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Policy uncertainty and firm cash holdings☆,☆☆

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ABSTRACT

This research examines the relation between government economic policy uncertainty and firm cash holdings. We find evidence that policy uncertainty is positively related to firm cash holdings due to firms' precautionary motives and, to a lesser extent, investment delays. The relation between policy uncertainty and cash holdings is more pronounced for firms dependent on government spending and extends beyond business cyclicality. Further analysis indicates that the effects of policy uncertainty on corporate cash holdings are distinct from those of political, market, or other macroeconomic uncertainty.

1. Introduction

Government economic policy uncertainty can have detrimental effects on the economy. Previous research suggests that uncertainty related to government spending, tax, and regulatory and monetary policies exacerbated the 2007–2009 Great Recession and slowed the economic recovery (Baker, Bloom, & Davis, 2016; Stock & Watson, 2012). The level of policy uncertainty in the United States increased significantly during the period 1985–2012, peaking around the government's failure in raising federal debt-ceiling in August 2011 and the fiscal cliff crisis at the end of 2012 whereby several previously enacted laws would come into effect simultaneously, potentially leading to an increase in taxes and a decrease in spending.[1] Economic policy uncertainty was suggested to have caused more than one-percentage-point decrease in the U.S. real gross domestic product (GDP) and the loss of over one million jobs during the period 2011–2012 (source: Wall Street Journal, April 28, 2013).[2] Given the profound impact of policy uncertainty on the economy, academic researchers have shown increasing interest in investigating the effects of policy uncertainty on corporate policies.

Recent studies document that government economic policy uncertainty has negative financial and real effects. Gulen and Ion (2016) and Nguyen and Phan (2017) report that firms are more likely to delay investments, particularly those that are irreversible, amid high economic policy uncertainty. Policy uncertainty can increase the cost of external financing, which exacerbates firms' financial constraints (Gilchrist, Sim, & Zakrajšek, 2014; Pástor & Veronesi, 2013).

Cash is an important and liquid corporate asset. The increasing trend in cash holdings of U.S. firms has attracted attention from investors and academic researchers. Bates, Kahle, and Stulz (2009) report that the average cash-to-assets ratio of U.S. industrial firms more than doubled during the period 1980–2006, increasing from 10.5% to 23%. Previous studies offer several explanations for corporate cash holdings, including transaction costs (Mulligan, 1997), precautionary motives (Bates et al., 2009; Han & Qiu, 2007; Khieu & Pyles, 2012; Opler, Pinkowitz, Stulz, & Williamson, 1999), corporate governance (Dittmar

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[1] The fiscal cliff was related to the expiration of the Bush tax cuts of 2001 and the planned spending cuts under the Budget Control Act of 2011.
[2] Available at http://www.wsj.com/articles/SB10001424127887323789704578443431277889520, last accessed on May 22, 2016.

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& Mahrt-Smith, 2007; Harford, Mansi, & Maxwell, 2008; Kuan, Li, & Chu, 2011), business organization structure (Locorotondo, Dewaelheyns, & Hulle, 2014), tax incentives (Foley, Hartzell, Titman, & Twite, 2007; Pinkowitz, Stulz, & Williamson, 2013), product market competition (Fresard, 2010), and idiosyncratic risk (Campbell, Lettau, Malkiel, & Xu, 2001). However, little is known about the link between government economic policy uncertainty and corporate liquidity. Our research fills this gap in the literature by examining the effect of policy uncertainty on corporate cash holdings.

Policy uncertainty can affect corporate cash holdings in a number of ways. Since policy uncertainty decreases asset returns and increases the cost of external financing, which exacerbate firms' financial constraints (Brogaard & Detzel, 2015; Gilchrist et al., 2014 and Pástor & Veronesi, 2013), firms are motivated to increase cash reserves to buffer against financial shocks and maintain smooth operation. From the real option perspective, firms may choose to delay investment amid high uncertainty (Bernanke, 1983; Dixit & Pindyck, 1994; Gulen & Ion, 2016), which also leads to an increase in cash holdings. Since policy uncertainty tends to be temporary, increased cash holdings can provide flexibility that allows firms to exploit future profitable investment opportunities when uncertainty recedes. Policy uncertainty can also increase managerial conservatism (Panousi & Papanikolaou, 2012), inducing firms to hold more cash, which is the most liquid asset. For these reasons, we expect a positive relation between policy uncertainty and cash holdings.

We begin by examining the effect of government economic policy uncertainty on corporate cash holdings. Similar to recent studies related to policy uncertainty (Gilchrist et al., 2014; Gulen & Ion, 2016; Nguyen & Phan, 2017; Panousi & Papanikolaou, 2012; Pástor & Veronesi, 2013), we use the economic policy uncertainty index developed by Baker et al. (2016; hereinafter labeled BBD index) as the measure of government economic policy uncertainty. Using a sample that includes 119,322 firm-year observations of 13,981 unique firms over the period 1986–2015, we find that policy uncertainty is positively related to corporate cash holdings. Further analysis indicates that precautionary motives and, to a lesser extent, investment delays explain the positive relation between policy uncertainty and the level of cash. Our findings are not susceptible to possible alternative explanations such as managerial agency problems or external financing.

Since the BBD index and corporate cash holdings follow an increasing trend over the sample period, one may be concerned about a possible spurious relation between the two. Alternatively, policy uncertainty tends to be countercyclical whereas firms may hold more cash in the down state of the economy, which raises a possibility that our observed positive relation between policy uncertainty and corporate cash reserves is simply driven by business cyclicality. We perform two analyses to address these concerns. In the first analysis, we examine the relation between policy uncertainty and corporate cash holdings conditional on firms' dependence on government spending. We find that the positive relation between policy uncertainty and cash holdings is more pronounced for firms dependent on government spending, implying that government economic policy uncertainty affects corporate cash holdings rather than the two being spuriously related. In the second analysis, we sort firms into subgroups depending on whether they belong to pro-cyclical or countercyclical industries. Our results indicate that the positive relation between corporate cash holdings and policy uncertainty is significant for both subgroups of firms, suggesting that the relation extends beyond business cyclicality.

We run several additional tests to ensure the robustness of our findings. First, policy uncertainty and corporate cash holdings can be jointly correlated with unobservable variables, such as investment opportunities, which raises endogeneity concern. We use the IV regression model to address this endogeneity concern and find that our results are robust to endogeneity correction. Second, the BBD index may capture the effects of general economic uncertainty that potentially confound our finding, therefore, we control for several proxies for economic uncertainty including the annual standard deviation of firm profit growth, the uncertainty of equity markets, economic uncertainty measured by GDP forecast dispersion, and aggregate macroeconomic uncertainty measures suggested by Jurado, Ludvigson, and Ng (2015). Our finding is qualitatively unchanged. Third, the BBD index may pick up the effects of some other non-policy-related economic uncertainty, such as labor market variations, currency uncertainty or oil shocks, which tend to affect corporate cash reserves. Following Gulen and Ion (2016)'s suggestion that the U.S. and Canadian economies are closely linked and a shock that affects the economic uncertainty in the U.S. is likely to affect the economic uncertainty in Canada as well, we use the residuals of the regression of the BBD news-based index for the U.S. on the Canadian BBD news-based index and other macroeconomic variables as a proxy for policy uncertainty. We find that our results continue to hold. Fourth, some previous research reports that political uncertainty, which is typically associated with elections, can affect corporate policies. To alleviate a concern that policy uncertainty merely picks up the effects of political uncertainty, we control for political uncertainty in the cash holdings regressions but our results are qualitatively similar.

Our research contributes to a burgeoning stream of literature that studies the effects of policy uncertainty on corporate behavior and firm value and to a more established stream of literature on the determinants of corporate liquidity. We show that policy uncertainty relates significantly to corporate cash holdings, which is one of the most important corporate financial policies. We uncover the drivers, i.e., precautionary motives and, to a lesser extent, investment delays, of the positive relation between policy uncertainty and corporate cash holdings. Our findings provide timely implications for corporate managers, investors, and policy makers given the recent sharp increase in policy uncertainty and the acute interest in promoting business growth and job creation.

Our research is related to some recent studies on the relation between uncertainty and firm cash holdings. Gao, Grinstein, and Wang (2017) find a positive effect of systematic uncertainty, which is obtained from the regression of implied volatility of firms' traded stock options on the implied volatility of the S&P 500 index (VIX), on firm cash holdings through firms' future cash needs and costs of external financing channels. However, our research focuses particularly on the effects of government economic policy uncertainty, which is different from their systematic uncertainty in measurement, time frame, and implications (Baker et al., 2016; Nguyen & Phan, 2017). Another research related to ours is Demir and Ersan (2017), which examines the relation between policy uncertainty and corporate cash holdings in emerging (BRIC) economies over the period 2006–2015. Our research examines the relation between policy uncertainty and cash holdings of firms in a single country, the U.S., which is not susceptible to unobserved time-varying country social, economic, and political conditions that may correlate with policy uncertainty. Moreover, our sample period (from 1986 to 2015) spans several business cycles, thus, our results are unlikely to be confounded by the consequences of the recent Great Recession.

2. Empirical prediction

Policy uncertainty may increase firms' future cash flow volatility, thereby increasing the deadweight costs of financial distress. Previous research reports that policy uncertainty reduces asset returns and increases the cost of external financing, which exacerbate firms' financial constraints (Brogaard & Detzel, 2015; Gilchrist et al., 2014; Pástor & Veronesi, 2013). Facing possible external financing uncertainty and higher costs of capital amid high policy uncertainty, firms are more likely to increase their cash reserves to buffer against financial shocks and maintain smooth operation and investment. Moreover, firms are likely to delay investments amid high policy uncertainty (Gulen & Ion, 2016; Nguyen & Phan, 2017), which may also lead to larger cash

holdings. Obviously, firms can distribute cash that is not used for investment to investors but they might consider the trade-off between reducing unprofitable cash holdings and costly external financing due to market frictions if they have to raise external funds to support investments in the future when policy uncertainty recedes. Since policy uncertainty is unlikely to be permanent, holding cash could be more cost effective than paying out first and raising external funds later.[3] Policy uncertainty also heightens managerial conservatism (Panousi & Papanikolaou, 2012). Among different classes of assets, cash is the most liquid that could be the asset of choice for conservative managers during the periods of high policy uncertainty. Given the foregoing discussions, we predict a positive relation between policy uncertainty and firm cash holdings.

3. Samples, variables construction, and descriptive statistics

We obtain U.S. public firms' accounting data from Compustat and stock price and return data from the Center for Research in Security Prices (CRSP) databases. Since the first year that the BBD index is available is 1985, our sample period begins in 1986 and ends in 2015. Following the literature, we exclude firms from the utility and financial industries from our sample because these firms are highly regulated and their cash holdings may have a different meaning.

We use the BBD policy uncertainty index constructed by Baker et al. (2016) as the measure of government economic policy uncertainty. The BBD index is constructed based on the monthly value-weighted average of three components that include the frequency of newspaper articles containing key terms related to policy matters and economic uncertainty, the dispersion in economic forecasts of government spending and consumer price index (CPI) as a proxy for uncertainty about future fiscal and monetary policy, and uncertainty about future changes in the federal tax codes measured by the dollar impact of tax provisions set to expire in the near future. The weights for the news-based, forecaster disagreement and expiration tax code components are 1/2, 1/3, and 1/6, respectively. In our analysis, we construct the policy uncertainty measure as the natural logarithm of the average of monthly BBD index values in a given year.

The first component of the BBD index, the news-based uncertainty, captures the intensity of concerns about policy uncertainty. This component is constructed based on the news articles from 10 large newspapers including the Boston Globe, the Chicago Tribune, the Dallas Morning News, the Los Angeles Times, the Miami Herald, the New York Times, the San Francisco Chronicle, USA Today, the Wall Street Journal, and the Washington Post. Specifically, an article will be counted if it contains terms in all three categories related to uncertainty, the economy, and policy including: 'uncertainty' or 'uncertain', one of the terms 'economic' or 'economy', and one of the terms 'congress', 'deficit', 'federal reserve', 'legislation', 'regulation', or 'white house'. Baker et al. (2016) find that the news-based uncertainty increases with intense news coverage of events such as the Gulf Wars, terrorist attack (9/11), the Lehman Brothers bankruptcy, the 2011 debt-ceiling dispute, and stock market crash (Black Monday).

The second component, the dispersion in economic forecasts of government spending and consumer price index (CPI), is measured as the average of the interquartile ranges of Consumer Price Index (CPI) and federal, state and local governments spending forecasts. The fiscal and monetary policies data are obtained from the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters. The third component, the level of uncertainty related to future changes to the tax code, is measured by the discounted value of the revenue effects of all tax provisions set to expire over the next ten years. The federal tax code provision expiration data are acquired from the Congressional Budget Office.

We report the descriptive statistics of the sample in Table 1. The sample consists of 119,322 firm-year observations of 13,981 unique firms. *Cash-to-assets* is the ratio of cash to the book value of assets (i.e., Compustat items CH/AT). *Cash-to-net assets* is the ratio of cash to net assets, where net assets are defined as the book value of assets minus cash. *Policy uncertainty* is the natural logarithm of the average monthly BBD index in a given year. *Market-to-book* is defined as the market value of assets divided by the book value of assets. *Leverage* is the ratio of the book value of debt to the book value of assets. Other variables are defined in Appendix A. We winsorize the continuous variables at the 1% and 99% levels to mitigate the effects of outliers. The sample average *cash-to-assets ratio* (*cash-to-net assets ratio*) is 14.04% (30.20%). The average value of BBD index is 104.76, which is similar to those reported by Baker et al. (2016) and Gulen and Ion (2016).

4. Empirical models, results, and discussions

4.1. Baseline regressions

Our cash holdings model is similar to the one adopted by previous research (e.g., Bates et al., 2009; Harford et al., 2008; Opler et al., 1999; Phan, Simpson, & Nguyen, 2017) and has the following form:

$$\begin{aligned}\frac{C_{i,t}}{TA_{i,t}} = {} & \beta_0 + \beta_1 PU_{i,t-1} + \beta_2 Size_{i,t} + \beta_3 MB_{i,t} + \beta_4 \frac{CF_{i,t}}{TA_{i,t}} + \beta_5 \frac{NWC_{i,t}}{TA_{i,t}} \\ & + \beta_6 \frac{Capex_{i,t}}{TA_{i,t}} + \beta_7 Leverage_{i,t} + \beta_8 Industry\ sigma \\ & + \beta_9 Dividend\ dummy_{i,t} + \beta_{10} \frac{R\&D_{i,t}}{Sales_{i,t}} + \beta_{11} \frac{M\&A_{i,t}}{TA_{i,t}} \\ & + firm\ fixed\ effects + e_{i,t}, \end{aligned} \quad (1)$$

In Eq. (1), the dependent variable is either the cash-to-assets or cash-to-net assets ratio. The test variable is policy uncertainty, *PU*, which is proxied by the BBD index. We use policy uncertainty lagged by one period to alleviate endogeneity concern. Consistent with our prediction, we expect the coefficient β_1 to be positive and statistically significant. We control for several factors that are documented in the literature as having power to explain corporate cash holdings, including firm size, growth opportunities, cash flows, net working capital, capital expenditures, financial leverage, industry cash flow volatility, R&D investments, and acquisition activities.[4] It is worth noting that since the cash level model explicitly controls for the level of firm investment in the forms of capital expenditures, R&D, and acquisitions, the model captures both the direct effect of policy uncertainty on the level of cash, due to precautionary purposes, through the stand-alone policy uncertainty variable and its indirect effect on cash holdings due to investment delays through the investment variables. The model further includes firm fixed effects to control for unobserved time-invariant firm characteristics or industry fixed effects to control for industry-wide common factors. We do not control for year fixed effects because BBD index is the same for all firms in a given year (Gulen & Ion, 2016; Nguyen & Phan, 2017). Finally, we use the heteroscedasticity-robust standard errors clustered by firms for statistical inference.

Table 2 reports the results of the corporate cash holdings regressions. Because the results are qualitatively similar when the dependent variable is either the cash-to-assets or cash-to-net assets ratio, we report the cash-to-assets regression results for discussion (but the results for cash-to-net assets regressions are available from the authors).

[3] We examine the effect of policy uncertainty on corporate payouts in the robustness check section and find that firms actually decrease payout during the periods of high policy uncertainty.

[4] Similar to the previous research (e.g., Bates et al., 2009; Foley et al., 2007; Harford et al., 2008; Opler et al., 1999; Phan et al., 2017), we control for contemporaneous firm characteristics in the cash level model. However, our findings hold if we use the lagged firm characteristics as controls.

Table 1
Summary statistics.

Variable	N	Mean	Q1	Median	Q3	Std. dev.
Cash/Asset	119,322	0.140	0.022	0.073	0.189	0.176
Cash/Net asset	119,322	0.302	0.022	0.079	0.233	0.864
PU	119,322	104.756	81.106	104.041	118.673	26.283
Book assets ($ million)	119,322	1012.861	33.653	143.239	728.091	2063.331
Market-to-book	119,322	2.243	1.104	1.504	2.361	2.928
Cash flow	119,322	0.021	0.002	0.101	0.164	0.363
NWC	119,322	0.064	−0.044	0.057	0.197	0.270
R&D	119,322	0.083	0.000	0.000	0.069	0.179
Capex	119,322	0.064	0.019	0.040	0.079	0.073
Leverage	119,322	0.224	0.019	0.175	0.347	0.248
Dividend dummy	119,322	0.325	0.000	0.000	1.000	0.469
Acquisition	119,322	0.022	0.000	0.000	0.007	0.060
Industry sigma	119,322	0.173	0.085	0.138	0.208	0.148

Table 1 reports the descriptive statistics of the full sample. *Cash-to-assets* is the ratio of cash to the book value of assets. *Cash-to-net assets* is the ratio of cash to net assets, where net assets are defined as the book value of assets minus cash. *PU* is the average of the monthly BBD policy uncertainty index in a given year. *Market-to-book* is defined as the market value of assets divided by the book value of assets. *Cash flow* is calculated as a ratio of earnings after interest, dividends, and taxes but before depreciation to the book value of assets. *NWC* is the ratio working capital without cash to the book value of assets. *R&D* is measured as the ratio of R&D expenses to sales. *Capex* is calculated as the corporate capital expenditure divided by the book value of assets. *Leverage* is the ratio of the book value of debt to the book value of assets. *Dividend dummy* is an indicator variable that takes a value of 1 if a firm pays a common dividend in a given year, and 0 otherwise. *Acquisition* is defined as a ratio of corporate acquisition expenditure to the book value of assets. *Industry sigma* is the average of the standard deviation of the ratio of cash flow to the book value of assets over the last 10 years for firms in the same 2-digit SIC code industries. Appendix A provides the definitions of the variables.

Consistent with our expectation, the estimated coefficients of policy uncertainty are positive, ranging from 0.011 to 0.016, and statistically significant at the 1% level.[5] The economic effect of policy uncertainty on corporate cash holdings is also important. Our calculation indicates that, holding other variables fixed at their sample means, a one standard deviation increase in policy uncertainty above its sample mean is associated with a 0.39 to 0.64 percentage-point increase in corporate cash holdings, which is equivalent to 2.7% to 4.6% of the sample mean. Turning to the control variables, the coefficients of *capex* and *acquisitions* are all negative and statistically significant, indicating a negative relation between investment and the level of cash. To the extent that policy uncertainty negatively affects investment (Gulen & Ion, 2016), the negative relation between corporate investment and cash holdings implies an indirect and positive effect of policy uncertainty on the level of cash through the investment channel.

To put the economic effects of policy uncertainty on cash holdings due to the precautionary motives and investment delays in perspective, based on the estimates reported in Column 1 of Table 2, we find that one standard deviation increase in policy uncertainty is associated with an increase of 0.42% (42 basis points) in cash after controlling for the investment effects. On the other hand, one standard deviation increase in capital expenditures (R&D) is associated with a decrease (increase) of 0.02% (0.0055%) in cash. These comparisons of the magnitude of effects underscore our claim that the precautionary motives have a much larger economic impact on cash holdings as compared to the investment channel.

[5] In an unreported analysis, we examine the effect of policy uncertainty on corporate excess cash. Specifically, we run a cash level regression model that includes all control variables but without policy uncertainty and obtain the predicted level of cash. Excess cash is calculated as the difference between the actual and predicted level of cash. Then we regress excess cash on policy uncertainty measure and find a positive relation between the two, which is consistent with our main finding. We thank a referee for suggesting this analysis.

Table 2
Policy uncertainty and corporate cash holdings.

Variable	(1)	(2)	(3)
PU	0.016***	0.016***	0.011***
	(6.32)	(6.27)	(4.56)
Size	−0.005***	−0.005***	−0.010***
	(12.38)	(11.95)	(9.53)
Market-to-book	0.008***	0.007***	0.005***
	(12.78)	(12.28)	(12.04)
Cash flow	−0.020***	−0.021***	0.033***
	(4.63)	(5.03)	(7.48)
NWC	−0.110***	−0.102***	−0.064***
	(12.96)	(11.45)	(9.22)
R&D	0.031***	0.029***	0.009***
	(18.22)	(16.92)	(4.38)
Capex	−0.278***	−0.236***	−0.213***
	(28.31)	(23.15)	(20.89)
Leverage	−0.214***	−0.204***	−0.132***
	(34.79)	(32.37)	(20.77)
Dividend dummy	−0.036***	−0.030***	0.004**
	(21.83)	(18.54)	(2.51)
Acquisition	−0.169***	−0.178***	−0.142***
	(26.98)	(28.04)	(24.19)
Industry sigma	0.135***	0.081***	0.028***
	(13.00)	(9.13)	(4.24)
Intercept	0.135***	0.155	0.171***
	(10.35)	(0.01)	(12.70)
Industry fixed effects	No	Yes	No
Firm fixed effects	No	No	Yes
Number of observations	119,322	119,322	119,322
Adjusted R^2	0.30	0.32	0.60

Table 2 reports the results of the cash holdings regressions. The dependent variable is *cash-to-assets ratio*. *PU* is the average of the monthly BBD policy uncertainty index in a given year. *Size* is measured as the natural logarithm of the book value of assets. *Market-to-book* is defined as the market value of assets divided by the book value of assets. *Cash flow* is calculated as a ratio of earnings after interest, dividends, and taxes but before depreciation to the book value of assets. *NWC* is the ratio working capital without cash to the book value of assets. *R&D* is measured as the ratio of R&D expenses to sales. *Capex* is calculated as capital expenditures divided by the book value of assets. *Leverage* is the ratio of the book value of debt to the book value of assets. *Dividend dummy* is an indicator variable that takes a value of 1 if a firm pays a common dividend in a given year, and 0 otherwise. *Acquisition* is defined as a ratio of corporate acquisition expenditure to the book value of assets. *Industry sigma* is estimated as the average of the standard deviation of the ratio of cash flow to book value of assets over the last 10 years for firms in the same 2-digit SIC code industries. Other variables are defined in Appendix A. *t*-statistics based on heteroscedasticity-robust standard errors clustered by firms are reported in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.2. Firm dependence on government spending and business cyclicality

Since the BBD index and corporate cash holdings follow an increasing trend over the sample period, one may be concerned about a possible spurious relation between the two. To address this concern, we examine the relation between policy uncertainty and corporate cash holdings conditional on firms' dependence on government spending. In particular, firms that are more dependent on government spending are more likely to be adversely affected by policy uncertainty, potentially leading to larger corporate cash holdings. Thus, policy uncertainty is expected to have a stronger effect on the level of cash of those firms that are more prone to the components of policy uncertainty, such as government spending. We follow Belo, Gala, and Li (2013) in measuring industry sensitivity to government spending by the ratio of each industry's sales purchased by the government using the data from the Benchmark Input-Output Accounts provided by the Bureau of Economic

Table 3
Policy uncertainty, sensitivity to government spending, and firm cash holdings.

Variable	(1)	(2)	(3)	(4)
PU	0.012***	0.008***	0.037***	0.018***
	(4.48)	(3.59)	(12.18)	(6.08)
PU × Sensitivity to government spending dummy	0.008**	0.005*		
	(2.14)	(1.68)		
Sensitivity to government spending dummy	−0.02	−0.011		
	(1.19)	(0.67)		
PU × Government contract dummy			0.002	0.018**
			(0.26)	(2.22)
Government contract dummy			−0.025	−0.080**
			(0.62)	(2.16)
Other controls	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes
Number of observations	119,322	119,322	58,142	58,142
Adjusted R^2	0.30	0.60	0.33	0.67

Table 3 reports the results of the cash holdings regressions. The dependent variable is *cash-to-assets ratio*. *PU* is the average of the monthly BBD policy uncertainty index in a given year. *Size* is measured as the natural logarithm of the book value of assets. *Sensitivity to government spending dummy* is an indicator variable that takes a value of 1 if a firm's industry sensitivity to government spending is above the sample median, and 0 otherwise. *Government contract dummy* is an indicator variable that equals to 1 for firms with sales to the government exceeding $1 million in a given year and 0 otherwise. The sensitivity to government spending is measured by the ratio of an industry's sales purchased by the government. The regressions control for other variables as specified in Eq. (1) but their estimates are suppressed for brevity. *t*-statistics based on heteroscedasticity-robust standard errors clustered by firms are reported in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Analysis (BEA). We construct the *Sensitivity to government spending dummy* variable that takes a value of 1 if a firm's industry sensitivity to government spending is above the sample median, and 0 otherwise. We rerun the corporate cash holdings model with *Sensitivity to government spending dummy* and its interaction with policy uncertainty and report the results in Columns 1–2 of Table 3. The coefficients of policy uncertainty remain positive and significant, whereas the coefficients of the interaction terms are also positive and significant, indicating that firms with sales sensitive to government spending hold larger cash reserves during the periods of high policy uncertainty.

In an additional analysis, we use the data on government contracts, which are available from year 2000 onward, to estimate firm-level sensitivity to government spending.[6] Due to the large government contract dataset and the lack of common identifiers between the government contractors and Compustat firms, we use a fuzzy matching algorithm (provided by the SAS statistical software) and company names to match government contractors with Compustat firms. We then construct the *Government contract dummy* variable that takes a value of 1 if a firm's sales to the government in a given year is greater than $1 million, and 0 otherwise. We rerun the corporate cash holdings model augmented with this dummy variable and its interaction with policy uncertainty and report the results in Columns 3–4 of Table 3. The coefficients of policy uncertainty remain positive and significant, whereas the coefficient of the interaction term is positive and significant in Column 4 that controls for firm fixed effects. This result indicates that firms with larger sales to the government increases cash reserves when policy uncertainty increases. Taken together, the evidence indicates that government economic policy uncertainty affects corporate cash holdings rather than the two being spuriously related.

Since policy uncertainty tends to be counter-cyclical while firms may hold larger cash reserves in the bad states of the economy, one may argue that the positive relation between policy uncertainty and cash reserves could simply be driven by business cyclicality. To alleviate this concern, we identify countercyclical and pro-cyclical industries based on the asset liquidation values proxied by firms' sales cyclicality (Almeida & Campello, 2007; Sharpe, 1994; Shleifer & Vishny, 1992). If the relation between policy uncertainty and firm cash holdings is simply driven by business cyclicality, we expect the results to hold for only pro-cyclical industries. We estimate the coefficients of correlation between a firm's sales and the annual gross national product (GNP) over the sample period, and calculate industry average of the correlation coefficients of the firms in the same 2-digit SIC industry. We sort industries into the pro-cyclical (countercyclical) subgroup if their average correlation coefficients are above (below) the sample median and then rerun the corporate cash holdings models by subgroups. The estimation results reported in Table 4 indicate that policy uncertainty has a positive and significant effect on the level of cash of firms in both industry subgroups, implying that policy uncertainty's effects on firm cash holdings extend beyond business cyclicality.[7]

4.3. Additional analyses of the drivers of the relation between policy uncertainty and cash holdings

The positive relation between policy uncertainty and cash holdings could arise from firm precautions and investment delays. To further establish the direct relation between policy uncertainty and corporate cash holdings due to precautionary purposes, we conduct a complementary analysis along firms' investment irreversibility. The intuition is that firms with irreversible investments are more likely to delay investments amid high policy uncertainty (Gulen & Ion, 2016; Nguyen & Phan, 2017), implying that these firms' larger cash holdings arise from investment delays. On the other hand, firms with low or no irreversible investments are less likely to delay investments during periods of high policy uncertainty, hence a positive relation between policy uncertainty and cash holdings of these firms indicates precautionary motives.

We use two different proxies for investment irreversibility. The first proxy is capital intensity, which is calculated as the ratio of the net fixed assets to the book value of assets. A higher level of capital intensity indicates a higher level of investment irreversibility (Gulen & Ion, 2016). We construct the *High irreversible investment dummy* variable that takes a value of 1 if a firm's capital intensity measure is above the sample median in a given year, and 0 otherwise. We employ industry redeployability scores as the second proxy for irreversible investments using information from the 1997 capital flow table from the BEA (Kim & Kung, 2013). The table provides information about the capital expenditures of 123 industries, sorted into 180 asset categories. The redeployability score for each asset category is the ratio of the number of industries using that asset category. An industry's redeployability score is the value-weighted average of the redeployability scores for each asset category in which the industry invests, whereas the weight for each asset category is its share in the industry's total capital expenditures.[8] By construction, a lower industry redeployability score means a higher level of investment irreversibility. We construct the *Low redeployability dummy* variable that takes a value of 1 if a firm's industry redeployability score is below the sample median, and 0 otherwise.

We rerun the corporate cash holdings regressions that include proxies for investment irreversibility and their interactions with policy uncertainty and report the results in Table A.1 in the Internet Appendix. The results indicate that the coefficients of policy uncertainty are

[6] Data on government contracts are publicly available at https://www.usaspending.gov/Pages/Default.aspx.

[7] Since we control for firm fixed effects in Columns 3 and 4 of Table 4, we cannot perform the Wald test to compare the magnitude of the coefficients of policy uncertainty in these two columns.

[8] The Bureau of Economic Analysis uses the North American Industry System (NAICS) industries code so we merge the data with our sample using the two-digit NAICS code.

Table 4
Policy uncertainty, pro-/countercyclical industries, and firm cash holdings.

Variable	Countercyclical industries	Pro-cyclical industries	Countercyclical industries	Pro-cyclical industries
	(1)	(2)	(3)	(4)
PU	0.019***	0.015***	0.018***	0.006*
	(8.05)	(5.89)	(5.73)	(1.85)
Other controls	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	Yes	Yes
Number of observations	73,973	45,349	73,973	45,349
Adjusted R^2	0.30	0.25	0.60	0.54
Test of difference in coefficients of PU of two subgroups:				
χ^2	1.42			
p-Value	0.23			

Table 4 reports the results of the firm cash holdings regressions for subsamples of firms in countercyclical and pro-cyclical industries. Countercyclical (pro-cyclical) industries include those that have industry average coefficients of correlation between sales and annual GNP below (above) the sample median. The dependent variable is *cash-to-assets ratio*. *PU* is the average of the monthly BBD policy uncertainty index in a given year. Columns 1 and 2 report the results of OLS cash holdings regressions while Column 3 and 4 report the results of cash holdings regressions that additionally control for firm fixed effects. The regressions control for other variables as specified in Eq. (1) but their estimates are suppressed for brevity. *t*-statistics based on heteroscedasticity-robust standard errors clustered by firms are reported in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

positive and statistically significant across specifications, suggesting a strong and robust direct effect of policy uncertainty on the corporate cash holdings of an average firm. On the other hand, the coefficient of the interaction between policy uncertainty and investment irreversibility proxy is positive and statistically significant in only Column 1, indicating a weak indirect effect of policy uncertainty on cash holdings through investment delays.

In the next analysis, we examine the effects of firms' financial constraints on the link between policy uncertainty and corporate cash holdings. Since financially constrained firms typically do not have sufficient internal funds to finance investments and lack access to external capital, they are less likely to increase cash reserves amid uncertainty unless for precautionary purposes (Han & Qiu, 2007; Khieu & Pyles, 2012). We run corporate cash holdings regressions separately for subgroups of firms sorted on the following measures of financial constraints: S&P long-term credit ratings, firm size, market-to-book ratio, Whited-Wu index (Whited & Wu, 2006), and size-age index (Hadlock & Pierce, 2010). The results reported in Table 5 indicate positive effects of policy uncertainty on the level of cash holdings for both subgroups, which implies that both precautionary motives and investment delays explain the positive relation between policy uncertainty and corporate cash holdings.

Managerial agency problems can affect the level of cash holdings (Harford et al., 2008), which may confound the relation between policy uncertainty and cash holdings if the regressions do not control for these problems. We rerun the cash level regressions while controlling for governance mechanisms that measure investor oversight by institutional investors (institutional ownership) and managerial entrenchment resulting from antitakeover provisions (GIM index or BCF index). The GIM index, developed by Gompers, Ishii, and Metrick (2003), is the number of anti-takeover provisions adopted by a firm. The BCF index constructed by Bebchuk, Cohen, and Ferrell (2009) is the managerial entrenchment index measuring the adoption of six important anti-takeover provisions including staggered boards, supermajority requirements for mergers, supermajority requirements for charter amendments, limits to shareholder bylaw amendments, poison pills, and golden parachutes. By construction, a larger (smaller) institutional ownership implies better (worse) corporate governance. A larger (smaller) GIM index or BCF index value indicates worse (better) corporate governance. Dittmar and Mahrt-Smith (2007) argue that these

Table 5
Policy uncertainty, financial constraints, and firm cash holdings.

Variable	Credit ratings		Firm size		Market-to-book ratio		Whited-Wu index		Size-age index	
	FC	Non FC	FC	Non FC	FC	Non FC	FC	Non FC	FC	Non FC
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PU	0.008***	0.022***	0.010***	0.014***	0.012***	0.012***	0.018***	0.006*	0.006*	0.017***
	(4.10)	(9.81)	(3.13)	(6.57)	(4.56)	(4.63)	(7.82)	(1.80)	(1.84)	(8.18)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	95,213	24,109	59,661	59,661	59,661	59,661	61,374	57,948	61,651	57,671
Adjusted R^2	0.58	0.55	0.58	0.64	0.57	0.65	0.62	0.60	0.57	0.61

Table 5 reports the results of the firm cash holdings regressions for subsamples of financially constrained and unconstrained firms. The dependent is *cash-to-assets ratio*. *PU* is the average of the monthly BBD policy uncertainty index in a given year. Firms are sorted on the following measures of financial constraints: S&P long-term credit ratings, firm size, market-to-book ratio, Whited-Wu index, and size-age index. Financially constrained–FC (unconstrained–Non FC) subgroup includes firms with Standard and Poor's (S&P) long-term credit ratings below (above) investment grade or no ratings, below (above) the sample median of firm size or the market-to-book ratio, above (below) the sample median of the Whited-Wu index value or the size-age index value. Columns 1 and 2 report the results of cash holdings regressions for firms sorted on credit ratings. Columns 3 and 4 report the results of cash holdings regressions for firms sorted on firm size. Columns 5 and 6 report the results of cash holding regressions for firms sorted on market-to-book ratio. Columns 7 and 8 report the results of cash holdings regressions for firms sorted on Whited-Wu index. Columns 9 and10 report the results of cash holdings regressions for firms sorted on Size-Age index. The regressions control for other variables as specified in Eq. (1) but their estimates are suppressed for brevity. Variables are defined in Appendix A. *t*-statistics based on heteroscedasticity-robust standard errors clustered by firms are reported in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

governance mechanisms can substantially affect the ability of investors to pressure managers to use cash efficiently. The estimated results reported in Table A.2 in the Internet Appendix indicate that the positive effect of policy uncertainty on corporate cash holdings is not sensitive to controlling for corporate governance measures. In an alternative specification, we rerun the test for subgroups of firms sorted on governance measures relative to their respective sample medians but the results are qualitatively similar.

If firms raise external financing and hold the cash proceeds to buffer against policy uncertainty, which is a precautionary move, it will also explain the positive relation between policy uncertainty and the level of cash. We run the net debt and net equity issues regressions to gauge the effects of policy uncertainty on external financing and report the results in Panels A and B, respectively, of Table A.3 in the Internet Appendix. The dependent variable in Panel A is net debt issues which are calculated as the ratio of the change in total liabilities to total book value of assets (Hovakimian, Hovakimian, & Tehranian, 2004; Lewis & Tan, 2016). The dependent variable in Panel B is net equity issues, which are estimated as the ratio of net cash from issuing and repurchasing equities to lagged assets. The results in both panels indicate that firms actually decrease external financing during high policy uncertainty periods. This evidence is also consistent with higher external financing costs amid policy uncertainty documented by Gilchrist et al. (2014).

Intuitively, firms can pay out unused cash when policy uncertainty is high and access external financing markets later to raise funds when needed. However, policy uncertainty tends to be temporary and firms incur transactions costs when raising external financing, making paying out first and raising external financing later less appealing. We examine the effect of policy uncertainty on total payouts and report the results in Table A.4 in the Internet Appendix. We find that firms actually decrease payouts during the periods of high policy uncertainty, which lends further support to the precautionary motives of cash holdings.

In summary, we investigate alternative explanations for the relation between policy uncertainty and firm cash holdings and find precautionary motives and, to a certain extent, investment delays as plausible explanations for the positive relation between the two.

5. Robustness checks and additional analyses

5.1. Instrumental variable (IV) regressions

Policy uncertainty and corporate cash holdings can be jointly correlated with unobservable variables, such as investment opportunities, which implies that our cash holdings regression model could be subject to the omitted variable bias, a source of endogeneity. We use the IV regression model to address this endogeneity concern. In particular, we use the partisan polarization measure suggested by McCarty, Poole, and Rosenthal (1997), Poole and Rosenthal (2000), and Gulen and Ion (2016) as an instrument for policy uncertainty. This measure tracks legislators' ideological position over time. McCarty (2004) argues that partisan polarization hinders legislation building, leading to policy gridlock and greater variation in policy. Political polarization is a valid instrument in our analysis because it is directly related to policy uncertainty but there is no obvious reason to argue that it has a direct impact on the level and value of cash other than through policy uncertainty.

We report the results of the level of cash IV regression in Table 6. Columns 1 and 2 do not control for firm fixed effects but Columns 3 and 4 do. The first-stage results of the IV regression model reported in Columns 1 and 3 of Table 6 indicate that the coefficients of the instrument are positive (0.496 and 0.690, respectively) and significant at the 1% level, confirming its relevance. The Wu-Hausman endogeneity test statistic validates our endogeneity concern. The Kleibergen-Paap underidentification test statistic and the Cragg-Donald weak identification test statistic indicate that our selected instrument is relevant. The results of the outcome regression reported in Columns 2 and 4 of Table 6 indicate that the coefficients of *instrumented PU* are positive (0.458 and 0.195, respectively) and highly significant, suggesting that our findings are robust to endogeneity correction.[9]

Table 6
Policy uncertainty and firm cash holdings – IV regressions.

Variable	First-stage IV regression	Second-stage IV regression	First-stage IV regression	Second-stage IV regression
	(1)	(2)	(3)	(4)
Instrumented PU		0.458***		0.195***
		(42.83)		(21.20)
Polarization	0.496***		0.690***	
	(59.01)		(52.95)	
Size	−0.006***	−0.008***	−0.026***	−0.013***
	(15.79)	(27.30)	(23.21)	(24.41)
Market-to-book	−0.002***	0.008***	−0.002***	0.005***
	(6.77)	(42.03)	(7.69)	(33.06)
Cash flow	0.020***	−0.023***	0.018***	0.034***
	(8.03)	(11.84)	(5.83)	(20.14)
NWC	−0.018***	−0.093***	−0.009**	−0.059***
	(6.00)	(39.36)	(2.22)	(26.17)
R&D	−0.002***	0.032***	−0.004***	0.010***
	(2.77)	(46.50)	(2.92)	(14.17)
Capex	−0.154***	−0.171***	−0.291***	−0.139***
	(16.51)	(22.11)	(22.29)	(17.12)
Leverage	0.011***	−0.206***	−0.016***	−0.126***
	(3.63)	(90.44)	(3.76)	(52.24)
Dividend dummy	0.031***	−0.041***	0.029***	−0.000
	(19.58)	(32.97)	(12.04)	(0.36)
Acquisition	−0.255***	−0.049***	−0.185***	−0.096***
	(22.75)	(5.26)	(15.38)	(13.73)
Industry sigma	−0.122***	0.170***	−0.223***	0.066***
	(25.35)	(44.66)	(31.02)	(15.18)
Intercept	4.332***	−1.915***	4.327***	−0.678***
	(738.34)	(38.58)	(539.50)	(15.93)
Firm fixed effects	No	No	Yes	Yes
Number of observations	119,322	119,322	119,322	119,322
Endogeneity test:				
Wu-Hausman F-statistic	2763.11***		1848.39***	
Underidentification test:				
Kleibergen-Paap LM statistic	5000.31***		1185.06***	
Weak identification test:				
Cragg-Donald Wald F-statistic	5218.94***		1194.63***	
Weak instrument robust inference:				
Anderson-Rubin Wald χ^2	2847.71***		1840.13***	

Table 6 reports the results of the firm cash holdings two-stage IV regressions. The outcome variable is *cash-to-assets ratio*. *PU* is the average of the monthly BBD policy uncertainty index in a given year. *Polarization* is a measure of political polarization of the U.S. Senate, which is used as the instrument for policy uncertainty. *Size* is measured as the natural logarithm of the book value of assets. *Market-to-book* is defined as the market value of assets divided by the book value of assets. *Leverage* is the ratio of the book value of debt to the book value of assets. Other variables are defined in Appendix A. *t*-statistics based on heteroscedasticity-robust standard errors clustered by firms are reported in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

[9] We note that the coefficient estimates of policy uncertainty in Table 6 are significantly larger than those reported in Table 2, which could be because the IV models identify the local average treatment effect of the endogenous variable on the outcome variable (Imbens & Angrist, 1994).

5.2. Control for other types of uncertainty

The BBD index may capture the effects of general economic uncertainty that potentially confound our finding of a positive relation between policy uncertainty and cash holdings. We address this concern by controlling for several proxies for economic uncertainty suggested by Bloom (2009) in our regressions. First, we calculate the annual cross-sectional standard deviation of firm profit growth as a proxy for future profitability variation, where firm profit growth is measured as the ratio of the change in net income to average sales. Second, we control for the uncertainty of the equity markets proxied by the standard deviation of monthly stock returns and the Chicago Board Options Exchange's VXO index of implied volatility. Third, we use the GDP forecast data from the Philadelphia Federal Reserve's Livingston survey to calculate the coefficient of variation of GDP forecast as a proxy for expected economic growth uncertainty. Finally, we control for an alternative measure of aggregate macroeconomic uncertainty suggested by Jurado et al. (2015). We augment the corporate cash holdings model with these five general economic uncertainty proxies but our finding is qualitatively unchanged (the results are not reported for brevity but they are available from the authors).

To alleviate concern about possible collinearity between policy uncertainty and economic uncertainty when their proxies are included in the same regression, we further use a 2-step regression model to isolate the effects of economic policy uncertainty from those of economic uncertainty. Specifically, in the first step, we regress the BBD index on the five economic uncertainty variables mentioned above and obtain the residuals. We then rerun the cash holdings model using the residuals as a proxy for policy uncertainty. The results reported in Table A.5 in the Internet Appendix indicate that our finding persists.

The BBD index may pick up some other non-policy-related economic uncertainty, such as labor market variations, currency uncertainty or oil shocks, which tend to affect the level of cash. This possibility implies a potential error-in-measurement problem that could bias the model estimation. It is noteworthy that the U.S. and Canadian economies are closely linked and a shock that affects the economic uncertainty in the U.S. is likely to affect the economic uncertainty in Canada as well. Thus, to address the possible error-in-measurement problem, we follow Gulen and Ion (2016) in estimating the BBD news-based index for the U.S. as a function of the Canadian BBD news-based index and other macroeconomic variables, and then we use the residuals (labeled RPU) from the regression as a proxy for policy uncertainty in the cash holdings model. By construction, the residuals are orthogonal to economic uncertainty common to both the U.S. and Canada and other macroeconomic factors included in the model. We re-estimate the level of cash model using RPU in place of the BBD index and report the results in Table A.6 in the Internet Appendix. The results suggest that our findings are robust to the error-in-measurement correction.

Previous research documents that political uncertainty, which is positively related to national elections, affects corporate policies and asset prices. Bialkowski, Gottschalk, and Wisniewski (2008) and Boutchkova, Doshi, Durnev, and Molchanov (2011) report that firms operating in politically related industries experience higher stock return volatility during the presidential election periods. Kelly, Pástor, and Veronesi (2016) find that political uncertainty is priced in the equity stock market. Julio and Yook (2012) document a negative effect of presidential elections on investments. Xu, Chen, Xu, and Chan (2016) report a positive relation between political uncertainty and firm cash holdings for Chinese firms. To rule out a possibility that policy uncertainty merely picks up the effects of political uncertainty, we control for political uncertainty by augmenting the cash holdings model with an election indicator variable that takes a value of 1 for a presidential election year during the sample period, and 0 otherwise. The estimation results reported in Table 7 indicate that our results are robust to controlling for political uncertainty.

Table 7
Policy uncertainty and firm cash holdings – controlling for political uncertainty.

Variable	(1)	(2)	(3)
PU	0.017***	0.016***	0.011***
	(9.39)	(9.28)	(7.42)
Political uncertainty	0.003***	0.003***	0.003***
	(3.50)	(3.43)	(3.48)
Other controls	Yes	Yes	Yes
Industry fixed effects	No	Yes	No
Firm fixed effects	No	No	Yes
Number of observations	119,322	119,322	119,322
Adjusted R^2	0.30	0.32	0.60

Table 7 reports the results of the cash holdings regressions. The dependent variable is *cash-to-assets ratio*. *PU* is the average of the monthly BBD policy uncertainty index in a given year. *Political uncertainty* is a dummy variable that takes a value of 1 for a presidential election year during the sample period, and 0 otherwise. The regression models include other control variables as specified in Eq. (1) but their estimates are suppressed for brevity. *t*-statistics based on heteroscedasticity-robust standard errors clustered by firms are reported in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

5.3. Additional analyses

In a robustness check, we rerun the cash holdings regressions with the dependent variable being the ratio of cash and short-term investment to the book value of assets (i.e., Compustat items CHE/AT). The regression results reported in Table A.7 in the Internet Appendix indicate that our findings are robust to this alternative measure of corporate cash holdings.

We argue earlier that policy uncertainty exacerbates firms' financial constraints, leading to their increased precautionary cash holdings. In an unreported analysis, we examine the relations between policy uncertainty and debt maturity and debt costs. We find that policy uncertainty is negatively related to debt maturity and positively related to the costs of debt. Moreover, the stringent debt terms are concentrated among financially constrained firms (i.e., firms with low credit ratings or no ratings), which is consistent with the findings reported by Tran and Phan (2018). This evidence lends support to a positive relation between policy uncertainty and financial constraints.

The BBD index is constructed based on three components: The news-based uncertainty, the uncertainty of future expiration of the tax codes, and the disagreement in the monetary and fiscal policy. To gauge the effects of individual components on corporate cash holdings while alleviating concern about possible collinearity among the three components, we rerun the level of cash regressions with each component of policy uncertainty and report the results in Table A.8 in the Internet Appendix. The results indicate that the news-based and the tax-related uncertainty components have positive and significant effect on corporate cash holdings but the fiscal and monetary policy uncertainty does not have a significant effect on corporate cash holdings. This result is consistent with the findings of Gulen and Ion (2016) and Nguyen and Phan (2017) for corporate investments.

As most of the accounting data are available on an annual basis, we use annual data in our analysis. However, to further check the robustness of our results, we reconstruct variables using quarterly data and perform analyses with these newly constructed variables. For variables whose quarterly data are unavailable, we use their annual data instead. Policy uncertainty is measured as the natural logarithm of the average monthly BBD index value of the preceding quarter. The results of the cash level model reported in Table A.9 in the Internet Appendix indicate that the coefficients of policy uncertainty are all positive (ranging from 0.081 to 0.120) and statistically significant at the 1% level, implying that the positive effect of policy uncertainty on corporate cash holdings is robust to quarterly data.

Since our sample includes all firms from the Compustat universe (but

excludes those in the financial and utility industries), there are many small firms that tend to be more susceptible to policy uncertainty. To alleviate a concern that our results could be biased by the inclusion of small firms in the sample, we filter out firms with the book value of assets below either $100 million, $500 million, or $1 billion, and rerun the level of cash regressions. We find that our results are insensitive to these filters.

Fresard (2010) documents a positive relation between a firm's cash holdings and its future market share gains at the expense of industry rivals, and the effect is stronger when rival firms face more financial constraints and belong to more competitive industries. To the extent that policy uncertainty exacerbates financial constraints, firms may be concerned about losing market share to cash-rich rivals, leading them to hold larger cash reserves to preempt competition.

To examine the effect of policy uncertainty on the level of cash conditioned on industry rivalry, we use the Herfindahl-Hirschman index (HHI) as a proxy for industry rivalry. HHI is calculated as the sum of the squares of market shares of the firms within the same 3-digit SIC code industry in a given year, where market share is defined as a ratio of a firm's sales to the sum of sales of the industry. Using whole percentages of market shares for calculation, HHI ranges from 0 to 10,000; a lower (higher) HHI value indicates higher (lower) industry rivalry. Then we construct the *competitive industry dummy* variable that takes a

Table 8
Policy uncertainty, industry rivalry, and firm cash holdings.

Variable	(1)	(2)	(3)
PU	0.013***	0.008***	0.009***
	(4.77)	(3.06)	(4.07)
Competitive Industry Dummy	−0.046***	−0.080***	−0.016**
	(2.77)	(4.84)	(2.10)
PU × Competitive Industry Dummy	0.016***	0.022***	0.004**
	(4.49)	(6.22)	(2.14)
Other control variables	Yes	Yes	Yes
Industry fixed effects	No	Yes	No
Firm fixed effects	No	No	Yes
Number of observations	119,322	119,322	119,322
Adjusted R^2	0.31	0.32	0.60

Table 8 reports the results of the cash holdings regressions. The dependent variable is *cash-to-assets ratio*. *PU* is the average of the monthly BBD policy uncertainty index in a given year. *Competitive Industry Dummy* is an indicator variable that takes a value of 1 for an industry with the Herfindahl-Hirschman Index (HHI) value below 1500, and 0 otherwise. The regression models include other control variables as specified in Eq. (1) but their estimates are suppressed for brevity. *t*-statistics based on heteroscedasticity-robust standard errors clustered by firms are reported in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 10
Policy uncertainty and credit lines.

Variable	Credit line	Credit line	Credit line	Line credit dummy
	(1)	(2)	(3)	(4)
PU	−0.072***	−0.072***	−0.053***	−0.119***
	(14.44)	(14.65)	(14.00)	(2.85)
Size	0.001	0.001	0.001	0.051***
	(0.11)	(1.22)	(1.37)	(3.12)
Market-to-book	−0.023***	−0.022***	−0.002	0.006**
	(11.78)	(11.55)	(1.60)	(2.12)
NWC	0.358***	0.340***	0.262***	−0.134*
	(26.86)	(22.74)	(22.80)	(1.82)
R&D	−0.061***	−0.057***	−0.012*	0.019
	(8.26)	(7.99)	(1.71)	(1.16)
Capex	0.072**	0.048	0.089***	0.268*
	(2.16)	(1.47)	(2.96)	(1.75)
Leverage	0.279***	0.273***	0.111***	0.110
	(29.58)	(28.24)	(11.46)	(1.56)
Dividend dummy	0.071***	0.069***	0.007*	−0.01
	(20.84)	(20.63)	(1.71)	(0.26)
Industry sigma	−0.122***	−0.109***	0.016	−0.368**
	(7.87)	(7.18)	(0.81)	(2.25)
Cash flow volatility	−0.094***	−0.096***	−0.014	0.087
	(9.50)	(7.92)	(1.24)	(0.76)
Tangibility	0.234***	0.278***	0.528***	0.104
	(24.92)	(27.28)	(28.11)	(0.92)
Profitability	0.032	0.029	−0.039***	0.080
	(1.51)	(1.40)	(3.35)	(1.29)
Intercept	0.831***	0.804***	0.673***	0.977***
	(33.74)	(32.63)	(34.20)	(5.17)
Industry fixed effects	No	Yes	No	No
Firm fixed effects	No	No	Yes	Yes
Number of observations	32,996	32,996	32,996	1657
Adjusted R^2	0.20	0.23	0.65	0.69

Table 10 reports the results of the credit line regressions. The dependent variable in Columns 1–3 is *credit line*, which is calculated as the ratio of undrawn revolving credit to the sum of cash and undrawn revolving credit. Undrawn revolving credit data are obtained from the Capital IQ database. The dependent variable in Column 4 is the *Line Credit Dummy*, which is an indicator variable that equals to 1 for firms with positive lines of credit in the random sample of 300 Compustat firms constructed by Sufi (2009), and 0 otherwise. *PU* is the average of the monthly BBD policy uncertainty index in a given year. Other variables are defined in Appendix A. *t*-statistics based on heteroscedasticity-robust standard errors clustered by firms are reported in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 9
Policy uncertainty, growth opportunities, and firm cash holdings.

Variable	High growth	Low growth	High growth	Low growth	High growth	Low growth
	(1)	(2)	(3)	(4)	(5)	(6)
PU	0.016***	0.017***	0.018***	0.017***	0.015***	0.015***
	(4.18)	(6.75)	(4.94)	(6.78)	(4.10)	(6.78)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	Yes	Yes	No	No
Firm fixed effects	No	No	No	No	Yes	Yes
Number of observations	39,784	39,762	39,784	39,762	39,784	39,762
Adjusted R^2	0.28	0.30	0.30	0.32	0.59	0.66

Table 9 reports the results of the cash holdings regressions for subsamples of firms sorted on growth opportunities. The dependent variable is *cash-to-assets ratio*. *PU* is the average of the monthly BBD policy uncertainty index in a given year. Firms are assigned to the high growth opportunities (High Growth) subgroup if their market-to-book ratios are in the top tercile of the sample. Firms in the low growth opportunities (Low Growth) subgroup include those having market-to-book ratios in the bottom tercile of the sample. The regressions control for other variables as specified in Eq. (1) but their estimates are suppressed for brevity. Variables are defined in Appendix A. *t*-statistics based on heteroscedasticity-robust standard errors clustered by firms are reported in parentheses. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

value of 1 if an industry's HHI value is below 1500 in a given year, and 0 otherwise. We re-estimate the level of cash regressions augmented with *competitive industry dummy* and its interaction with policy uncertainty. Consistent with our predictions, the results reported in Table 8 indicate that the positive effect of policy uncertainty on the level of cash is more pronounced for firms in more competitive industries.

In an additional analysis, we re-estimate our cash holdings regressions for high and low growth subsamples. Specifically, we sort firms into the high and low growth subgroups based on their market-to-book ratios, which proxy for growth opportunities. Firms are assigned to the high (low) growth opportunities subgroup if their market-to-book ratios are in the top (bottom) tercile of the sample. The results reported in Table 9 indicate that the coefficients of policy uncertainty are positive and significant at the 1% level for both subgroups, implying that policy uncertainty is associated with an increase in the corporate cash holdings for both high and low growth firms.

Previous research documents that firms facing higher liquidity risk prefer cash over lines of credit (Acharya, Almeida, & Campello, 2013; Acharya, Almeida, Ippolito, & Perez, 2014). To the extent that policy uncertainty increases firm liquidity risk, it may decrease firms' lines of credit while increasing cash reserves. We examine the relation between policy uncertainty and firm's lines of credit and report the results in Table 10. Following Acharya et al. (2014), we use data from the Capital IQ database to construct the credit line variable as the ratio of undrawn revolving credit to the sum of cash and undrawn revolving credit.[10] The estimation results indicate a negative relation between policy uncertainty and firms' lines of credit in Columns 1–3. In a complementary analysis, we rerun the lines of credit regressions using the data of a random sample of 300 Compustat firms provided by Sufi (2009) that are also used by Acharya et al. (2014) in their analysis. The dependent variable is the Line Credit Dummy, which is an indicator that equals to 1 for firms with positive lines of credit, and 0 otherwise. The estimated results reported in Column 4 indicate that policy uncertainty is negatively related to firms' lines of credit. This evidence further corroborates the argument that firms increase cash holdings for precautionary purposes.[11]

6. Conclusions

We examine the relation between policy uncertainty and corporate cash holdings. Using the BBD index as a proxy for policy uncertainty, we find robust evidence that corporate cash holdings are positively related to policy uncertainty. Our analyses suggest that firms' precautions and, to a lesser extent, investment delays induced by policy uncertainty lead to larger cash reserves. Our findings of a positive relation between policy uncertainty and cash holdings for firms with high growth opportunities highlight the detrimental effects of policy uncertainty on the type of firms that typically create more jobs, which is also consistent with earlier evidence that policy uncertainty delays real investments and impedes job creation.

Appendix A. Variables definition

Variable name	Construction	Data source
Acquisition	The ratio of corporate acquisition expenditures to the book value of assets	Compustat
Capex	The ratio of capital expenditures to the book value of assets.	Compustat
Cash-to-assets	The ratio of cash to the book value of assets	Compustat
Cash-to-net assets	The ratio of cash to net assets, where net assets are defined as the book value of assets minus cash	Compustat
Cash flow	the ratio of earnings after interest, dividends, and taxes but before depreciation to the book value of assets	Compustat
Competitive industry dummy	An indicator that takes a value of 1 for competitive industries with the Herfindahl-Hirschman Index (HHI) below 1500, and 0 otherwise. The HHI index is measured as the sum of market share squared for firms in the same 3 digit SIC code and year, where market share is defined as a ratio of sale to the total sum of sales for this market	Compustat
Dividend dummy	An indicator that takes a value of 1 if a firm pays a common dividend in a given year, and 0 otherwise.	Compustat
Excess return	the difference between a firm's annual stock return in a given year and its benchmark return in the same year where the benchmark return comes from the Fama-French 25 size and book-to-market matched portfolio	CRSP and Compustat
Excess cash	The residual of the level of cash regression	Compustat
Herfindahl-Hirschman index	The Herfindahl-Hirschman (HHI) index is measured as the sum of the squares of market shares of the firms within the same 3-digit SIC code industry in a given year, where market share is defined as a ratio of a firm's sales to the sum of sales of the industry in a given year. HHI ranges from 0 to 1.	Compustat
Industry sigma	The average of the standard deviation of the ratio of cash flow to book value of assets over the last 10 years of firms in the same 2-digit SIC code industries	Compustat
Leverage	The ratio of the book value of debts, which includes short-term and long-term debt, to the book value of assets	Compustat
Market-to-book	The market value of assets divided by the book value of assets	Compustat
NWC	The ratio of net working capital without cash to the book value of assets	Compustat
Policy uncertainty	The natural logarithm of the average monthly BBD index in a given year.	http://www.policyuncertainty.com
PU-fiscal and monetary	The natural logarithm of the average monthly fiscal and monetary policies component of the BBD index in a given year.	http://www.policyuncertainty.com
PU-news		

[10] We acknowledge that the credit lines data from Capital IQ could be noisy.
[11] We thank an anonymous referee for suggestion to consider lines of credit.

	The natural logarithm of the average monthly news-based component of the BBD index in a given year.	http://www.policyuncertainty.com
PU-tax code	The natural logarithm of the average monthly tax-related component of the BBD index in a given year.	http://www.policyuncertainty.com
R&D	The ratio of R&D expenses to sales	Compustat
Size	The natural logarithm of the book value of assets	Compustat
Size-age (SA) index	SA index = -0.737*Assets + 0.043*Assets^2 $-$ 0.040*Age, where *Assets* is the log of the minimum value between actual book value of assets and \$4.5 billion, and *Age* is the minimum value between firms' age and thirty-seven years.	Compustat
Whited-Wu (WW) index	WW index = -0.091*CF $-$ 0.062*DIVPOS + 0.021*TLTD $-$ 0.044*LNTA + 0.102*ISG -0.035*SG, where CF is the ratio of cash flow to the book value of assets; *DIVPOS* is a dummy variable that equals to one if the firm pays cash dividends in a given year, and zero otherwise; *TLTD* is the ratio of the long-term debt to the book value of assets; *LNTA* is the natural log transformation of the book value of assets; *ISG* is the firm's three-digit SIC industry sales growth; and *SG* is the firm's sales growth.	Compustat

Appendix B. Supplementary data

The internet Appendix of this article can be found online at https://doi.org/10.1016/j.jbusres.2018.10.001.

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