Economic policy uncertainty, value of cash and financial crisis

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Received 10 October 2020
Revised 11 January 2021
19 February 2021
Accepted 3 March 2021

Abstract

Purpose – This paper investigates the effect of economic policy uncertainty on value of cash before and after the global financial crisis.

Design/methodology/approach – We investigate the relationship between economic policy uncertainty and value of excess cash based on the valuation model of Fama and French (1998). Baker *et al.* (2016) news-based index (BBD index) is employed to calculate measures of economic policy uncertainty. Our research sample includes 103,474 observations from 11,000 firms across 19 countries over the period 2004–2016.

Findings – We find that economic policy uncertainty is negatively "positively" related to value of cash in the pre-crisis "post-crisis" period. Moreover, we also document that the positive effect of economic policy uncertainty in the post-crisis period is stronger in financially constrained firms.

Originality/value – While prior studies find a relationship between economic policy uncertainty and cash levels or the effect of firm-level uncertainty on value of cash, this paper shows how economic policy uncertainty as an institutional environment factor affects value of cash. Moreover, it documents that economic policy uncertainty has opposite effects on value of cash before and after the global financial crisis.

Keywords Economic policy uncertainty, Value of cash, Cash holdings, Financial crisis

Paper type Research paper

1. Introduction

Policy making and implementing processes typically result in a large amount of uncertainty in the economy and thus influence corporate financial behavior (Zhang *et al.*, 2015). Recently, the relationship between economic policy uncertainty and corporate liquidity policy has attracted much attention from researchers. Economic policy uncertainty increases precautionary motive for saving cash. Demir and Ersan (2017), Phan *et al.* (2019) show that economic policy uncertainty is positively related to corporate cash holdings. However, there has been little knowledge about how economic policy uncertainty determines value of cash. In addition, prior studies show that a financial crisis is an exogenous shock to corporate financial decisions through the mechanism of external financial constraint (Tran *et al.*, 2017). Therefore, this paper investigates the effect of economic policy uncertainty on value of cash before and after the global financial crisis.

When facing high economic policy uncertainty, investors may have two opposite views on corporate cash holdings. On the one hand, they tend to value cash higher because corporate cash holdings become more important for firms' survival and investment. Firms have to

JEL Classification — G32, G34.

The author thanks Thi Huong Dao, Tran Sy Nguyen, Thi Mai Nguyen and Tuan Duong Nguyen for their valuable contributions to this paper.

This research is funded by Foreign Trade University under research program number FTURP01-2020-07.

European Journal of Management and Business Economics
Vol. 32 No. 1, 2023
pp. 24-46
Emerald Publishing Limited
e-ISSN: 2444-8494
p-ISSN: 2444-8451
DOI 10.1108/EJMBE-10-2020-0292

struggle to survive or lose their investment opportunities if they fail to have enough cash and their external financing are more expensive due to high uncertainty (External financing channel). On the other hand, investors may recognize that high economic policy uncertainty is an opportunity for corporate managers to save more cash and overinvest in unprofitable projects. Due to the separation of ownership and control, corporate managers tend to use their firms' resources to overinvest in unprofitable projects in order to serve their own benefits. When firms face high uncertainty caused by economic policy, managers take advantage of precautionary reasons to hold more cash and then use it to benefit themselves through overinvestment. Therefore, investors assign lower value to cash (agency cost channel). We argue that in the pre-crisis period, the financial system is in normal condition and thus investors have high incentives to focus more on agency cost channel than external financing channel. As a result, high economic policy uncertainty leads to lower value of cash during the pre-crisis period. However, when the financial system is under crisis, investors tend to concentrate on external financing channel more than agency cost channel. Therefore, economic policy uncertainty positively affects value of cash during the post-crisis period.

Following Drobetz *et al.* (2010), Kyröläinen *et al.* (2013), Pinkowitz *et al.* (2006), we investigate the relationship between economic policy uncertainty and value of excess cash based on the valuation model of Fama and French (1998). Baker *et al.* (2016) news-based index (BBD index) is employed to calculate measures of economic policy uncertainty. With a sample of 103,474 observations from 11,000 firms across 19 countries over the period 2004–2016, the effect of economic policy uncertainty on value of cash is negative in the pre-crisis period 2004–2008 but it becomes positive in the post-crisis period 2009–2016. Our robustness checks with a reduced sample, an alternative measure of cash and other measures of economic policy uncertainty also show consistent results. Moreover, we continue to examine how firm-specific financial constraint determines the relationship between economic policy uncertainty and value of cash in the post-crisis period. We use the country-year top and bottom 30th percentiles of Kaplan and Zingales (1997) index, Whited and Wu (2006) index and firm size as criteria to classify observations into sub-samples of financially constrained and unconstrained firms. We find that the positive effect of economic policy uncertainty on value of cash is stronger in financially constrained firms during the post-crisis period.

This paper has two important contributions to the literature as follows. First, we contribute to the literature of corporate cash holdings. While prior studies find a relationship between economic policy uncertainty and cash levels (Demir and Ersan, 2017; Phan *et al.*, 2019) or the effect of firm-level uncertainty on value of cash (Im *et al.*, 2017), we show how economic policy uncertainty as an institutional environment factor affects value of cash. Second, our research provides a contribution to the literature of financial crisis. The extant literature shows that a financial crisis changes corporate cash holdings (Arslan *et al.*, 2006; Lian *et al.*, 2011; Tran, 2019a), dividend policy (Al-Malkawi *et al.*, 2014; Rhee and Park, 2018), the effects of shareholder rights and creditor rights on dividend policy Tran *et al.* (2017) and the effect of shareholder rights on cash holdings (Tran, 2020). In this paper, we document that economic policy uncertainty has opposite effects on value of cash before and after the global financial crisis.

The rest of this paper is structured as follows: Section 2 reviews the literature and develops research hypotheses. In Section 3, we design research models following prior studies. Section 4 presents data source and data description. Section 5 shows regression results, robustness checks and additional analysis. Section 6 concludes.

2. Literature review and hypothesis development

The extant literature shows that corporate cash holdings lead to both costs and benefits. Corporate cash holdings are opportunities for managers to expropriate shareholders. Firms need to accumulate cash due to their precautionary motive (Myers and Majluf, 1984; Ozkan and

Ozkan, 2004; Phan *et al.*, 2019). Firms hold cash a safety buffer that helps them size profitable investment projects and handle unpredictable contingencies. Bates *et al.* (2009) find that firms save more cash when facing riskier cash flows. Hugonnier *et al.* (2014) show that corporate cash holdings are positively related to the uncertainty of capital supply and firms with more cash are more likely to seize emerging investment opportunities. Almeida *et al.* (2004), Ferreira and Vilela (2004), Kim *et al.* (2011) also find empirical evidence for precautionary motive of cash holdings. On the other hand, corporate cash holdings lead to agency costs. According to agency theory, corporate managers tend to use cash to serve their own benefits at shareholders' expenses (Jensen, 1986; Jensen and Meckling, 1976). Dittmar and Mahrt-Smith (2007), Dittmar *et al.* (2003), Jebran *et al.* (2019), Kalcheva and Lins (2007), La Porta *et al.* (1998), Pinkowitz *et al.* (2006) find that weak corporate governance results in high levels of corporate cash holdings.

As a crucial government policy, economic policy generates uncertainty in business environment when it is made and implemented by government agencies. Many prior studies show that economic policy uncertainty determines firm performance and corporate financial decisions. Sum and Fanta (2012) find a long-run positive association between economic policy uncertainty and excess return volatility in the US from 1985 to 2011. Debata and Mahakud (2018) show that the effect of economic policy uncertainty on stock market liquidity is moderate in normal market conditions but it is strong during financial crises. Dash *et al.* (2021) also document a causal relationship between economic policy uncertainty and stock market liquidity. Besides, Hoque *et al.* (2019) find that global economic policy uncertainty has a negative impact on the overall stock market and geopolitical risk makes it stronger. Paule-Vianez *et al.* (2020) show that economic policy uncertainty has a greater effect on return and volatility during recession periods.

In addition, economic policy uncertainty influences a wide range of corporate financial decisions including corporate investment (Kang *et al.*, 2014; Wang *et al.*, 2014, 2017), capital structure Zhang *et al.* (2015), dividend policy (Attig *et al.*, 2021) and corporate risk-taking (Tran, 2019b). Demir and Ersan (2017) investigate the relationship between economic policy uncertainty and corporate liquidity policy in BRIC countries during the period from 2006 to 2015 and find that firms prefer holding more cash when they face higher uncertainty. Phan *et al.* (2019) argue that economic policy uncertainty may affect corporate cash holdings in two mechanisms. First, following the real option hypothesis, firms tend to delay investment under high uncertainty and this leads to higher cash holdings. Second, this government policy uncertainty reduces asset returns and thus increases costs of external funds. When firms face high costs of external financing, they are motivated to reserve more cash in order to buffer against unexpected financial shocks and maintain their normal operation. Using a sample of 119,322 observations from 13,981 US firms between 1986 and 2015, they find that there is a positive relationship between economic policy uncertainty and cash reserves. Remarkably, their additional analysis shows that precautionary motive is more effective than investment delay in explaining this positive relationship. Moreover, Im *et al.* (2017) examine the effects of firm-specific uncertainty and its three components on value of cash in the US market. With a sample of 94,568 firm-years over the period from 1980 to 2015, they also document that firms with higher uncertainty have higher value of cash holdings. However, these prior studies have not fully addressed the effect of economic policy uncertainty on value of cash across countries.

Furthermore, the extant literature shows that as an exogenous shock, a financial crisis significantly influences corporate liquidity policy. Arslan *et al.* (2006) show that a financial crisis increases both corporate cash reserves and cash-cash flow sensitivity through its impact on firms' financial constraint. Consistently, Lian *et al.* (2011) argue that the global financial crisis makes capital markets become less efficient and bank credit dry up; therefore, precautionary motive of cash holdings become more important. Using a sample of 8,663 observations from 1,435 listed firms in China, they find that firms accumulate more cash during the crisis period. However, Tran (2019a) shows that the global financial crisis reduces

corporate cash holdings in Vietnam. This can be explained that the amount of cash firms consume is higher than the amount they save due to external financial constraint. Moreover, Chang *et al.* (2017) also document that value of cash holdings are higher under the impact of the global financial crisis. Motivated by these prior studies, this paper investigates the effect of economic policy uncertainty on value of cash before and after the financial crisis.

Before the global financial crisis, the financial system operates normally and external funds are highly available to firms. Under this condition, corporate managers are more flexible to conduct corporate liquidity policy. When firms face high economic policy uncertainty, corporate managers may take this opportunity to expropriate shareholders by accumulating more cash (Jensen, 1986; Jensen and Meckling, 1976). Recognizing managers' expropriation behavior and highly available external funds to firms, investors assign lower value to firms with higher cash levels. Attig *et al.* (2021) also find that firms pay dividends as a means to reduce agency costs of equity under high economic policy uncertainty. Drobetz *et al.* (2010) also show that information asymmetry negatively affects market value of corporate cash holdings. Consequently, we hypothesize that the effect of economic policy uncertainty on cash value is negative in the pre-crisis period.

H1. Economic policy uncertainty is negatively related to value of cash during the pre-crisis period.

Nevertheless, after the global financial crisis breaks out, firms face severely external financial constraint (Duchin *et al.*, 2010; Flannery *et al.*, 2013; Lian *et al.*, 2011; Roubini, 2007). Under this exogenous shock, high economic policy uncertainty reduces firms' access to credit and increases their costs of external financing more severely. Therefore, firms need more cash to seize emerging investment opportunities and handle unpredictable contingencies. Firms with low cash holdings may not survive through the crisis (Campello *et al.*, 2011; Ivashina and Scharfstein, 2010). Although investors understand that corporate managers may take economic policy uncertainty to expropriate shareholders, they still value firms with more cash higher due to severe external financial constraint. Consequently, we hypothesize that high economic policy uncertainty increases value of cash during the post-crisis period.

H2. Economic policy uncertainty is positively related to value of cash during the post-crisis period.

3. Research models

In line with prior studies (Drobetz *et al.*, 2010; Frésard and Salva, 2010; Kyröläinen *et al.*, 2013; Pinkowitz *et al.*, 2006), we modify the valuation model of Fama and French (1998) to examine the effects of economic policy uncertainty on value cash as follows.

$$\begin{aligned} \mathrm{MV}_t = {} & \alpha + \beta_1 \mathrm{EPU1}_t \times \mathrm{EXC}_t + \beta_2 \mathrm{EXC}_t + \beta_3 \mathrm{EPU1}_t + \beta_4 \mathrm{EN}_t + \beta_5 \mathrm{dEN}_t + \beta_6 \mathrm{dEN}_{t+1} \\ & + \beta_7 \mathrm{dNA}_t + \beta_8 \mathrm{dNA}_{t+1} + \beta_9 \mathrm{RD}_t + \beta_{10} \mathrm{dRD}_t + \beta_{11} \mathrm{dRD}_{t+1} + \beta_{12} \mathrm{IN}_t + \beta_{13} \mathrm{dIN}_t \\ & + \beta_{14} \mathrm{dIN}_{t+1} + \beta_{15} \mathrm{DV}_t + \beta_{16} \mathrm{dDV}_t + \beta_{17} \mathrm{dDV}_{t+1} + \beta_{18} \mathrm{dMV}_t + \eta C\_E \\ & + \pi C\_\mathrm{control}^{*} \mathrm{EXC}_t + \varphi \mathrm{Industry\ dummies} + \gamma \mathrm{Year\ dummies} + \varepsilon \end{aligned} \quad (1)$$

Where EPU1 is economic policy uncertainty calculated by the average of twelve monthly BBD indices within a fiscal year (Demir and Ersan, 2017). BBD indices are a news-based measure of uncertainty created by government economic policy. They are developed by Baker *et al.* (2016) and published at http://www.policyuncertainty.com. The original monthly BBD indices are large while the dependent variable is small. This results in small regression coefficients. Hence, before calculating EPU1, we rescale original BBD indices to have a shorter scale ranging from

0 to 100. Higher values of EPU1 indicate higher economic policy uncertainty. X_t is the value of variable X in year t. dX_t is the annual change in X in year t. dX_{t+1} is the annual change in X in year $t+1$. MV is market value measured by year-end market capitalization plus book value of debt. EXC is excess cash measured by the difference between actual cash holdings and normal cash holdings predicted by the IV regression in accordance with Appendix 1. EN is earnings before interest and extraordinary items. NA is net assets calculated by total assets minus total cash and short-term investment. RD is research and development expenditure. IN is interest expense. DV is cash dividend. All firm-level variables except excess cash are deflated by net assets. In line with Kyröläinen *et al.* (2013), we employ a vector of country-specific control variables (*C*_control) including anti-self-dealing index (ASD), revised creditor right index (CRE), rule of law (ROL), private credit (PCRE), market capitalization (MCAP), GDP per capita (GCAP) and GDP growth rate (GGRO). Anti-self-dealing index is a proxy of shareholder protection developed by Djankov *et al.* (2008). Its higher values imply stronger shareholder rights. Revised creditor right index from Djankov *et al.* (2007) measures legal protection of creditors. Its higher values imply stronger creditor rights. Rule of law is "the average of the months of April and October of the monthly index" published in International Country Risk Guide between 1982 and 1995. This index ranges from 0 to 10 and its higher values represent more tradition of law and order. In addition, private credit is measured by domestic credit to private sector to GDP ratio. Market capitalization is total market capitalization to GDP ratio. GDP per capita is measured by the natural logarithm of GDP per capita. GDP growth rate is the annual growth of GDP. Macroeconomic information is annually published by World Bank.

Following Kyröläinen *et al.* (2013), Tran (2019b), we employ pooled OLS regression model to estimate Eqn (1) with two sub-samples of pre-crisis period 2004–2008 and post-crisis period 2009–2016 separately. Standard errors are clustered by firm. The interaction between economic policy uncertainty and excess cash is expected to be negative (positive) in the pre-crisis (post-crisis) period.

4. Research data

To construct the research sample, we use only choose 19 countries whose economic policy uncertainty is available at http://www.policyuncertainty.com. Accounting information of firms incorporated in these countries is collected from Compustat database. Following prior cross-country research (Kyröläinen *et al.*, 2013; Thakur and Kannadhasan, 2019; Tran, 2019b), we eliminate the following firms and observations: (1) firms classified into utilities and financial sectors in accordance with SIC codes; (2) observations without consolidated financial reports; (3) firms with various issues of shares; (4) observations with abnormal information (i.e. negative values of total assets, net income and common equity; (5) observations with missing information and (6) firms contributing fewer than five observations in the research period. The final research sample consists of 103,474 observations from 11,000 unique firms between 2004 and 2016. Although our research sample ends in 2016, we use the data of 2017 to calculate the annual change in variable X in year $t+1(dX_{t+1})$ as shown in Eqn (1). The year 2018 experiences the trade war between US and China is another exogenous shock in the macroeconomic environment. Data of the fiscal year 2019 has not been completely available in Compustat for many countries and it may be affected by the pandemic Covid-19 – a severe shock for the world economy. However, our research only focuses on how the global financial crisis determines the relationship between economic uncertainty and cash value. Therefore, we fail to include the data for the period 2018–2019 in our sample. We winsorize all firm-level variables at the 1st and the 99th percentile [1] to control outlier effects.

Table 1 describes our research sample. Panel A shows that firm value significantly varies from 0.438 to 12.695. Its mean and median are 1.671 and 1.176 respectively. Excess

Panel A. Firm-level data

Variables	Mean	SD	1st quartile	Median	3rd quartile	Min	Max
$MV_{i,t}$	1.671	1.672	0.898	1.176	1.176	0.438	12.695
$EXC_{i,t}$	−0.098	1.147	−0.664	0.137	0.713	−3.866	1.784
$LNC_{i,t}$	−2.370	1.191	−2.991	−2.186	−1.546	−6.372	−0.271
$CAS_{i,t}$	0.158	0.153	0.050	0.112	0.213	0.002	0.763
$SGR_{i,t-2}$	0.134	0.410	−0.029	0.064	0.192	−0.619	2.769
$SIZ_{i,t}$	12.893	2.022	11.625	12.859	14.174	7.597	17.871
$CF_{i,t}$	−0.072	0.219	−0.124	0.008	0.054	−1.068	0.215
$NWC_{i,t}$	0.011	0.199	−0.079	0.022	0.127	−0.889	0.464
$CEX_{i,t}$	0.047	0.052	0.013	0.030	0.060	0.000	0.289
$LEV_{i,t}$	0.532	0.270	0.356	0.517	0.666	0.074	1.891
$EN_{i,t}$	−0.004	0.188	0.002	0.031	0.065	−1.217	0.244
$dEN_{i,t}$	0.004	0.126	−0.018	0.004	0.024	−0.567	0.632
$dEN_{i,t+1}$	0.009	0.123	−0.019	0.004	0.026	−0.444	0.667
dNA_{t}	0.032	0.175	−0.032	0.031	0.106	−0.752	0.567
dNA_{t+1}	0.063	0.225	−0.033	0.029	0.112	−0.450	1.308
$RD_{i,t}$	0.023	0.063	0.000	0.000	0.016	0.000	0.427
$dRD_{i,t}$	0.001	0.014	0.000	0.000	0.0004	−0.070	0.074
$dRD_{i,t+1}$	0.001	0.014	0.000	0.000	0.0004	−0.070	0.081
$IN_{i,t}$	0.014	0.021	0.002	0.008	0.018	0.000	0.142
$dIN_{i,t}$	0.000	0.008	−0.001	0.000	0.002	−0.039	0.036
$dIN_{i,t+1}$	0.106	0.191	−0.001	0.016	0.138	−0.101	0.886
$DV_{i,t}$	0.013	0.020	0.000	0.006	0.017	0.000	0.120
$dDV_{i,t}$	0.001	0.010	0.000	0.000	0.002	−0.045	0.048
$dDV_{i,t+1}$	0.001	0.011	0.000	0.000	0.002	−0.044	0.056
$dMV_{i,t}$	0.194	1.054	−0.121	0.044	0.289	−3.013	6.516

Panel B. Annual number of firms

Year	*N*	Year	*N*	Year	*N*	Year	*N*
2004	5,677	2008	7,872	2012	9,236	2016	8,023
2005	6,002	2009	8,238	2013	9,015		
2006	7,047	2010	8,701	2014	8,698		
2007	7,451	2011	9,225	2015	8,289		

Panel C. Industry distribution

Industry	2-Digit SIC	*N*	Industry	2-Digit SIC	*N*
Mineral industries	10–14	5,720	Wholesale trade	50–51	5,366
Construction industries	15–17	3,691	Retail trade	52–59	5,253
Manufacturing	20–39	59,729	Service industries	≥70	16,772
Transportation, communications	40–48	6,943			

Panel D. Country-level data

Country	No. obs	No. firms	MV	XCA	LCA	CAS
Australia	4,165	489	1.849	−0.531	−2.599	0.148
Brazil	1,211	146	1.668	0.024	−2.480	0.135
Canada	4,640	533	1.787	−0.633	−2.837	0.146
Chile	540	69	5.353	−1.019	−2.996	0.072
China	11,804	1,329	2.091	0.079	−2.080	0.162
Spain	782	80	1.431	−0.129	−2.779	0.095
France	3,835	372	1.382	0.111	−2.349	0.139

(*continued*)

Table 1.
Data description

Panel D. Country-level data

Country	No. obs	No. firms	MV	XCA	LCA	CAS
UK	3,753	434	1.675	−0.298	−2.683	0.119
Hong Kong	843	85	1.351	0.215	−2.009	0.188
India	8,401	1,094	1.516	−1.099	−3.221	0.085
Ireland	170	22	1.748	0.220	−2.265	0.170
Italy	1,326	148	1.281	−0.070	−2.619	0.107
Japan	25,280	2,201	1.070	0.239	−2.021	0.174
South Korea	5,283	568	1.048	−0.150	−2.359	0.134
Mexico	525	58	1.461	−0.055	−2.584	0.099
Russia	254	42	2.623	−0.494	−2.819	0.094
Singapore	2,472	303	1.205	0.058	−2.007	0.180
Sweden	1,653	202	1.926	−0.387	−2.608	0.126
USA	26,537	2,825	2.207	−0.003	−2.386	0.189

Note(s): X_t is the value of variable X in year t. dX_t is the annual change in X in year t. dX_{t+1} is the annual change in X in year $t+1$. MV is market value. EXC is excess cash. LNC is the natural logarithm of cash holdings to net assets ratio. CAS is cash holdings. SGR is sale growth. EN is earnings before interest and extraordinary items. NA is net assets calculated by total assets minus total cash and short-term investment. RD is research and development expenditure. IN is interest expense. DV is cash dividend. All firm-level variables except EXC, LNC and SGR are deflated by net assets

Table 1.

cash also fluctuates over a wide range between −3.866 and 1.784. Although the average of excess cash is negative (−0.098), the median value is positive (0.137). This implies that observations with positive excess cash constitute more than 50% of the research sample. In addition, Panel B reports the distribution of the research sample by year. We find that the annual number of firms increases from 2004 to 2012 and then declines slightly in the following years. Panel C illustrates that the largest industry is Manufacturing with 59,729 observations, followed by Service sector (16,777) and Transportation, communications (6,943). The smallest industry is Construction that contributes only 3,691 firm-years. Besides, Panel D shows that there is an unbalanced distribution of observations by across countries. The largest country is the US with 26,537 observations, followed by Japan (25,280) and China (11,804). These three largest countries account for 61.49% of firm-years in the research sample and they may drive our research results. Therefore, we also present results without them as robustness checks.

5. Research results

5.1 Economic policy uncertainty and value of cash during the pre-crisis and the post-crisis periods

Table 2 show regression results to analyze the relationship between economic policy uncertainty and value of cash during the pre-crisis and the post-crisis periods. We find that economic policy uncertainty is negatively related to value of excess cash in the pre-crisis period. This finding is consistent with Attig *et al.* (2021), Drobetz *et al.* (2010). The effect of economic policy uncertainty on cash value relies on investors' views on the role of cash holdings. If investors emphasize on the importance of cash when firms face higher costs of external financing due to high uncertainty, they value cash higher. However, when investors consider high economic policy uncertainty as an opportunity for corporate managers to save more cash for their overinvestment, they value cash lower. Before the global financial crisis, the financial system works normally and thus investors have high incentives to focus on agency cost of cash holdings more than the role of cash holdings in firms' survival and investment.

Table 2. Economic policy uncertainty and value of cash during the pre-crisis and the post-crisis periods

Variables	Pre-crisis (1)	Pre-crisis (2)	Post-crisis (1)	Post-crisis (2)
Intercept	−0.7679*** (−3.78)	−0.7731*** (−3.18)	1.4009*** (8.12)	1.7236*** (8.57)
$EPU1_t \times EXC_{i,t}$		−0.0101*** (−6.49)		0.0016** (2.30)
$EXC_{i,t}$	0.1139*** (9.83)	−0.0697 (−0.60)	0.0778*** (6.68)	0.5166*** (5.31)
$EPU1_t$		−0.0074*** (−2.70)		0.0034*** (4.04)
$EN_{i,t}$	−2.9430*** (−14.85)	−2.9263*** (−14.79)	−2.8533*** (−15.63)	−2.8327*** (−15.50)
$dEN_{i,t}$	1.3301*** (8.84)	1.3178*** (8.76)	1.0873*** (10.27)	1.0744*** (10.13)
$dEN_{i,t+1}$	−0.5107*** (−3.36)	−0.5044*** (−3.32)	−0.3680*** (−2.98)	−0.3697*** (−2.99)
$dNA_{i,t}$	1.0569*** (13.59)	1.0832*** (13.93)	0.8138*** (12.82)	0.7960*** (12.51)
$dNA_{i,t+1}$	1.2445*** (20.15)	1.2476*** (20.24)	0.8700*** (16.25)	0.8798*** (16.38)
$RD_{i,t}$	4.1138*** (8.54)	4.0423*** (8.29)	5.2713*** (13.25)	5.2740*** (13.20)
$dRD_{i,t}$	3.9851*** (3.26)	3.9071*** (3.19)	6.2545*** (7.49)	6.2472*** (7.48)
$dRD_{i,t+1}$	11.0283*** (10.64)	10.6899*** (10.29)	11.2295*** (13.06)	11.2498*** (13.11)
$IN_{i,t}$	14.3206*** (9.49)	14.3703*** (9.53)	11.8979*** (10.78)	11.8808*** (10.68)
$dIN_{i,t}$	−15.2841*** (−7.08)	−15.0962*** (−6.98)	−16.0610*** (−11.66)	−16.0155*** (−11.61)
$dIN_{i,t+1}$	−0.5213*** (−6.43)	−0.5201*** (−6.42)	−0.0567 (−0.90)	−0.1093* (−1.72)
$DV_{i,t}$	15.7008*** (18.14)	15.6627*** (17.97)	22.2930*** (23.64)	22.0210*** (23.34)
$dDV_{i,t}$	0.1562 (0.15)	0.3695 (0.35)	−2.9837*** (−3.51)	−2.8222*** (−3.30)
$dDV_{i,t+1}$	13.5334*** (12.13)	13.7227*** (12.30)	15.6708*** (17.58)	15.6262*** (17.48)
$dMV_{i,t}$	−0.1129*** (−5.97)	−0.1106*** (−5.84)	0.0135 (0.66)	0.0137 (0.66)
ASD	0.7168*** (6.30)	0.6296*** (5.58)	0.8976*** (9.32)	0.8525*** (9.11)
CRE	−0.1087*** (−5.27)	−0.1096*** (−5.11)	−0.1080*** (−5.77)	−0.0853*** (−4.50)
ROL	0.0353 (1.06)	0.0286 (0.83)	0.0709*** (2.68)	0.0337 (1.22)
$PCRE_t$	−0.0046*** (−7.87)	−0.0047*** (−7.87)	−0.0014*** (−2.93)	−0.0022*** (−4.56)
$MCAP_t$	0.0001 (0.33)	0.0001 (0.43)	−0.0002* (−1.71)	−0.0002 (−1.56)
$GCAP_t$	0.1873*** (10.68)	0.2144*** (10.13)	−0.0614*** (−4.02)	−0.0907*** (−5.18)
$GGRO_t$	0.0609*** (8.90)	0.0703*** (8.93)	0.0206*** (4.64)	0.0160*** (3.58)
$ASD \times EXC_{i,t}$		−0.0359 (−0.42)		0.1087 (1.37)
$CRE \times EXC_{i,t}$		0.0200 (1.16)		0.0246 (1.41)
$ROL \times EXC_{i,t}$		−0.0260 (−0.93)		−0.0483** (−2.36)
$PCREt \times EXC_{i,t}$		−0.0010*** (−2.61)		−0.0011*** (−3.13)
$MCAPt \times EXC_{i,t}$		0.0002 (1.25)		0.0002** (2.29)

(*continued*)

Table 2.

Variables	Pre-crisis (1)	Pre-crisis (2)	Post-crisis (1)	Post-crisis (2)
GCAPt × $EXC_{i,t}$		0.0372*** (3.20)		−0.0457*** (−4.52)
GGROt × $EXC_{i,t}$		−0.0005 (−0.12)		−0.0077 (−3.21)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
R^2	0.3902	0.3927	0.2854	0.2880
F-statistics	110.80***	91.22***	102.28***	84.52***
Breusch-Pagan Chi-squared	33,064.96***	33,344.10***	31,945.53***	32,928.02***
N	34,049	34,049	69,425	69,425

Note(s): The dependent variable is MV_t. X_t is the value of variable X in year t. dX_t is the annual change in X in year t. dX_{t+1} is the annual change in X in year $t+1$. MV is market value. EPU1 is economic policy uncertainty. EXC is excess cash. EN is earnings before interest and extraordinary items. NA is net assets calculated by total assets minus total cash and short-term investment. RD is research and development expenditure. IN is interest expense. DV is cash dividend. All firm-level variables except EXC are deflated by net assets. ASD is anti-self-dealing index. CRE is revised creditor right index. ROL is rule of law. PCRE is private credit. MCAP is market capitalization. GCAP is GDP per capita. GGRO is GDP growth rate. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. *t*-statistics are in parentheses

In addition, we find that economic policy uncertainty is positively associated with value of excess cash during the post-crisis period. In line with Arslan *et al.* (2006), Chang *et al.* (2017), Lian *et al.* (2011), under the impact of the global financial crisis, firms experience server external financial constraint and thus investors focus more on the role of cash reserves in firms' survival and investment.

5.2 Robustness checks

The distribution of our research data shows that the three largest countries including the US, Japan and China constitute 61.49% of observations. Therefore, we present all regression results for a reduced sample without them to ensure that these countries fail to drive our research findings. Table 3 reports that economic policy uncertainty still negatively (positively) affects value of excess cash during the pre-crisis (post-crisis) period.

Moreover, we also replace excess cash by cash level measured by cash holdings to net assets ratio and present regression results for this alternative measure as robustness checks. Table 4 shows that our research findings remain unchanged.

Furthermore, following Demir and Ersan (2017), Tran (2019b), we employ alternative measures of economic policy uncertainty as robustness tests. EPU2 is the weighted average of monthly BBD indices in a fiscal year. Those in the first (last) 6 months are assigned a weight of one (two). EPU3 is also the weighted average; however, but BBD indices from the first to the last quarter of a fiscal year are granted corresponding weights from 1 to 4. Regression results presented in Table 5 show consistent findings.

In addition, our research sample is unbalanced panel data; therefore, we also employ panel data regression methods including fixed effects and random effects as robustness checks. Panel data regression is able to control heterogeneity that is not performed by cross-sectional analysis and reduces the risk of biased results. Table 6 shows that our key findings are still stable in both panel data regression techniques.

5.3 The role of firm-level financial constraint in the post-crisis period

Almeida *et al.* (2004) find that financially constrained firms tend to save more cash. Chang *et al.* (2017) document that value of cash is higher in financially constrained firms under the impact of the global financial crisis. Therefore, we continue to investigate how firm-specific financial constraint influences the relationship between economic policy uncertainty and value of cash in the post-crisis period. An observation is defined as financially constrained (unconstrained) if it belongs to the country-year top (bottom) 30^{th} percentile of Kaplan and Zingales (1997) index or Whited and Wu (2006) index or the country-year bottom (top) 30th percentile of firm size.

Table 7 reports regression results to analyze the effect of economic policy uncertainty on value of cash by financial constraint during the post-crisis period. We find that this positive effect is statistically and economically stronger in financially constrained firms. This finding supports the argument that investors more emphasize on the role of cash holdings in firms' survival and investment due to high external financial constraint in the post-crisis period. Financially constrained firms face much higher financial constraint; therefore, investors assign higher value to corporate cash holdings when they face high economic policy uncertainty.

6. Conclusion

Prior studies show that economic policy uncertainty positively affects corporate cash holdings but they have not fully addressed how economic policy uncertainty determines value of cash. Using a research sample of 103,474 firm-years from 19 countries during the

Table 3.
Robustness checks with the reduced sample

Variables	Pre-crisis (1)	Pre-crisis (2)	Post-crisis (1)	Post-crisis (2)
Intercept	1.2425*** (4.81)	1.4178*** (5.21)	1.4706*** (6.58)	2.3417*** (9.55)
$EPU1_t \times EXC_{i,t}$		−0.0122*** (−4.79)		0.0054*** (3.89)
$EXC_{i,t}$	0.1278*** (7.40)	0.2248 (1.47)	0.0592*** (3.18)	0.9074*** (5.86)
$EPU1_t$		−0.0102** (−2.12)		−0.0121*** (−6.14)
$EN_{i,t}$	−2.6538*** (−8.16)	−2.6053*** (−8.00)	−2.6765*** (−9.11)	−2.6248*** (−8.95)
$dEN_{i,t}$	0.9581*** (3.36)	0.9346*** (3.28)	1.0985*** (7.45)	1.0750*** (7.32)
$dEN_{i,t+1}$	−0.6685*** (−2.57)	−0.6575** (−2.52)	−0.5362*** (−3.00)	−0.5428*** (−3.03)
$dNA_{i,t}$	0.9570*** (8.10)	0.9628*** (8.15)	0.6806*** (7.34)	0.6866*** (7.49)
$dNA_{i,t+1}$	0.8626*** (8.71)	0.8515*** (8.64)	0.6865*** (8.41)	0.6925*** (8.58)
$RD_{i,t}$	3.3936*** (3.94)	3.3162*** (3.76)	5.9783*** (8.30)	5.9152*** (8.19)
$dRD_{i,t}$	1.1584 (0.57)	1.1948 (0.58)	2.7091** (2.26)	2.9749** (2.48)
$dRD_{i,t+1}$	9.2341*** (6.03)	9.0433*** (5.89)	9.1341*** (6.93)	9.1362*** (6.93)
$IN_{i,t}$	12.5423*** (4.67)	12.5549*** (4.67)	5.0765*** (3.48)	5.7351*** (3.95)
$dIN_{i,t}$	−21.1116*** (−5.11)	−20.9247*** (−5.04)	−10.0955*** (−5.71)	−9.8230*** (−5.56)
$dIN_{i,t+1}$	−0.1411 (−1.08)	−0.1450 (−1.10)	−0.2479** (−2.49)	−0.2733*** (−2.71)
$DV_{i,t}$	16.6435*** (13.81)	16.7087*** (13.76)	24.8128*** (18.26)	24.4560*** (18.07)
$dDV_{i,t}$	−0.5826 (−0.39)	−0.6645 (−0.44)	−2.5125** (−2.16)	−2.1892* (−1.91)
$dDV_{i,t+1}$	12.6141*** (8.09)	12.5188*** (8.06)	17.4153*** (14.37)	17.2607*** (14.38)
$dMV_{i,t}$	−0.0254 (−0.56)	−0.0233 (−0.52)	0.0508 (1.35)	0.0459 (1.24)
ASD	0.6555*** (4.88)	0.5254*** (4.06)	−0.0949 (−0.76)	0.2404* (1.94)
CRE	−0.1251*** (−4.93)	−0.1339*** (−4.93)	0.0689** (2.10)	−0.0480 (−1.44)
ROL	−0.1489*** (−2.67)	−0.1479** (−2.53)	−0.2067*** (−5.66)	−0.1962*** (−4.81)
$PCRE_t$	0.0004 (0.45)	0.0007 (0.81)	−0.0052*** (−3.43)	−0.0022* (−1.68)
$MCAP_t$	−0.0001 (−0.37)	0.0000 (0.09)	0.0002 (1.08)	0.0001 (0.37)
$GCAP_t$	−0.0425* (−1.80)	−0.0315 (−1.15)	0.0025 (0.08)	−0.0851*** (−2.92)
$GGRO_t$	−0.0069 (−0.64)	−0.0033 (−0.29)	−0.0129* (−1.79)	−0.0154** (−2.26)
$ASD \times EXC_{i,t}$		0.0271 (0.27)		0.2931*** (3.59)
$CRE \times EXC_{i,t}$		−0.0137 (−0.66)		−0.1137*** (−5.20)
$ROL \times EXC_{i,t}$		0.0184 (0.37)		−0.0097 (−0.39)
$PCRE_t \times EXC_{i,t}$		0.0003 (0.40)		0.0072*** (5.46)
$MCAP_t \times EXC_{i,t}$		0.0002 (1.56)		−0.0006*** (−4.66)
$GCAP_t \times EXC_{i,t}$		−0.0016 (−0.09)		−0.1718*** (−6.23)
$GGRO_t \times EXC_{i,t}$		−0.0038 (−0.62)		0.0208*** (4.64)

(*continued*)

Table 3.

Variables	Pre-crisis (1)	Pre-crisis (2)	Post-crisis (1)	Post-crisis (2)
Industry fixed effects		Yes		Yes
Year fixed effects		Yes		Yes
R^2	0.2804	0.2841	0.1935	0.2075
F-statistics	33.13***	29.52***	31.37***	27.26***
Breusch-Pagan Chi-squared	6,373.70***	6,448.94***	9,325.07***	12,868.09***
N	9,930	9,930	29,923	29,923

Note(s): The dependent variable is MV_t. X_t is the value of variable X in year t. dX_t is the annual change in X in year t. dX_{t+1} is the annual change in X in year $t+1$. MV is market value. EPU1 is economic policy uncertainty. EXC is excess cash. EN is earnings before interest and extraordinary items. NA is net assets calculated by total assets minus total cash and short-term investment. RD is research and development expenditure. IN is interest expense. DV is cash dividend. All firm-level variables except EXC are deflated by net assets. ASD is anti-self-dealing index. CRE is revised creditor right index. ROL is rule of law. PCRE is private credit. MCAP is market capitalization. GCAP is GDP per capita. GGRO is GDP growth rate. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. *t*-statistics are in parentheses

Table 4.
Robustness checks with cash level

Variables	Pre-crisis (1)	Pre-crisis (2)	Post-crisis (1)	Post-crisis (2)
Intercept	−0.8788*** (−4.36)	0.0467 (0.21)	1.1102*** (6.52)	0.7626*** (4.13)
$EPU1_t \times CAS_{i,t}$		−0.0782*** (−5.01)		0.0166** (2.37)
$CAS_{i,t}$	1.5273*** (11.06)	−4.3714*** (−2.98)	1.3109*** (12.66)	7.6894*** (5.69)
$EPU1_t$		0.0058* (1.73)		−0.0012 (−0.87)
$EN_{i,t}$	−2.8072*** (−14.20)	−2.7647*** (−14.00)	−2.7396*** (−15.15)	−2.7535*** (−15.22)
$dEN_{i,t}$	1.2413*** (8.21)	1.2184*** (8.04)	1.0386*** (9.83)	1.0260*** (9.76)
$dEN_{i,t+1}$	−0.4042*** (−2.66)	−0.3917*** (−2.59)	−0.2706** (−2.21)	−0.2869** (−2.34)
$dNA_{i,t}$	1.1700*** (14.79)	1.1827*** (15.03)	0.9249*** (14.55)	0.9341*** (14.73)
$dNA_{i,t+1}$	1.1328*** (18.27)	1.1275*** (18.16)	0.7753*** (14.23)	0.7836*** (14.43)
$RD_{i,t}$	3.1174*** (6.04)	3.1841*** (6.03)	4.3938*** (10.58)	4.5600*** (10.77)
$dRD_{i,t}$	3.9015*** (3.15)	3.8017*** (3.08)	6.3842*** (7.59)	6.2738*** (7.51)
$dRD_{i,t+1}$	9.7002*** (9.23)	8.7791*** (8.37)	10.4447*** (12.05)	10.6216*** (12.28)
$IN_{i,t}$	16.2301*** (10.59)	16.3395*** (10.69)	13.6422*** (12.44)	13.8701*** (12.63)
$dIN_{i,t}$	−15.6201*** (−7.22)	−15.6242*** (−7.22)	−16.4708*** (−11.98)	−16.2816*** (−11.94)
$dIN_{i,t+1}$	−0.3207*** (−4.05)	−0.3265*** (−4.12)	0.1396** (2.14)	0.0842 (1.29)
$DV_{i,t}$	15.4345*** (17.87)	15.4594*** (17.84)	21.8440*** (23.38)	21.5485*** (23.50)
$dDV_{i,t}$	−0.1205 (−0.12)	−0.2352 (−0.23)	−3.2416*** (−3.85)	−3.1778*** (−3.79)
$dDV_{i,t+1}$	12.9624*** (11.67)	13.1063*** (11.92)	15.0488*** (17.14)	14.7940*** (16.91)
$dMV_{i,t}$	−0.1087*** (−5.79)	−0.1039*** (−5.55)	0.0123 (0.60)	0.0125 (0.61)
ASD	0.5600*** (5.01)	0.8737*** (6.09)	0.8401*** (8.76)	0.5579*** (3.94)
CRE	−0.1120*** (−5.47)	−0.1766*** (−6.01)	−0.1045*** (−5.57)	−0.0692** (−2.43)
ROL	0.0215 (0.65)	0.0536 (1.15)	0.0743*** (2.84)	0.0441 (1.22)
$PCRE_t$	−0.0039*** (−6.85)	−0.0017** (−2.34)	−0.0011** (−2.40)	−0.0013** (−2.04)
$MCAP_t$	0.0001 (0.42)	0.0002 (1.16)	−0.0002* (−1.93)	0.0001 (0.31)
$GCAP_t$	0.1742*** (10.16)	0.0629*** (2.75)	−0.0604*** (−4.00)	0.0118 (0.68)
$GGRO_t$	0.0570*** (8.43)	0.0128 (1.41)	0.0202*** (4.59)	0.0082 (1.63)
$ASD \times EXC_{i,t}$		−2.7630*** (−2.87)		1.5501** (2.00)
$CRE \times EXC_{i,t}$		0.3902* (1.82)		−0.1220 (−0.71)
$ROL \times EXC_{i,t}$		−0.4344 (−1.53)		0.0331 (0.14)
$PCRE_t \times EXC_{i,t}$		−0.0147*** (−3.42)		−0.0033 (−0.97)
$MCAP_t \times EXC_{i,t}$		−0.0006 (−0.60)		−0.0012* (−1.89)

(*continued*)

Table 4.

Variables	Pre-crisis (1)	Pre-crisis (2)	Post-crisis (1)	Post-crisis (2)
$GCAP_t \times EXC_{i,t}$		0.8209*** (5.74)		−0.7007*** (−5.62)
$GGRO_t \times EXC_{i,t}$		0.3439*** (6.95)		0.0405** (2.00)
Industry fixed effects		Yes		Yes
Year fixed effects		Yes		Yes
R^2	0.3998	0.4057	0.2927	0.2978
F-statistics	111.86***	95.77***	103.54***	87.46***
Breusch-Pagan Chi-squared	37,059.57***	37,588.59***	34,537.10***	35,337.27***
N	34,049	34,049	69,425	69,425

Note(s): The dependent variable is MV_t. X_t is the value of variable X in year t. dX_t is the annual change in X in year t. dX_{t+1} is the annual change in X in year $t+1$. MV is market value. EPU1 is economic policy uncertainty. CAS is cash holdings. EN is earnings before interest and extraordinary items. NA is net assets calculated by total assets minus total cash and short-term investment. RD is research and development expenditure. IN is interest expense. DV is cash dividend. All firm-level variables except CAS are deflated by net assets. ASD is anti-self-dealing index. CRE is revised creditor right index. ROL is rule of law. PCRE is private credit. MCAP is market capitalization. GCAP is GDP per capita. GGRO is GDP growth rate. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. *t*-statistics are in parentheses

Table 5.
Robustness checks with alternative measures of economic policy uncertainty

Variables	Pre-crisis		Post-crisis	
	EP_uncertainty is EPU2	EP_uncertainty is EPU3	EP_uncertainty is EPU2	EP_uncertainty is EPU3
Intercept	−0.7487*** (−3.06)	−0.7397*** (−3.04)	1.7836*** (8.89)	1.7265*** (8.59)
$EP\_uncertainty_t \times EXC_{i,t}$	−0.0087*** (−6.43)	−0.0091*** (−6.47)	0.0029*** (3.63)	0.0013* (1.91)
$EXC_{i,t}$	−0.0599 (−0.50)	−0.0425 (−0.36)	0.4725*** (4.89)	0.5299*** (5.45)
$EP\_uncertainty_t$	−0.0031 (−1.27)	−0.0032 (−1.22)	0.0021** (2.23)	0.0034*** (4.07)
$EN_{i,t}$	−2.9303*** (−14.81)	−2.9308*** (−14.81)	−2.8302*** (−15.48)	−2.8327*** (−15.49)
$dEN_{i,t}$	1.3205*** (8.77)	1.3206*** (8.77)	1.0742*** (10.13)	1.0743*** (10.13)
$dEN_{i,t+1}$	−0.5059*** (−3.33)	−0.5060*** (−3.33)	−0.3696*** (−2.99)	−0.3698*** (−2.99)
$dNA_{i,t}$	1.0817*** (13.92)	1.0818*** (13.92)	0.7978*** (12.55)	0.7962*** (12.52)
$dNA_{i,t+1}$	1.2501*** (20.27)	1.2504*** (20.28)	0.8797*** (16.38)	0.8797*** (16.37)
$RD_{i,t}$	4.0421*** (8.28)	4.0425*** (8.29)	5.2861*** (13.24)	5.2753*** (13.20)
$dRD_{i,t}$	3.9078*** (3.19)	3.9055*** (3.19)	6.2629*** (7.50)	6.2464*** (7.48)
$dRD_{i,t+1}$	10.7147*** (10.31)	10.7104*** (10.30)	11.2443*** (13.10)	11.2508*** (13.11)
$IN_{i,t}$	14.3359*** (9.50)	14.3360*** (9.49)	11.9682*** (10.77)	11.8894*** (10.70)
$dIN_{i,t}$	−15.0583*** (−6.96)	−15.0627*** (−6.96)	−16.0101*** (−11.61)	−16.0270*** (−11.62)
$dIN_{i,t+1}$	−0.5224*** (−6.44)	−0.5221*** (−6.44)	−0.1036 (−1.63)	−0.1082* (−1.70)
$DV_{i,t}$	15.6800*** (17.98)	15.6806*** (17.99)	22.0104*** (23.33)	22.0191*** (23.33)
$dDV_{i,t}$	0.3682 (0.35)	0.3713 (0.35)	−2.7972*** (−3.28)	−2.8249*** (−3.31)
$dDV_{i,t+1}$	13.7416*** (12.32)	13.7467*** (12.32)	15.6480*** (17.51)	15.6183*** (17.47)
$dMV_{i,t}$	−0.1117*** (−5.91)	−0.1118*** (−5.92)	0.0129 (0.62)	0.0137 (0.66)
ASD	0.6688*** (5.89)	0.6713*** (5.90)	0.8881*** (9.47)	0.8552*** (9.15)
CRE	−0.1071*** (−5.01)	−0.1071*** (−5.01)	−0.0942*** (−4.98)	−0.0860*** (−4.54)
ROL	0.0238 (0.69)	0.0216 (0.63)	0.0372 (1.34)	0.0337 (1.22)
$PCRE_t$	−0.0047*** (−7.94)	−0.0047*** (−7.97)	−0.0020*** (−4.16)	−0.0022*** (−4.52)
$MCAP_t$	0.0000 (0.28)	0.0000 (0.28)	−0.0002 (−1.63)	−0.0002 (−1.55)
$GCAP_t$	0.2058*** (9.85)	0.2049*** (9.88)	−0.0965*** (−5.52)	−0.0910*** (−5.20)
$GGRO_t$	0.0662*** (8.48)	0.0660*** (8.49)	0.0150*** (3.34)	0.0162*** (3.61)
$ASD \times EXC_{i,t}$	−0.0254 (−0.30)	−0.0191 (−0.22)	0.0984 (1.24)	0.1156 (1.45)
$CRE \times EXC_{i,t}$	0.0216 (1.26)	0.0221 (1.29)	0.0284* (1.65)	0.0227 (1.29)
$ROL \times EXC_{i,t}$	−0.0216 (−0.80)	−0.0239 (−0.88)	−0.0475** (−2.32)	−0.0475** (−2.33)
$PCRE_t \times EXC_{i,t}$	−0.0011*** (−2.76)	−0.0011*** (−2.83)	−0.0012*** (−3.40)	−0.0011*** (−3.02)

(*continued*)

Table 5.

Variables	Pre-crisis		Post-crisis	
	EP_uncertainty is EPU2	EP_uncertainty is EPU3	EP_uncertainty is EPU2	EP_uncertainty is EPU3
$MCAP_t \times EXC_{i,t}$	0.0002 (1.24)	0.0002 (1.20)	0.0002** (2.35)	0.0002** (2.27)
$GCAP_t \times EXC_{i,t}$	0.0351*** (3.01)	0.0336*** (2.89)	−0.0438*** (−4.38)	−0.0467*** (−4.61)
$GGRO_t \times EXC_{i,t}$	−0.0017 (−0.38)	−0.0024 (−0.54)	−0.0067*** (−2.78)	−0.0079*** (−3.31)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
R^2	0.3925	0.3925	0.2880	0.2880
F-statistics	91.15***	91.11***	84.61***	84.55***
Breusch-Pagan Chi-squared	33,288.96***	33,279.44***	32,952.45***	32,942.90***
N	34,049	34,049	69,425	69,425

Note(s): The dependent variable is MV_t. X_t is the value of variable X in year t. dX_t is the annual change in X in year t. dX_{t+1} is the annual change in X in year $t+1$. MV is market value. EP_uncertainty is economic policy uncertainty. EPU2 and EPU3 are alternative measures of economic policy uncertainty. EXC is excess cash. EN is earnings before interest and extraordinary items. NA is net assets calculated by total assets minus total cash and short-term investment. RD is research and development expenditure. IN is interest expense. DV is cash dividend. All firm-level variables except EXC are deflated by net assets. ASD is anti-self-dealing index. CRE is revised creditor right index. ROL is rule of law. PCRE is private credit. MCAP is market capitalization. GCAP is GDP per capita. GGRO is GDP growth rate. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. *t*-statistics are in parentheses

Table 6.
Robustness checks with panel data regression

Variables	Fixed effects		Random effects	
	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
Intercept	−5.2584*** (−5.97)	−0.3837 (−0.52)	−1.2984*** (−5.74)	1.6700*** (10.06)
$EPU1_t \times CAS_{i,t}$	−0.0075*** (−4.33)	0.0006** (2.23)	−0.0081*** (−5.36)	0.0004** (2.27)
$CAS_{i,t}$	−0.0085*** (−3.79)	−0.0028*** (−4.34)	−0.0055*** (−2.77)	−0.0015** (−2.23)
$EPU1_t$	−0.5432*** (−2.75)	0.0487 (0.58)	−0.2302* (−1.88)	0.1382* (1.94)
$EN_{i,t}$	−1.5694*** (−5.81)	−0.8716*** (−5.44)	−2.0999*** (−10.56)	−1.4244*** (−9.96)
$dEN_{i,t}$	0.8115*** (5.25)	0.4946*** (6.35)	0.9522*** (6.98)	0.6064*** (8.21)
$dEN_{i,t+1}$	−0.1983 (−1.36)	0.1332 (1.39)	−0.3701*** (−2.91)	−0.0973 (−1.07)
$dNA_{i,t}$	0.3507*** (5.27)	0.2750*** (5.90)	0.6067*** (10.07)	0.4190*** (9.60)
$dNA_{i,t+1}$	1.2894*** (20.32)	1.1636*** (24.70)	1.2662*** (23.64)	1.1193*** (26.91)
$RD_{i,t}$	3.7630*** (3.96)	4.6328*** (7.87)	4.5417*** (8.43)	5.7525*** (13.80)
$dRD_{i,t}$	1.8131* (1.83)	2.0318*** (3.31)	2.1347** (2.30)	2.1624*** (3.63)
$dRD_{i,t+1}$	6.8916*** (6.72)	7.3016*** (10.65)	8.2718*** (9.89)	8.3229*** (13.36)
$IN_{i,t}$	11.0703*** (5.91)	7.7414*** (6.44)	13.9476*** (9.77)	10.4764*** (10.54)
$dIN_{i,t}$	−9.5792*** (−5.40)	−8.2983*** (−7.75)	−11.5644*** (−7.03)	−10.2254*** (−10.18)
$dIN_{i,t+1}$	−0.6356*** (−4.15)	−0.4322*** (−3.89)	−0.5208*** (−5.54)	−0.2286*** (−2.83)
$DV_{i,t}$	3.8434*** (2.99)	10.5640*** (12.87)	10.4084*** (11.54)	13.6203*** (19.48)
$dDV_{i,t}$	2.8420*** (3.50)	−1.3147** (−2.34)	0.8017 (1.03)	−2.1735*** (−4.09)
$dDV_{i,t+1}$	5.6033*** (6.40)	7.8455*** (13.30)	9.2963*** (11.75)	9.5595*** (16.69)
$dMV_{i,t}$	−0.2787*** (−22.05)	−0.2541*** (−21.15)	−0.2459*** (−19.14)	−0.2323*** (−19.21)
ASD			0.4270*** (3.56)	1.4126*** (14.27)
CRE			−0.0922*** (−4.05)	−0.2053*** (−10.37)
ROL	−0.0420 (−1.46)	−0.0775*** (−3.61)	−0.0086 (−0.30)	−0.0085 (−0.39)
$PCRE_t$	−0.0030*** (−2.66)	0.0036*** (4.82)	−0.0047*** (−8.60)	0.0012*** (2.72)
$MCAP_t$	0.0017*** (5.48)	0.0021*** (5.89)	0.0009*** (4.27)	−0.0002* (−1.87)
$GCAP_t$	0.6478*** (7.66)	0.2834*** (4.91)	0.2604*** (12.66)	−0.0765*** (−5.19)
$GGRO_t$	0.0875*** (10.31)	0.0143*** (4.83)	0.1036*** (13.98)	0.0148*** (5.20)
$ASD \times EXC_{i,t}$	0.1817 (1.17)	0.0217 (0.26)	0.0277 (0.27)	0.0712 (1.01)
$CRE \times EXC_{i,t}$	−0.0383 (−1.54)	0.0142 (0.86)	−0.0072 (−0.42)	0.0136 (0.95)
$ROL \times EXC_{i,t}$	−0.0202 (−0.94)	0.0064 (0.41)	−0.0298 (−1.42)	0.0031 (0.21)
$PCRE_t \times EXC_{i,t}$	0.0002 (0.35)	−0.0010*** (−2.90)	−0.0004 (−1.10)	−0.0010*** (−3.36)
$MCAP_t \times EXC_{i,t}$	−0.0006** (−2.05)	0.0002** (2.07)	−0.0003 (−1.25)	0.0002** (2.48)

(*continued*)

Table 6.

Variables	Fixed effects		Random effects	
	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
$GCAP_t \times EXC_{i,t}$	0.0604*** (3.25)	0.0035 (0.38)	0.0439*** (3.57)	−0.0088 (−1.12)
$GGRO_t \times EXC_{i,t}$	0.0171*** (3.69)	−0.0023 (−1.39)	0.0105*** (2.61)	−0.0026 (−1.62)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
N	34,049	69,425	34,049	69,425

Note(s): The dependent variable is MV_t. X_t is the value of variable X in year t. dX_t is the annual change in X in year t. dX_{t+1} is the annual change in X in year $t+1$. MV is market value. EPU1 is economic policy uncertainty. CAS is cash holdings. EN is earnings before interest and extraordinary items. NA is net assets calculated by total assets minus total cash and short-term investment. RD is research and development expenditure. IN is interest expense. DV is cash dividend. All firm-level variables except CAS are deflated by net assets. ASD is anti-self-dealing index. CRE is revised creditor right index. ROL is rule of law. PCRE is private credit. MCAP is market capitalization. GCAP is GDP per capita. GGRO is GDP growth rate. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. *t*-statistics are in parentheses

Table 7.
The effect of economic policy uncertainty on value of cash by financial constraint during the post-crisis period

Variables	KZ index		WW index		Firm size	
	Low	High	Low	High	Large	Small
Intercept	1.9086*** (5.73)	1.0306*** (2.84)	0.0020** (2.30)	0.0070*** (3.72)	1.8025*** (7.11)	2.7450*** (6.00)
$EPU1_t \times EXC_{i,t}$	0.0034*** (2.79)	0.0044*** (2.59)	−0.0001 (−0.11)	0.0070*** (3.25)	0.0020** (2.28)	0.0067*** (3.49)
$EXC_{i,t}$	0.0063 (0.03)	0.4521** (2.56)	1.5987** (2.24)	−3.4905*** (−18.02)	0.2455* (1.87)	0.8797*** (4.47)
$EPU1_t$	−0.0004 (−0.22)	0.0082*** (3.68)	0.2870** (2.22)	0.7752*** (4.02)	−0.0012 (−1.13)	0.0083*** (3.67)
$EN_{i,t}$	−1.0801*** (−3.22)	−3.8750*** (−17.12)	0.2413 (0.77)	0.8446*** (6.55)	4.1613*** (8.85)	−3.4315*** (−17.32)
$dEN_{i,t}$	1.2553*** (6.88)	0.8960*** (5.39)	1.8176*** (4.47)	−1.0406*** (−7.32)	−0.3075** (−2.17)	0.8167*** (6.16)
$dEN_{i,t+1}$	0.5536** (2.50)	−1.0030*** (−5.45)	0.6305*** (5.80)	1.0187*** (9.35)	3.0249*** (13.42)	−1.0349*** (−7.17)
$dNA_{i,t}$	0.7796*** (6.48)	0.7456*** (6.87)	0.4886*** (4.99)	1.2251*** (13.36)	0.1219** (1.96)	0.9174*** (8.19)
$dNA_{i,t+1}$	0.7684*** (9.04)	1.2331*** (11.68)	8.0070*** (10.11)	3.7589*** (7.45)	0.1969** (2.46)	1.2011*** (12.76)
$RD_{i,t}$	5.6166*** (11.90)	5.0257*** (6.94)	9.0352*** (3.25)	5.0033*** (4.92)	5.8849*** (5.51)	3.8438*** (7.33)
$dRD_{i,t}$	7.1493*** (6.23)	3.0815** (1.98)	15.0993*** (5.57)	8.3691*** (8.07)	7.6366*** (3.42)	4.9940*** (4.91)
$dRD_{i,t+1}$	12.1243*** (11.40)	9.0252*** (5.32)	5.6439*** (3.59)	17.2513*** (11.09)	12.7415*** (5.40)	8.3741*** (7.60)
$IN_{i,t}$	17.5443*** (9.10)	9.3041*** (5.80)	−8.3035*** (−2.68)	−17.8582*** (−9.20)	5.3514*** (5.22)	18.9171*** (11.37)
$dIN_{i,t}$	−13.5644*** (−4.93)	−16.0409*** (−8.03)	0.0574 (0.80)	−0.5025*** (−3.76)	−4.1574** (−2.38)	−18.6636*** (−9.21)
$dIN_{i,t+1}$	−0.1771* (−1.74)	−0.3249*** (−2.94)	19.6909*** (12.39)	26.1928*** (10.38)	0.2182*** (2.92)	−0.4258** (−2.55)
$DV_{i,t}$	18.8544*** (16.29)	53.9883*** (6.12)	−0.9581 (−0.88)	−8.3586*** (−3.42)	14.8932*** (10.94)	24.4272*** (12.70)
$dDV_{i,t}$	−0.0293 (−0.03)	−16.0536*** (−4.26)	14.1744*** (9.93)	15.5222*** (7.69)	−2.0077** (−2.11)	−6.8930*** (−3.38)
$dDV_{i,t+1}$	14.4255*** (12.25)	21.8134*** (6.39)	−0.1347*** (−2.78)	−0.0049 (−0.17)	10.1555*** (8.51)	16.3502*** (9.76)
$dMV_{i,t}$	−0.0221 (−0.85)	−0.0102 (−0.26)	0.2778* (1.92)	1.6759*** (8.48)	−0.1447*** (−3.13)	−0.0258 (−1.00)
ASD	1.1642*** (8.20)	−0.0670 (−0.25)	0.0400* (1.79)	−0.2755*** (−6.32)	0.1237 (0.75)	1.8760*** (8.94)
CRE	−0.1386*** (−5.15)	0.0720 (1.17)	−0.1365*** (−3.43)	0.1842*** (2.75)	0.0464** (2.08)	−0.3074*** (−6.39)
ROL	−0.0058 (−0.11)	0.0341 (0.57)	−0.0051*** (−9.54)	0.0035*** (3.25)	−0.0965*** (−2.82)	0.1565** (2.30)
$PCRE_t$	−0.0011 (−1.55)	−0.0058*** (−3.70)	0.0003 (0.99)	−0.0009*** (−5.28)	−0.0042*** (−7.36)	0.0040*** (3.49)
$MCAP_t$	−0.0005*** (−4.52)	0.0005* (1.89)	−0.0918*** (−3.83)	−0.1713*** (−4.91)	0.0004 (1.06)	−0.0012*** (−6.27)
$GCAP_t$	−0.1529*** (−5.18)	−0.0192 (−0.50)	−0.0155*** (−2.66)	0.0374*** (3.87)	−0.0556** (−2.19)	−0.2339*** (−6.53)
$GGRO_t$	0.0258*** (3.38)	−0.0174 (−1.56)	0.2011 (1.35)	0.0841 (0.58)	−0.0038 (−0.56)	0.0380*** (4.05)
$ASD \times EXC_{i,t}$	−0.1123 (−0.91)	−0.0841 (−0.55)	0.0184 (0.84)	0.0257 (0.72)	0.2919* (1.70)	0.2064 (1.29)
$CRE \times EXC_{i,t}$	0.1082*** (4.34)	0.0499 (1.48)	0.0289 (1.06)	−0.1412*** (−2.87)	0.0211 (0.96)	−0.0004 (−0.01)
$ROL \times EXC_{i,t}$	−0.0742* (−1.67)	−0.1227*** (−2.81)	−0.0007 (−1.76)	−0.0002 (−0.26)	0.0707*** (2.84)	−0.1054 (−2.16)
$PCRE_t \times EXC_{i,t}$	−0.0036*** (−5.85)	−0.0014* (−1.97)	−0.0001 (−0.30)	0.0002 (1.37)	−0.0011** (−2.56)	−0.0001 (−0.09)
$MCAP_t \times EXC_{i,t}$	0.0002 (1.31)	0.0003 (1.52)	−0.0360** (−2.43)	−0.0866*** (−4.22)	−0.0002 (−0.80)	0.0002 (0.93)

(*continued*)

Variables	KZ index		WW index		Firm size	
	Low	High	Low	High	Large	Small
$GCAP_t \times EXC_{i,t}$	0.0362* (1.83)	−0.0375*** (−2.00)	−0.0084** (−2.40)	−0.0032 (−0.63)	−0.0353** (−2.28)	−0.1002*** (−4.70)
$GGRO_t \times EXC_{i,t}$	−0.0049 (−1.15)	−0.0157*** (−3.08)	2.2630*** (8.18)	1.7347*** (4.75)	−0.0128*** (−3.28)	−0.0040 (−0.74)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.3089	0.3294	0.3107	0.3585	0.3008	0.36
N	20,846	21,004	20,885	20,911	20,897	20,897

Note(s): The dependent variable is MV_t. X_t is the value of variable X in year t. dX_t is the annual change in X in year t. dX_{t+1} is the annual change in X in year $t+1$. MV is market value. EPU1 is economic policy uncertainty. EXC is excess cash. EN is earnings before interest and extraordinary items. NA is net assets calculated by total assets minus total cash and short-term investment. RD is research and development expenditure. IN is interest expense. DV is cash dividend. All firm-level variables except EXC are deflated by net assets. ASD is anti-self-dealing index. CRE is revised creditor right index. ROL is rule of law. PCRE is private credit. MCAP is market capitalization. GCAP is GDP per capita. GGRO is GDP growth rate. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. *t*-statistics are in parentheses

Table 7.

period 2004–2016, we find that economic policy uncertainty is negatively (positively) related to value of cash in the pre-crisis (post-crisis) period. These findings imply that investors pay more attention to agency costs (precautionary motive and transaction motive) than precautionary motive and transaction motive (agency costs) of cash holdings in the pre-crisis (post-crisis) period. Moreover, we also document that the positive effect of economic policy uncertainty in the post-crisis period is stronger in financially constrained firms.

This paper contributes to the literature of corporate cash holdings and financial crisis. While prior studies focus on the effect of economic policy uncertainty on cash levels, we show that economic policy uncertainty also determines value of cash across countries. In addition, we extend the line of research on how a financial crisis affects corporate financial decisions by showing that the effect of economic policy uncertainty on cash value are different before and after the financial crisis. These understandings help investors in their investment decisions under normal economic conditions (before a financial crisis) and in the post-crisis period. Future research may investigate how the Covid-19 pandemic affects the relationship between economic policy uncertainty and value of cash.

Note

1. Our research findings remain stable with 3% and 5% of winsorization.

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Appendix 1

Appendix 1 is avaialble at https://www.emerald.com/insight/content/doi/10.1108/EJMBE-10-2020-0292/full/html

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