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Uncertainty and the Value of Cash Holdings

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Abstract

This study examines the effects of uncertainty on the value of cash holdings. We find that a dollar held by a firm facing high uncertainty is 76 cents more valuable than a dollar held by a firm facing low uncertainty, and we find that the positive effects of uncertainty on the value of cash holdings are consistently observed for firm-level, time-series, and residual uncertainty measures. A further investigation suggests that uncertainty increases the value of cash holdings by aggravating financial constraints and mitigating agency conflicts through its disciplinary role. Furthermore, we provide evidence that the effects can also be attributed to the increased value of the option of waiting and seeing, which makes reducing investments and holding more cash beneficial to shareholders.

Keywords: Uncertainty, Cash Holdings, Real Options, Financial Constraints, Agency Costs
JEL classification: D22, D81, D92, G31, G32, G34

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1 Introduction

The effects of uncertainty on corporate cash holdings have received growing attention from researchers in both economics and finance. A number of studies have considered firm-level uncertainty (Bates et al., 2009; Duchin, 2010; Pinkowitz et al., 2012; Gao and Grinstein, 2014) or aggregate uncertainty (Foley et al., 2007; Acharya et al., 2013) as a driver of corporate cash holdings. For example, Gao and Grinstein (2014) use stock return volatility as an uncertainty measure, decompose it into systematic and idiosyncratic components, and show that systematic components have a more significant influence over cash holdings. In addition, a rich body of literature has shown that uncertainty reduces corporate investment by increasing the value of the option of waiting and seeing, causing a firm to wait for additional information before taking actions (Bernanke, 1983; Bloom et al., 2007). In this paper we investigate the relationship between uncertainty measured by stock return volatility, as in Gao and Grinstein (2014), Leahy and Whited (1996), and Bloom et al. (2007), and the market value of cash holdings, using the approach used in Faulkender and Wang (2006), Dittmar and Mahrt-Smith (2007), and Denis and Sibilkov (2010).

Although there have been abundant studies regarding uncertainty and the value of cash holdings separately, none of the previous studies, to the best of our knowledge, has examined the effects of uncertainty on the value of cash holdings and the channels for these effects. However, given that the nature of uncertainty and the determinants of the value of cash holdings are well understood, we can identify two plausible channels through which uncertainty influences the value of cash holdings. First, a firm facing higher uncertainty may have a higher value of cash holdings due to more severe financial constraints. Han and Qiu (2007) find that financially constrained firms' levels of uncertainty measured by cash flow volatilities are positively associated with their cash holdings, while Faulkender and Wang (2006) and Denis and Sibilkov (2010) show that cash holdings are more valuable for financially constrained firms. Second, a firm facing higher uncertainty could have a higher value of cash holdings due to less severe agency conflicts between managers and shareholders. One possibility is that uncertainty mitigates agency conflicts through its disciplinary role. In this case, a high-uncertainty firm may have a higher value of cash holdings, given that a firm with less agency conflicts or better corporate governance tends to have a higher value of cash holdings (Dittmar and Mahrt-Smith, 2007). However, uncertainty could aggravate agency conflicts between managers and shareholders due to more severe information asymmetry. In this case, a high-uncertainty firm may have a lower value of cash holdings (Drobetz et al., 2010).

In addition to the two channels described above, this study proposes a new channel based on real-option theories. A rich body of literature, such as Bernanke (1983), Bloom et al. (2007), and Bloom (2009), has shown that uncertainty increases the value of the option of waiting and seeing, making a firm's investment decision-making more cautious. Thus, a firm's optimal decision when faced with a high level of uncertainty would be to reduce current investments and increase cash holdings in preparation for the investments that are postponed to the next period. Even when financial constraints and agency conflicts are not matters of concern, a firm facing high uncertainty would be better off by holding more cash in the current period for the following reasons: *i)* additional cash holdings will allow the firm to execute the delayed investments at the right time; *ii)* shareholders are less concerned about the increase in agency conflicts as additional cash holdings are to be used to fund the delayed investments; *iii)* the availability, and the timing, of cash injections from external financing sources are more uncertain in the subsequent period. Thus, the positive effects of uncertainty on the value of cash holdings through this channel are likely to be stronger for firms with more growth opportunities.

In this study we first investigate whether firm-level uncertainty and each of its three components—a macroeconomic component, a time-invariant firm-specific component, and an idiosyncratic time-varying component—affect the value of cash holdings. To measure the impact of an uncertainty measure on the value of cash holdings, we investigate the effect of the uncertainty measure on the coefficient of the change in cash holdings in a regression model in which the dependent variable is a firm's excess stock returns. We then move on to examine which channels stated above—the financial constraints channel, the agency conflicts channel, and the real options channel—are better supported by the data. To do this, we investigate if the effects of uncertainty on the value of cash holdings are larger for financially constrained firms, firms with less agency conflicts, or firms with more growth opportunities.

2 Data and methodology

We use Center for Research in Security Prices (CRSP) data to calculate a firm's annual stock returns and the total market value of a firm's equity. As benchmark returns, we use the returns to the 5×5 Fama and French portfolio provided in Kenneth French's data library. In addition, we use data from Compustat North America for the period 1980–2015 to construct variables based on the information contained in financial statements. We carry out a series of data-cleaning procedures, such as excluding firms operating in the utilities and financial services industries, excluding firms with total book assets of less than 25 million in constant 1980

dollars, dropping firm-years with non-positive total assets or cash holdings or negative capital expenditures, and restricting the sample to common shares traded in three major stock exchanges in the US (NYSE, NASDAQ, and AMEX). We then winsorize all variables at the 1st and 99th percentiles. After all these procedures, we have an unbalanced panel of 9,948 firms among 244 industries based on three-digit Standard Industrial Classification (SIC) codes over the period 1980–2015, which contains 94,568 firm-year observations with non-missing excess returns, uncertainty, and cash holding measures as defined below.

As a measure of firm-level uncertainty, we use the standard deviation of a firm's daily stock returns for each fiscal year ($SD_{i,t}$) suggested by Leahy and Whited (1996) and Bloom et al. (2007). See Bloom et al. (2007) for a discussion about the advantages of this forward-looking comprehensive measure, which varies across firms and over time. Following Bloom et al. (2007), we decompose this measure into three components: a macroeconomic component, common to all firms in a particular year ($\overline{SD_t}$); a time-invariant firm-specific component ($\overline{SD_i}$); and an idiosyncratic time-varying component ($\widetilde{SD}_{i,t} = SD_{i,t} - \overline{SD_t} - \overline{SD_i}$). We assign firms with each uncertainty measure in the top (bottom) terciles to the high (low) uncertainty group.

To examine how the market value of cash holding varies with the degree of uncertainty that a firm faces, we modify an empirical framework suggested by Faulkender and Wang (2006), Dittmar and Mahrt-Smith (2007), and Denis and Sibilkov (2010). Specifically, we investigate the effect of an uncertainty measure on the coefficient of the change in cash holdings in a regression model in which the dependent variable is a firm's excess stock returns. Our baseline model is specified as follows:

$$r_{i,t} - R_{p,t} = \beta_0 + \beta_1 \Delta Cash_{i,t} + \beta_{CONTROLS} CONTROLS + \varepsilon_{i,t}, \tag{1}$$

where the dependent variable ($r_{i,t} - R_{p,t}$) is firm i's excess stock return over the fiscal year, computed as the stock return over the fiscal year minus the return on a benchmark portfolio; the benchmark portfolios are 25 Fama-French value-weighted portfolios, constructed by independently sorting stocks on size and book-to-market ratio; and $\Delta Cash_{i,t}$ is the change in firm i's cash holding over the fiscal year scaled by its lagged market capitalization. As in Faulkender and Wang (2006), Dittmar and Mahrt-Smith (2007), and Denis and Sibilkov (2010), *CONTROLS* includes the change in book assets net of cash, change in earnings before interest and extraordinary items, change in research and development (R&D) expenses, change in interest expenses, change in dividends, lagged cash holdings, leverage, and net financing during fiscal year. All these variables except leverage are scaled by lagged market value of equity. We also include the interaction terms between

cash and the change in cash, and between leverage and the change in cash, to control for the capital constraints faced by the firm. In this specification, the market value of cash holdings is measured by the regression coefficient for $\Delta Cash_{i,t}$, which is modeled as a linear function of the high-uncertainty dummy: $\beta_1 = \gamma_0 + \gamma_1 D\_HighUNC_{i,t}$, where $D\_HighUNC_{i,t}$ is a dummy variable whose value equals one if firm i belongs to the high-uncertainty group in year t and zero if it belongs to the low-uncertainty group. The sign of γ_1, the coefficient for $D\_HighUNC_{i,t} \times \Delta Cash_{i,t}$, tells us whether firms facing higher uncertainty have a higher or lower market value of cash holdings.

3 Empirical results

3.1 Main regression results

Before we present the main regression results, we investigate if cash holdings vary with the level of uncertainty that a firm faces. Table 1 presents univariate comparisons of firm characteristics for two subsamples based on uncertainty. Consistent with the hypothesis that cash provides important benefits to firms facing high uncertainty, high-uncertainty firms tend to hold more cash. The mean (median) cash holdings of high-uncertainty firms are 22.6% (12.6%), while the mean (median) cash holdings of low-uncertainty firms are 10.8% (5.6%). High-uncertainty firms also have lower earnings, are smaller, have more volatile cash holdings and cash changes, and incur higher R&D expenses than low-uncertainty firms.

[Insert Table 1 Here]

Similarly, Figure 1 shows that lagged uncertainty and changes in cash-to-total assets ratios are highly positively correlated with each other, while lagged uncertainty and investment-to-total assets ratios are highly negatively correlated with each other, consistent with Bloom et al. (2007). In particular, during two recent uncertainty shocks (i.e., the Global Financial Crisis and the Dot-com Crash) cash ratios increased very significantly, while investment ratios dropped significantly, unlike in the years surrounding the shocks. This figure clearly shows that current investments and cash savings are substitutes. Overall, these preliminary analyses suggest that cash holdings and uncertainty are positively associated with each other.

[Insert Figure 1 Here]

Panel A of Table 2 reports the main regression results for the model specified in Equation (1). Column (1) uses the raw uncertainty measure, while Columns (2)–(4) employ each component of the uncertainty measure. For the raw measure and all of its components the interaction of the change in cash with the high-uncertainty dummy is positive and statistically significant at the 1% level, suggesting that cash is more valuable for firms facing high uncertainty. The results in Columns (2) through (4) suggest that cash is not only more valuable for a firm facing a higher level of uncertainty at a given point in time, but it is also more valuable for a given firm at a more uncertain point in time. Idiosyncratic uncertainty also makes a difference in regard to the value of cash holdings, but its effect is smaller than that of a time-invariant firm-specific component or a macroeconomic component.

Panel B of Table 2 uses the coefficients from Panel A to compute the marginal value of a dollar of cash from the mean firm in the sample, following the procedures used in Faulkender and Wang (2006) and Dittmar and Mahrt-Smith (2007). The results reported in Column (1) show that a dollar of cash is worth approximately \$0.92 on average, which is comparable to \$0.94 reported in Faulkender and Wang (2006). However, the value can jump up to \$1.29 if the firm is facing high uncertainty. Alternatively, a dollar in a firm facing low uncertainty is worth as little as \$0.53. Thus, the marginal value of one dollar cash is about \$0.76 higher for a firm facing high uncertainty than for a firm facing low uncertainty. The results reported in Columns (2)–(4) can be interpreted accordingly.

[Insert Table 2 Here]

3.2 Testing the channels through which uncertainty increases the value of cash holdings

To examine why cash is more valuable for firms facing high uncertainty we test which channels are better supported by the data: *i)* financial constraints; *ii)* agency conflicts; and *iii)* real options. To test each channel, we model the regression coefficient for $\Delta Cash_{i,t}$ in Equation (1), β_1, as follows:

$$\beta_1 = \gamma_0 + \gamma_1 D\_HighUNC_{i,t} + \gamma_2 D\_Channel_{i,t} + \gamma_3 D\_HighUNC_{i,t} \times D\_Channel_{i,t}, \tag{2}$$

where $D\_Channel_{i,t}$ is a dummy variable indicating financially constrained firms, firms with less severe agency conflicts, or firms with more investment opportunities. The significance of γ_3, the coefficient of $D\_HighUNC_{i,t} \times D\_Channel_{i,t} \times \Delta Cash_{i,t}$, tells us whether each of the channels is at play. The regression

results are presented in Table 3.

[Insert Table 3 Here]

First, we test whether uncertainty increases the value of cash holdings though the financial constraints channel, using the WW index (Whited and Wu, 2006) and the SA index (Hadlock and Pierce, 2010) as measures for financial constraints. Panel A shows that cash is more valuable for financially constrained firms, consistent with Faulkender and Wang (2006) and Denis and Sibilkov (2010). More importantly, we also find that the positive effect of uncertainty on the value of cash holdings is stronger for financially constrained firms, consistent with Han and Qiu (2007). Thus, the financial constraints channel is supported: financially constrained firms facing high uncertainty are likely to hold more cash to avoid passing up positive net present value (NPV) projects.

Second, we investigate if uncertainty increases the value of cash holdings though the agency conflicts channel, using the GIM index (Gompers et al., 2003) and the inverse of analyst coverage as measures for the severity of agency conflicts. Panel B contains the empirical results. We first confirm that firms with less severe agency conflicts have higher values of cash holdings, consistent with Dittmar and Mahrt-Smith (2007). We then show that the effect of uncertainty on the value of cash holdings is more favorable for firms with less severe agency conflicts.[1] It seems that high uncertainty has a disciplinary role, so that the managers of high-uncertainty firms tend to work in the interests of shareholders, mitigating agency conflicts between shareholders and managers and enhancing the value of cash holdings.

Finally, we examine whether uncertainty increases the value of cash holdings through the real options channel, using Tobin's q and sales growth as measures for investment opportunities. The empirical results are reported in Panel C. We find that firms with more investment opportunities have higher values of cash holdings. We also find that the positive effect of uncertainty on the value of cash holdings is greater for firms with more growth opportunities, supporting the real options channel. Our conjecture is that it is better for firms with higher uncertainty to reduce their current investments (or delay investments) (Bernanke, 1983; Bloom et al., 2007; Bloom, 2009) and to hold more cash in preparation for the investments postponed to the future. This conjecture is also supported by Figure 1. Our finding suggests that firms with more investment opportunities are more likely to experience the positive effects of uncertainty on the value of their cash holdings.

[1] Note that the effect of uncertainty on the value of cash holdings is positive only when agency conflicts are less severe, based on the GIM index.

4 Conclusion

This study has examined the effects of uncertainty on the amount and the value of cash holdings. We first show that a firm facing high uncertainty holds more than twice as much cash as a firm facing low uncertainty holds. We find that a dollar held by a firm facing high uncertainty is 76 cents more valuable than a dollar held by a firm facing low uncertainty: the value of one dollar is $1.29 for a firm facing high uncertainty, while it is only $0.53 for a firm facing low uncertainty. In addition, we find that the effects of uncertainty in regard to increasing the value of cash holdings are consistently observed for firm-level, time-series, and residual uncertainty measures. A further investigation suggests that uncertainty increases the value of cash holdings by aggravating financial constraints and mitigating agency conflicts through its disciplinary role.

More importantly, we provide evidence that the effects can be attributed to the increased value of the option of waiting and seeing which makes reducing investments and holding more cash beneficial to shareholders. Dixit and Pindyck (1994) argue that uncertainty increases the gap between the marginal productivity of capital, which justifies investment, and the marginal product of capital, which justifies disinvestment, thereby increasing the range of inaction where investment is zero as the firm prefers to "wait and see" rather than undertaking a costly action with uncertain consequences (Bloom et al., 2007). Thus, it is better for a firm facing a high level of uncertainty to reduce current investments and increase cash holdings in preparation for the investments postponed to subsequent periods.

The findings in this paper contribute to the literature regarding uncertainty and corporate decisions. First, we add to the literature about the determinants of the value of cash holdings, including Faulkender and Wang (2006), Denis and Sibilkov (2010), and Dittmar and Mahrt-Smith (2007). We find that the level of uncertainty that a firm faces has an economically significant influence on the value of cash holdings. To our knowledge, this is the first study which examines the relationship between firm-level uncertainty and the value of cash holdings. Second, we add to the literature regarding the effects of uncertainty on corporate investment decisions, such as Bloom et al. (2007). Finally, we improve our understanding of the relationship between uncertainty and the motive of holding cash by investigating the channels through which uncertainty increases the value of cash holdings. We provide evidence to show that the real options channel is at play, as well as the financing constraints and agency conflicts channels.

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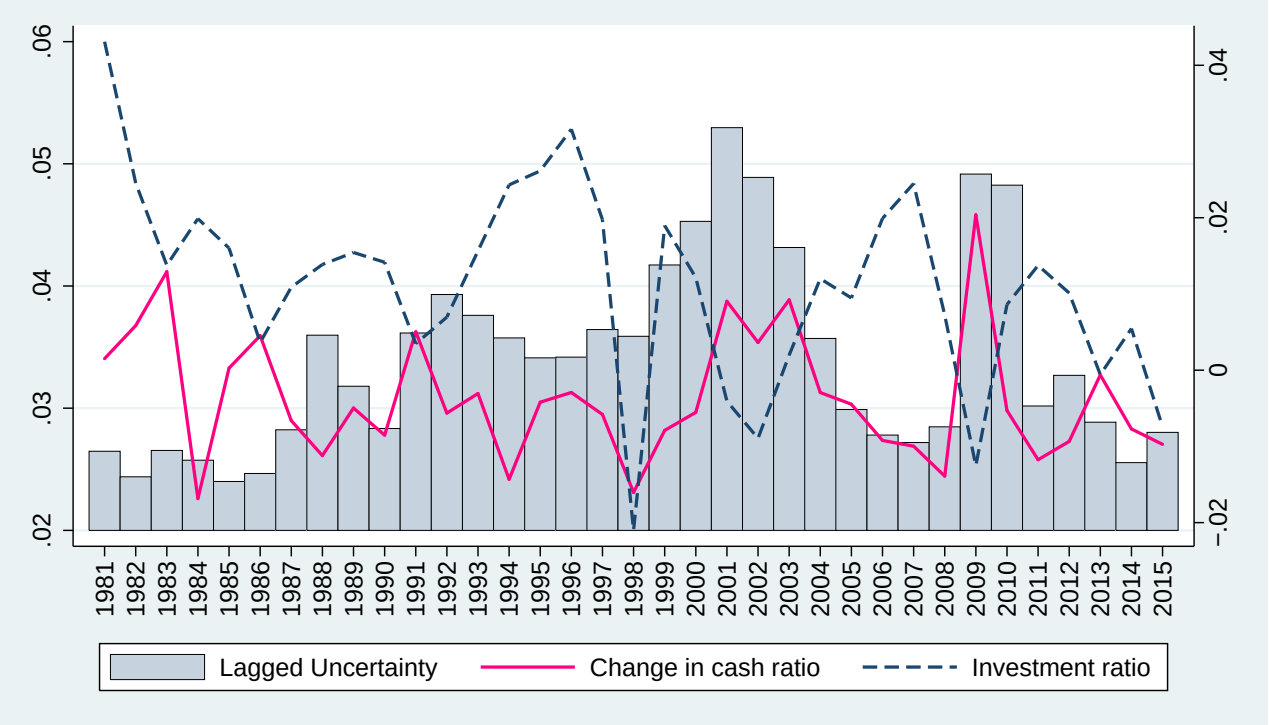
Figure 1. Uncertainty, change in cash ratios, and investment ratios



This figure depicts the cross-sectional means of one-year lagged uncertainty levels (the left axis), the changes in cash-to-total assets ratios (the right axis), and the investment-to-total assets ratios (the right axis). The light blue bar presents the average levels of one-year lagged uncertainty, the pink solid line the average changes in cash ratios, and the navy dotted line the average investment ratios.

Table 1. Descriptive statistics: High-uncertainty firms vs. low-uncertainty firms

	Low-uncertainty firms		High-uncertainty firms	
Variables	Mean	Median	Mean	Median
Cash holdings	0.108	0.056	0.226	0.126
St. dev. cash	0.066	0.053	0.100	0.088
St. dev. Cash chg.	0.056	0.047	0.096	0.085
Earnings	0.111	0.112	-0.065	0.031
Net investment	0.021	0.012	-0.005	-0.001
Size	10161	1269	946	129
R&D expenses	0.033	0.018	0.124	0.072
Total debt	0.235	0.219	0.246	0.174
Market-to-book	1.416	1.116	1.691	1.071
Uncertainty	0.018	0.018	0.058	0.052

Data are from Compustat for the period 1980–2015. We exclude companies from the financial (SIC 6000–6999) and utility (SIC 4900–4999) industries. We also exclude firms with total book assets of less than 25 million in constant 1980 dollars and firm-years with non-positive assets or cash holdings, or negative capital expenditures. See the text for definitions of high-uncertainty and low-uncertainty firms. Size is total book assets measured in 1980 dollars (adjusted for GDP deflator). Cash holdings, earnings, net investment, R&D expenses, total debt are scaled by total book assets.

Table 2. The impact of uncertainty on the value of cash holdings using return regressions

Panel A. Regression results

	Uncertainty measure			
Variables	Raw uncertainty $r_{i,t} - R_{p,t}$	Firm uncertainty $r_{i,t} - R_{p,t}$	Year uncertainty $r_{i,t} - R_{p,t}$	Resid. uncertainty $r_{i,t} - R_{p,t}$
Change in cash	1.216***	1.106***	1.322***	1.557***
	(0.068)	(0.067)	(0.054)	(0.053)
High uncertainty×change in cash	0.759***	0.744***	0.688***	0.113***
	(0.058)	(0.055)	(0.040)	(0.041)
High uncertainty dummy	0.032***	-0.050***	0.061***	0.106***
	(0.007)	(0.007)	(0.006)	(0.007)
Change in earnings	0.564***	0.557***	0.567***	0.568***
	(0.012)	(0.013)	(0.012)	(0.011)
Net assets	0.189***	0.178***	0.187***	0.185***
	(0.008)	(0.008)	(0.008)	(0.007)
Change in R&D	0.294**	0.240*	0.120	0.184
	(0.149)	(0.143)	(0.143)	(0.142)
Change in interest expenses	-1.361***	-1.326***	-1.640***	-1.386***
	(0.110)	(0.110)	(0.103)	(0.100)
Change in dividends	1.834***	2.181***	2.011***	1.656***
	(0.486)	(0.479)	(0.398)	(0.429)
Lagged cash	0.489***	0.526***	0.467***	0.421***
	(0.016)	(0.016)	(0.014)	(0.014)
Leverage	-0.575***	-0.573***	-0.555***	-0.571***
	(0.015)	(0.015)	(0.013)	(0.013)
Net financing	0.074***	0.137***	0.075***	0.088***
	(0.016)	(0.016)	(0.015)	(0.014)
Cash×change in cash	0.374***	0.460***	0.443***	0.434***
	(0.054)	(0.054)	(0.049)	(0.049)
Leverage×change in cash	-2.975***	-2.814***	-2.868***	-2.838***
	(0.098)	(0.098)	(0.089)	(0.089)
Constant	0.046***	0.056***	0.018***	0.005
	(0.007)	(0.006)	(0.006)	(0.006)
Observations	51,079	50,405	57,966	53,643
Adjusted R-squared	0.198	0.200	0.198	0.203

Panel B. Marginal value of cash for the average firm

Sample means for cash value computation				
Cash	0.225	0.206	0.219	0.226
Leverage	0.259	0.255	0.255	0.268
High uncertainty dummy	0.509	0.492	0.492	0.491
Marginal value of $1 (average uncertainty)	$0.92	$0.85	$1.03	$0.95
Marginal value of $1 (high uncertainty)	$1.29	$1.23	$1.37	$1.01
Marginal value of $1 (low uncertainty)	$0.53	$0.48	$0.69	$0.89
Difference in marginal value of $1	$0.76	$0.74	$0.69	$0.11

This table uses ordinary least squares (OLS) return regressions motivated by Faulkender and Wang (2006). Panel A reports the regression results. The dependent variable is stock return over fiscal year minus the return on a benchmark portfolio. The benchmark portfolios are 25 Fama-French value-weighted portfolios. The independent variables include the change in cash, change in book assets net of cash, change in earnings before interest and extraordinary items, change in R&D expenses, change in interest expenses, change in dividends, lagged cash holdings, leverage, and net financing during fiscal year. All explanatory variables except leverage are standardized by lagged market equity. The high-uncertainty dummy takes a value of 1 if a company is categorized as a high-uncertainty firm and 0 if a company is categorized as having a low-uncertainty firm. Regressions are estimated using OLS. Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. In Panel B, we use the mean (in-sample for each regression) levels of cash, leverage, and uncertainty variables to compute the marginal value of $1 in cash for the average firm in the sample. As in Dittmar and Mahrt-Smith (2007), the marginal value for the average firm is calculated as the coefficient of the change in cash plus the sample average for all variables that are interacted with the change in cash times the respective regression coefficient from the model.

Table 3. Testing channels through which uncertainty increases the value of cash holdings

Panel A. Testing the financial-constraints channel

	Financial constraint measure			
	Whited and Wu (2006)		Hadlock and Pierce (2010)	
Variables	$r_{i,t} - R_{p,t}$	$r_{i,t} - R_{p,t}$	$r_{i,t} - R_{p,t}$	$r_{i,t} - R_{p,t}$
Change in cash	1.544***	1.205***	1.271***	0.985***
	(0.058)	(0.092)	(0.058)	(0.090)
High uncertainty×change in cash		0.656***		0.387***
		(0.097)		(0.092)
Constrained×change in cash	0.089**	-0.277**	0.431***	-0.065
	(0.042)	(0.122)	(0.043)	(0.136)
High uncertainty×constrained×change in cash		0.288**		0.544***
		(0.140)		(0.152)
High-uncertainty dummy	Included	Included	Included	Included
Financial constraints dummy	Included	Included	Included	Included
Control variables	Included	Included	Included	Included
Observations	62,785	42,696	65,175	44,553
Adjusted R-squared	0.169	0.174	0.166	0.172

The dummy variable for financially constrained firms (i.e., constrained) takes a value of 1 if a company is identified as financially constrained and 0 if a company is identified as financially unconstrained by the respective criterion. Definitions of all the other variables are provided below Table 2. Regressions are estimated using OLS. Standard errors are reported in parentheses. *** and ** indicate significance at the 1% and 5% levels, respectively.

Panel B. Testing the agency-conflicts channel

	Agency conflicts measure			
	GIM index		Analyst coverage	
Variables	$r_{i,t} - R_{p,t}$	$r_{i,t} - R_{p,t}$	$r_{i,t} - R_{p,t}$	$r_{i,t} - R_{p,t}$
Change in cash	1.161***	1.445***	1.420***	0.835***
	(0.129)	(0.202)	(0.055)	(0.145)
High uncertainty×change in cash		-0.816***		0.777***
		(0.243)		(0.138)
Less agency conflicts×change in cash	0.855***	-0.104	0.516***	0.598***
	(0.100)	(0.244)	(0.046)	(0.161)
High uncertainty×less agency conflicts×change in cash		1.966***		0.312*
		(0.293)		(0.176)
High-uncertainty dummy	Included	Included	Included	Included
Less agency conflicts dummy	Included	Included	Included	Included
Control variables	Included	Included	Included	Included
Observations	9,797	6,270	44,975	29,224
Adjusted R-squared	0.177	0.182	0.176	0.180

The dummy variable for firms with less severe agency conflicts (i.e., less agency conflicts) takes a value of 1 if a company is identified as having less severe agency conflicts and 0 if a company is identified as having more severe agency conflicts by the respective criterion. Definitions of all the other variables are provided below Table 2. Regressions are estimated using OLS. Standard errors are reported in parentheses. *** and * indicate significance at the 1% and 10% levels, respectively.

Panel C. Testing the real-options channel

	Investment opportunities measure			
	Tobin's q		Sales growth	
Variables	$r_{i,t} - R_{p,t}$	$r_{i,t} - R_{p,t}$	$r_{i,t} - R_{p,t}$	$r_{i,t} - R_{p,t}$
Change in cash	0.554***	0.412***	1.162***	0.814***
	(0.054)	(0.091)	(0.049)	(0.100)
High uncertainty×change in cash		0.201***		0.467***
		(0.076)		(0.094)
More investment opportunities×change in cash	1.959***	0.551***	0.762***	0.418***
	(0.047)	(0.170)	(0.037)	(0.127)
High uncertainty× more investment		1.742***		0.602***
opportunities×change in cash		(0.177)		(0.138)
High-uncertainty dummy	Included	Included	Included	Included
More investment opportunities dummy	Included	Included	Included	Included
Control variables	Included	Included	Included	Included
Observations	64,033	41,669	63,427	40,421
Adjusted R-squared	0.249	0.250	0.206	0.207

The dummy variable for firms with more investment opportunities (i.e., more investment opportunities) takes a value of 1 if a company is identified as having more investment opportunities and 0 if a company is identified as having less investment opportunities by the respective criterion. Definitions of all the other variables are provided below Table 2. Regressions are estimated using OLS. Standard errors are reported in parentheses. *** indicates significance at the 1% level, respectively.