.44 (1.93)*
$\Delta C_t * D_{crisis}$	$\beta_2$	1.06 (1.66)*	1.15 (2.24)**	0.26 (1.03)	1.67 (1.74)*	1.40 (2.09)**	0.22 (0.69)	1.15 (1.38)	1.27 (2.04)**	1.30 (1.71)*	0.72 (2.08)**	0.55 (2.43)**	0.09 (0.22)
$\Delta C_t * D_{cons}$	$\beta_3$	0.75 (2.35)**	0.46 (2.32)**	0.64 (3.92)***	1.14 (3.50)***	0.73 (2.61)***	0.77 (3.61)***	2.74 (2.27)**	2.57 (4.64)***	2.07 (2.89)***	-0.27 (-1.33)	0.00 (0.01)	0.22 (0.63)
$\Delta C_t * D_{crisis} * D_{cons}$	$\beta_4$	-1.90 (-2.20)**	-2.04 (-2.49)**	-1.06 (-4.38)***	-2.90 (-2.38)**	-2.67 (-2.52)**	-1.63 (-4.68)***	-2.54 (-1.64)	-2.89 (-4.46)***	-2.96 (-3.84)***	2.14 (4.53)***	0.91 (1.72)*	1.27 (2.89)***
$D_{crisis} * D_{cons}$	$\beta_5$	-0.06 (-0.55)	-0.04 (-0.32)	-0.03 (-0.29)	-0.02 (-0.12)	-0.01 (-0.07)	-0.05 (-0.46)	-0.07 (-0.73)	-0.16 (-1.14)	-0.01 (-0.09)	0.10 (0.96)	0.06 (0.41)	0.00 (0.00)
<i>Dcons</i>	$\beta_6$	0.08 (1.22)	0.02 (0.36)	0.04 (0.84)	0.08 (1.04)	0.02 (0.35)	0.03 (0.45)	0.17 (3.16)***	0.12 (1.02)	0.04 (0.98)	0.00 (0.01)	-0.08 (-0.60)	-0.02 (-1.04)
<i>Dcrisis</i>	$\beta_7$	0.05 (1.26)	0.02 (1.25)	0.03 (0.69)	0.02 (0.83)	-0.00 (-0.08)	0.05 (0.92)	0.05 (2.00)**	0.03 (2.12)**	0.07 (1.62)	0.02 (1.08)	0.02 (1.45)	0.00 (0.02)
<i>Governance</i>	$\beta_8$				-0.06 (-2.89)***	-0.08 (-3.47)***	-0.11 (-4.07)***	-0.01 (-0.55)	-0.03 (-1.41)	0.05 (0.58)	0.01 (1.16)	0.00 (0.34)	0.00 (0.13)
<i>Obs</i>		5,228	5,750	4,203	3,143	3,486	2,614	1,804	1,736	1,079	2,594	2,469	1,418
<i>Adj R<sup>2</sup></i>		0.067	0.066	0.054	0.076	0.071	0.068	0.207	0.171	0.087	0.075	0.050	0.056



## Highlights

- It examines the value of cash holdings in the time of financial crisis.
- It studies cash holdings with financial constraint and corporate governance.
- It shows the value of cash holdings increases in the time of financial crisis.
- It shows that the constraint effect on cash holdings weakens during the crisis.
- It shows that the governance effect on cash holdings increases during the crisis.