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by

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Abstract

We examine the impact on firm cash holdings of uncertainty of uncertainty, measured as the ex post volatility of economic policy uncertainty. Using the news-based index developed by Baker, Bloom, and Davis (2016) for twenty-two countries, we find that, when there is greater volatility of economic uncertainty, firms hold more cash. Our results are robust to controlling for a host of firm-level and country-level factors. Consistent with Baker, Bloom, and Davis (2016), we consider that less economic policy uncertainty is associated with more investment; and so the real-option value of cash is sensitive to the possibility of a future desirability of investment. Therefore, when there is greater expected volatility of uncertainty, measured under rational expectations as the recent ex post volatility of uncertainty, firms will hold more cash. We also find that the volatility of economic policy uncertainty is much more economically significant in determining firm cash holdings than economic policy uncertainty itself. Therefore, our paper not only adds to the literature on uncertainty and cash holdings, but also, importantly, to the limited literature in finance on the impact of uncertainty of uncertainty.

1. Introduction

Using the news-based index developed by Baker, Bloom, and Davis (2016) for twenty-two countries, we examine the impact on firm cash holdings of uncertainty of uncertainty, measured as the ex post volatility of economic policy uncertainty (EPU). We find that, when there is greater volatility of economic uncertainty, firms hold more cash. Results also evidence that the volatility of uncertainty is much more important in determining firms cash levels than EPU itself.

As observed by Drobetz et al. (2018) and many others, the measure of EPU of Baker, Bloom, and Davis (2016) has been widely applied in finance research.[1] However, related aspects of this very useful measure of uncertainty have only lightly been considered, leaving other avenues to pursue. First, the impact of the uncertainty regarding the measuring of EPU on firm decisions has not generally been considered. Second, there has been little consideration of how firms react vis-à-vis uncertainty about what levels of uncertainty will be in the future. Further, more specifically to cash holdings, Baker, Bloom, and Davis (2016) themselves note the importance of changes in uncertainty impacting investments. Cash is held against the possibility that uncertainty will change (lessen) and this cash will be applied to investment. Therefore, the volatility of uncertainty is likely very important as a determinant for firm cash holdings.

[1] See the Background section of this paper for a brief survey of some of these articles.

In short, the impact of *uncertainty of uncertainty* has only lightly been investigated, despite the notion of model uncertainty being widely acknowledged in the research of other fields such as with regard to asset prices, affine term structure models, the equity variance risk premium and a host of other topics (Ju and Miao, 2012; Maenhout, 2004). Bloom (2014) notes that the distinction between risk and uncertainty extends at least back to Knight (1921). Knight (1921) highlights the difference between uncertainty and risk. Risk refers to randomness that can be measured precisely, such as the probabilities associated with tosses of a coin. Knight notes that if risk were the only relevant feature of randomness, well-organized financial institutions should be able to price and market insurance contracts that only depend on risky phenomena.

We apply the term "model uncertainty" broadly. Uncertainty regarding future levels of uncertainty can occur because either 1) levels of uncertainty can unexpectedly change for a vast array of reasons; and 2) the nature of how uncertainty is being measured is likely not entirely certain to be accurate. Concomitant with this second potential cause of uncertainty of uncertainty is the question of whether today's level of uncertainty accounts for concerns about how levels of uncertainty will change in the future.

While we apply broadly the term "model uncertainty," one of the advantages of using the EPU measure of Baker, Bloom, and Davis (2016) to form a measure of uncertainty about uncertainty is that this measure has been very widely adopted in finance research. EPU has been established by previous studies as a primary measure of uncertainty. The recent adoption of a widely used standard for assessing EPU allows us to cautiously draw inferences about the impact of uncertainty of uncertainty on the practices of firms without being concomitantly concerned about whether uncertainty is being adequately assessed.

Uncertainty refers to an inability to perfectly forecast the probability of events happening. Such future events have ambiguous or unknown probability (Baker, Bloom, and Davis, 2016; Ellsberg, 1961; Knight, 1921). Uncertainty, therefore, creates friction-generating transaction costs that these institutions are challenged to accommodate. Bloom (2014) notes that measures of EPU are inherently imperfect blends of measures of both risk and uncertainty. And so, with regard to EPU, there remains model risk (see also Carnap, 1950). While Knight (1921) suggests that risk is insurable through exchange while uncertainty is

not, recent research suggests that firms adjust many aspects of their behavior in response to uncertainty as measured by Baker, Bloom, and Davis (2016) measure. But does the potential variability of EPU also matter? This is the question of this paper, applied to the context of firm cash holding. Because of its widespread use and acceptance, we believe it is important to begin to address an important unpursued direction, that of the impact of uncertainty about uncertainty. We consider that, because of the increasingly widespread use of the Baker, Bloom, and Davis (2016) measure, there is now greater opportunity for researchers to investigate the impact of uncertainty of uncertainty on firms, while using an accepted measure of uncertainty. In this sense then, it is not so much about uncertainty with regard to how Baker, Bloom, and Davis (2016) estimate uncertainty, but rather uncertainty about how this particular measure might change in the future.

Overall, we hypothesize that firm cash holdings will be larger in environments of greater model uncertainty about levels of uncertainty. This broadly follows from Routledge and Zin (2009), Epstein and Wang (1994), and others who model the implications of Knightian uncertainty on levels of aggregate liquidity. When there is greater uncertainty regarding levels of EPU, access to liquidity will be generally constrained, with concomitant increase in the real option value of cash (Hubbard, 1994; Nishimura and Ozaki, 2007; Runde, 1994), and consequent hoarding of cash by firms.

Consistent with our hypothesis, we find that greater uncertainty of uncertainty results in firms holding more cash. In this paper, we examine the impact on firm cash holdings of ex ante uncertainty of future uncertainty. This is proxied, under an assumption of rational expectations, as the ex post volatility of EPU. Using the news-based index developed by Baker, Bloom, and Davis (2016) for the twenty-two countries for which this measure is available, we find that when there is greater past volatility of economic uncertainty, firms hold more cash relative to total assets. While previous research has studied the effect of the level of economic uncertainty on cash holding, this paper alternatively focuses on the impact of uncertainty regarding future changes in economic uncertainty.

Our results are robust to a wide-range of control variables, including firm-level controls, as well as macroeconomic factors, national governance, and national culture. We also test alternative measures of

cash holding; as well as investigate the impact of both country-specific and global measures of EPU. We also test various country subsamples, with results unchanged. Lastly, by employing instrument-variable analysis, we rule out any possible endogeneity problem or sample selection bias in our study. Therefore, we report robust evidence about the role of the uncertainty of uncertainty of economic policy on the cash holdings of firms.

Additionally, and importantly, we find that when including EPU as a control variable, the volatility of EPU is much more economically significant than policy uncertainty itself. Indeed, the coefficient on uncertainty of uncertainty is about 50-times larger than the coefficient on levels of uncertainty. Overall, our paper adds not just to the literature on cash holdings but to the so-far limited amount of literature regarding the impact of uncertainty of uncertainty on firms and financial systems.

The rest of the paper is organized as follows. Section 2 provides background discussion, while Section 3 discusses the research design and data. Section 4 reports the empirical results, while Section 5 provides a discussion. Finally, Section 6 summarizes our findings and provides a conclusion.

2. Background

2.1 Uncertainty and financial systems

Research suggests that uncertainty can impact financial systems in two fundamental ways: 1) by increasing the transaction costs of exchanges; and by impacting the value of real options to invest. As noted by Williamson (1988) and Hart (2001), the primary transactions costs of market exchanges stem from asymmetric information and the uncertainties of contracts. Clearly, levels of uncertainty have important implications for financial systems. Uncertainty impacts the transaction costs of markets and the costs of vetting exchange in a financial sectors (Das and Teng, 1998; Klijn, Edelenbos, and Steijn, 2010; Poppo and Zenger, 2002). Additionally, uncertainty related to investment increases the value of real options to the firm, causing it to wait for additional information before investing (Bernanke, 1983). Consequently, uncertainty, due to an impact on the value of real options, will have a broad impact on various types of

corporate investments (Abel and Eberly, 1994; Abel and Eberly, 1996, Bertola and Caballero, 1994; Bloom, 2009; Veracierto, 2002).

It is not surprising, therefore, that uncertainty has been shown to impact financial systems in a host of ways: levels of interest rates and bank credit extension (Ashraf and Shen, 2019; Berger et al., 2018; Bordo, Duca, and Koch, 2016); stock market prices and volatility (Arouri et al., 2016; Ko and Lee, 2015; Liu and Zhang, 2015); energy, commodity and cryptocurrency prices (Antonakakis, Chatziantoniou, and Filis, 2014; Demir et al, 2018; Kang and Ratti, 2013); credit default spreads (Wisniewski and Lambe, 2015); corporate investment in the form of capital expenditures, research and development, accruals or private investment (Arif, Marshall, and Yohn, 2016; Bloom, 2009; Dixit and Pindyck, 1994; Gulen and Ion, 2015; Pindyck, 1993; Rodrik, 1991**)**; mergers and acquisitions (Bonaime, Gulen, and Ion, 2018; Harford, Dam, and Bhagwat, 2016; Nguyen and Phan, 2017); capital structure (Çolak, Gungoraydinoglu, and Öztekin, 2018); dividend payout (Attig et al., 2019); the maturity structure of corporate debt (Datta, Doan and Iskandar-Datta, 2019); the impact of elections on markets (Goodell, McGee, and McGroarty, 2020; Pástor and Veronesi, 2013), and many other areas.

2.2 Uncertainty and cash holding

It is intuitively reasonable that firm cash holding will be impacted by uncertainty, as a primary motive for holding cash is because of their option value vis-à-vis possible future investment opportunities. For instance, Gulen and Ion (2015) evidence a strong negative relationship between firm-level capital investment and the aggregate level of uncertainty associated with future policy and regulatory outcomes. Chen, Jia, and Sun (2016) find that corporate managers tend to preserve cash with an expectation of a worse economy while spend cash to exercise growth opportunities with a favorable economic condition. A number of articles have modeled relationships between firm cash holdings and uncertainty of either future cash flows or uncertainty regarding investment opportunities (e.g., Chen, Jia, and Sun, 2016; Han and Qiu, 2007; Hugonnier, Malamud, and Morellec, 2014; Kim and Kung, 2016).

Further, research also evidences strong links between cultural toleration of uncertainty and firm cash holdings. For instance, Ramirez and Tadesse (2009) find that firms in countries with high uncertainty avoidance hold more cash as a way to hedge against undesired states of nature. Chen et al. (2015) find that corporate cash holdings are negatively associated with individualism and positively associated with uncertainty-avoidance. Second, individualism and uncertainty avoidance influence the precautionary motive for holding cash. Third, firms in individualistic states in the United States hold less cash than firms in collectivistic states.

National governance has also been shown to impact cash holdings and so it is important to include as a control variable, which we do in this paper. However, the nature of how national governance impacts cash holdings is yet unsettled. For example, in countries with weak shareholder rights, Dittmar, Mahrt-Smith and Servaes (2003); and Kusnadi and Wei (2011) report that firms tend to hold more cash. Also, Chen, Li, Xiao and Zou (2014) find firms in China hold less cash when governance quality is higher. However, Stulz (2005) suggests that, in environments of poor national governance, firms will want to disgorge cash to avoid government expropriation. Caprio, Faccio and McConnell (2013) support this, showing that firms hold more cash in common law countries.

Demir and Ersan (2017) find an association of greater firm cash holding with EPU for select emerging market countries. Im, Park, and Zhao (2017) report that a firm facing higher uncertainty will assign a higher value to cash because of increased value of real options (see also Opler et al., 1999). Chen, Jia, and Sun (2016) suggest corporate managers prefer to preserve cash when there are expectations of economic worsening with a view to subsequent spending of cash to exercise growth opportunities during later favorable economic condition.

While there has been some notable research on the impact of uncertainty, much less has been investigated regarding the impact on cash holdings on uncertainty of uncertainty. An important and interesting exception is Neamtiu et al. (2014) who find a positive association of macroeconomic ambiguity with cash holdings of firms. They also proxy ambiguity with the dispersion of forecasts of profits from the Survey of Professional Forecasters. This measure is also a measure of dispersion of uncertainty. In this

paper, in contrast, we test the association of firm cash holdings directly with the volatility of uncertainty of the now widely regarded measure of EPU of Baker, Bloom, and Davis (2016).

3. Methodology

3.1. Model Specification

We collect data on cash holdings and EPU, as well as for firm-level and country-level controls for the longest period possible up to December 2017. We are limited to 22 countries, due to restricting our study to countries which have a measure of EPU. Our basic specification is described by Equation 1.

$$csh\_assts_{i,t} = \beta_1 + \beta_2 \sigma\_epu_{i,t} + \beta_3 size_{i,t} + \beta_4 leverage_{i,t} + \beta_5 roa_{i,t} + \beta_6 payout_{i,t} + \beta_7 \sigma\_cf_{i,t-1} + \beta_8 mktbk_{i,t} + \beta_9 sls\_grwth_{i,t} + \beta_{10} wrkng\_cap_{i,t} + \beta_{11} gdp_{i,t} + \beta_{12} gdpgr_{i,t} + \beta_{13} rule\_law_{i,t} + \beta_{14} \sigma\_stk\_mkt_{i,t} + Fixed\ effects + \varepsilon_{it} \quad (1)$$

The dependent and independent variables of Equation 1 are defined in Appendix A and in the following sections.

3.2 Dependent variable

Our dependent variable of interest is cash holdings to total assets (*cash_assts*). This is cash and short-term investments divided by total assets of the firm at the end of the financial year from Worldscope. This is the dependent variable for our empirical tests in most tables of the paper. However, in a later section, we also substitute alternative proxies for cash holdings as dependent variables (e.g., Bigelli and Sánchez-Vidal, 2012) for robustness purposes. These include the annual change in cash and short-term investments of the firm (*Δcash*); cash and short-term investments divided by total sales of the firm at the end of the financial year (*cash_sls*); the natural logarithm of the cash conversion cycle, which is the sum of the average number of days inventory is held and the average number of days it takes for the firm to receive the money for the goods sold minus the average number of days it takes for the firm to pay its bills for the goods sold (*ccc*); and the annual change in the cash conversion cycle (*Δccc*). Additionally, we test for cash and short–term investments divided by total assets minus short-term debt of the firm at the end of the financial year (*cash_net_assts*). The source for these variables is Worldscope.

(Please insert Table 1 about here)

3.2 Independent variables of primary interest

The independent variable that is of primary interest for this study is the volatility of the country-specific time-series index of EPU. More specifically, it is the standard deviation of the monthly country-specific EPU index of Baker, Bloom, and Davis (2016) over the twelve months ending in the month of the respective fiscal year-end (*σ_epu*) in the country where the firm is incorporated.

As described by Datta, Londono, Sun, Beltran, Ferreira, Iacoviello, Jahan-Parvar, Li, Rodriguez and Rogers (2017), the EPU measure of Baker, Bloom, and Davis (2016) is one of the most widely used non-asset-market indicators of uncertainty of the economic policy. This index for the US is constructed from three components: 1) searching the archives of 10 major U.S. newspapers for articles that contain terms related to EPU; 2) counting the number of federal tax code provisions set to expire in future years; and 3) disagreement among economic forecasters as an indication of uncertainty. EPU indexes are constructed for almost 20 other countries or country aggregates but are based on only the first component—newspaper articles regarding policy uncertainty. To address the overall volume of articles varies across newspapers and time. Baker, Bloom, and Davis (2016) scale the raw monthly counts for each newspaper by the total number of articles in that newspaper and in that month. They also scale each newspaper-level series to ensure that each country-specific EPU has a unit standard deviation.

In robustness tests, we also substitute for *σ_epu* with the global index of EPU (*σ_epu_global*). More specifically, this is the standard deviation of the monthly global EPU index over the twelve months ending in the month of the fiscal year-end in the country where the firm is incorporated, also from Baker, Bloom, and Davis (2016).

We consider that what determines cash holdings of firms, as noted above, is ex ante concerns about expected transaction costs and expected investment opportunities. And so, we acknowledge a limitation of our empirical design is the rational expectations assumption that ex-post volatility of uncertainty indeed reflects uncertainty of uncertainty (Elton, 1999; Muth, 1961).

A seminal question regarding our research design is whether the volatility of an uncertainty measure implies a less valid measure? Alternatively, if the uncertainty measure is strong, is the volatility of uncertainty conveying additional information? While such seminal questions are beyond the focus of this paper, we note the widespread usage acceptance of the Baker, Bloom, and Davis (2016) measure. While this paper is focused on cash holdings, this study may prompt similar future research on the impacts of uncertainty of uncertainty on differing topics.

3.3 Control variables

As controls, we include several firm-level factors in our set of independent variables. These include the natural log transformation of book value of the total assets of the firm at the end of the financial year in million US$ (*size*); total debt divided by total assets of the firm at the end of the financial year (*leverage*), EBIT divided by total assets of the firm at the end of the financial year (*roa*), the sum of common cash dividend paid and share repurchases divided by total assets of the firm at the end of the financial year (*payout*); the standard deviation of the past three financial year net income divided by the total assets of the firm (σ_cf), the market-to-book value of the firm at the end of the financial year (*mktbk*), the annual change in the total sales of the firm (*sls_grwth*), and the total working capital divided by total assets of the firm at the end of the financial year (*wrking_cap*). The source for these firm-level variables is Worldscope.

In our baseline regressions, we also include the standard deviation of the weekly returns of equally weighted benchmark country-specific stock index (σ_stk_mkt). Country-specific equally weighted benchmark index values are from Datastream. Baker, Bloom, and Davis (2016) note that their EPU measure is related to measures of market uncertainty.

We also control for two macroeconomic controls: the log transformation of the country-specific GDP at the end of the financial year in constant 2010 million US dollars (*gdp*), and the country-specific GDP per capita growth at the end of the financial year (*gdpgr*). These variables are from World Bank's World Development Indicators database. Chen, Jia, and Sun (2016) find that corporate managers tend to preserve cash with an expectation of a worse economy while spend cash to exercise growth opportunities

with a favorable economic condition. They find that corporate cash holdings; serving both functions of precautionary saving and exercising growth options, in aggregate, increase when the real GDP declines and decreases when GDP inflates. Also, stocks with returns declining more, due to a shock to the aggregate real option component of cash holdings, earn higher future returns. Moreover, stock returns of firms with higher cash holdings positively comove with the shock to the aggregate real option component, suggesting investors prefer to hold firms with higher cash holdings when the economy is deteriorating.

We also control for national governance. We include the Rule of Law measure from World Governance Indicators (*rule_law*). This reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and, in particular, the quality of contract enforcement.

Table 1 reports the descriptive statistics of our main variables of interest for each country in our sample, along with the number of observations per country, the number of firms included as well as the start year. We can see that the change in EPU varies considerably across the countries of our sample, with Sweden having the lowest volatility of EPU (0.126), while China has the highest volatility of EPU (0.655). Regarding cash holdings, there is also great variability. The Indian firms have the lowest aggregate cash to assets (0.146), while the Australian firms have the highest (0.552)—over 3.5 times higher than that of the Indian firms. Summary statistics across all countries are reported in Table 2. As can be seen in this table, we have over 277,000 observations in our sample.

(Please insert Tables 1 and 2 about here)

3.3 Controlling for endogeneity with instrumented variables

Amongst the tests reported in this paper, we also address endogeneity concerns with an instrumented variable and a two-stage approach. Our instrument is political fractionalization (*pol_frac*). This variable is the time-series country-specific probability that two deputies picked at random from the legislature will be of different political parties (Database of Political Institutions).

We reason that political fractionalization is not correlated with firm cash holdings; however, is related to the volatility of EPU. If polities are more fractionalized, announcements by public figures will be

more difficult to interpret. As a result, uncertainty about levels of EPU will be heightened. However, we also address any potential concern for whether political fractionalization is related to poor polities. We don't necessary conclude this, as for example, parliamentary systems are not often seen as more concentrated but concomitantly not seen as lesser polities than, for instance, systems similar to the US. However, as a precaution, as described in more detail further in this paper, we orthogonalize political fractionalization against the quality of the respective polity.

4. Results of determinants of cash holding

4.1. Initial tests

In our base-line empirical tests, the dependent variable is cash to total assets (*csh_assts*).[2] The independent variable of interest is the standard deviation of the volatility of EPU (*σ_epu*). Initial tests include as independent variables a number of firm-level controls and macroeconomic controls; as well as a variable to control for differences in national governance: *size*, *leverage*, *roa*, *payout*, *σ_cf*, *mtkbk*, *sls_grwth*, *wrkng_cap*, *gdp*, *gdpgr*, *rule_law*, and *σ_stk_mkt*. In Model 1 of Table 3, we restrict the model to just *σ_epu* and find that it has a coefficient of 0.03 and is statistically significant at the 1% level. Model 2 adds the firm level controls, while Model 3 further adds the macroeconomic and governance controls.

Model 4, includes the natural log of the EPU measure of Baker, Bloom, and Davis (2016) (*epu*). Model 4 results should be interpreted with caution as the correlation between *σ_epu* and *epu* is high at 0.76. However, the results of Model 4 are striking: *σ_epu* is significant at 1%, with a coefficient similar to the results of Models 1–3. On the other hand, *epu* is not significant. In Model 5, we include the interaction of *epu* and *σ_epu*. Both of these variables are significant at 1%. However, the coefficient of *σ_epu* (0.368) is about 23 times greater than the coefficient on *epu* (0.016). It is interesting that the coefficient of *σ_epu* (0.368) in Model 5 is so much higher than in the other models (around 0.054). Controlling for uncertainty, as well as the interaction of uncertainty with the volatility of uncertainty, results in the volatility of uncertainty being much more economically meaningful.

[2] We also use cash to net assets and a variety of other measures in subsequent robustness testing.

We also test our baseline models on subsamples of levels of *epu*. These results are reported in Appendix C.[3] Across these models, *σ_epu* remains significant at 1%. However, the economic significance, based on the size of the regression coefficients, noticeably lessens for higher levels of *epu.* This suggests that the uncertainty of uncertainty is less economically important for high levels of uncertainty.

More central to the focus of this paper, *σ_epu* is statistically significant in each of the models of Table 3. Specifically, we find that a 1% increase in the volatility of EPU increases cash holdings of firms by about five percentage points. These results strongly evidence that the volatility of EPU is an economically important determinant of cash holdings. When there is a positive change in the variability of EPU, the amount of cash held by firms meaningfully increases.

(Please insert Table 3 about here)

4.2 Culture

There is clear evidence in the literature about the importance of national culture. Therefore, to ensure that our results are not driven by such factors, in Table 4 we control for cross-national differences in national culture. Consistent with previous research, we consider that cash holding will be greater in environments with greater uncertainty avoidance (Breuer , Rieger, and Soypak, 2017; Im, Park, and Zhao, 2017; Ramirez and Tadesse, 2009). A greater need to avoid uncertainty will lead to more scrutiny of possible investment, along with a greater need to avoid investment shortfalls. We also consider that there will be a negative association of the cultural trait of individualism with cash holdings. We reason that individualism is associated with greater confidence. For instance, Biais et al. (2005) find an association of individualism with greater overconfidence bias, while Markus and Kitayama (1998) document a tendency to promote self-esteem in more individualistic cultures, leading to more pervasive self-attribution bias. Therefore, in more individualist societies a relatively higher percentage of available cash will be invested.

[3] We would like to thank a referee for suggesting this additional analysis.

In support of this view, for instance, Shao, Kwok, and Zhang (2013) find that in more individualist countries firms invest more in research and development (see also Chen et al., 2015).

In Model 1 of Table 4, we include national culture variables from Hofstede (2001) for individualism (IDV) and uncertainty avoidance (UAI). In Model 2 of Table 4, we alternatively use measures of egalitarianism (*egal*) and harmony (*harmony*) from Schwartz (1994). We consider that the egalitarian measure of Schwartz (1994) is similar to the collectivism (versus individualism) measure of Hofstede (2001). And so, if we expect a negative association of cash holdings with the individualism, we in turn expect a positive association with egalitarianism. We consider that the harmony measure of Schwartz (1994) is similar to the uncertainty avoidance measure of Hofstede (2001). And so, if we expect a positive association of cash holdings with the uncertainty avoidance, we in turn also expect a positive association with harmony. In Model 2, we find, as expected, a positive association of cash holdings with both egalitarianism and harmony. We also control for the interaction of the various national culture measures with *σ_epu.* For *uai*, *harmony*, and *egal* interacted respectively with *σ_epu*, the interaction term is significantly positive. For *idv* interacted with *σ_epu*, the interaction is negative. Most importantly, in these models, *σ_epu* nevertheless remains positively significant.

(Please insert Table 4 about here)

4.3 Controlling for national governance

Table 5 reports results controlling for various measures of national governance. In alternative models we add to the set of independent variables of Table 3 national measures of shareholder rights, and control of corruption. Shareholder rights (*shrhldr_rghts*) is from Djankov, La Porta, Lopez-de-Silvanes and Shleifer (2008), and Spamann (2010), and control of corruption (*cntrl_corruption*) is from Transparency International. Including these independent variables results in positive association of cash holdings with both shareholder rights and control of corruption, with a significance of 1%. These results are consistent with Harford, Mansi, and Maxwell (2008), who find firms hold more cash in nations with better governance. This could be because Dudley and Zhang (2016), for instance, find that countries with higher levels of

societal trust will be more tolerant for firms hoarding cash, concomitant with governance enhancing social trust (Lopez-de-Silanes, La Porta, Shleifer and Vishny, 1997). The results of Models 1 and 2 are consistent with this interpretation as cash holdings are positively associated with shareholder rights and control of corruption at a significance of 1%.

We also control for the interaction of the two national governance measures with *σ_epu*. In these two cases (*shrhldr_rghts* and *cntrl_corruption* interacted with *σ_epu*), the interaction term is significantly negative. This suggests that controlling for national governance lowers the impact of *σ_epu* on cash holdings. However, in these models *σ_epu* nevertheless remains positively significant.

(Please insert Table 5 about here)

4.4 Testing alternative measures of cash holding

In this section, we test whether uncertainty of EPU impacts cash holdings with alternative dependent variables, in other words, with alternative or related measures to cash holding. We alternatively select as a dependent variable, cash to sales (*csh_sls*), change in cash (*Δcash*), the natural log of the cash conversion cycle (*ccc*), and the change in the cash conversion cycle (*Δccc*). We also test cash to net assets (*csh_net_assts*). Across the models of Table 6, for five differing measures of cash holding, *σ_epu* is significant at either 1% or 5%. These results suggest our result of a positive association of cash holdings and variability of uncertainty is not driven by particular measures of cash holdings.[4]

(Please insert Table 6 about here)

4.5 Alternatively testing the role of the volatility of the global EPU measure

In this section we alternatively test the impact on cash holdings of the volatility of the global index of EPU (Baker, Bloom, and Davis, 2016). In other tests, up to this point, we have used instead the volatility of the country-specific index. From the results, reported in Table 7, we evidence that the volatility of the

[4] We expect to obtain a negative association with *ccc* and *Δccc*, as a shorter cash conversion is a way to hold more cash.

global EPU index also has a positive impact on cash holdings. Examining the results of Table 7, *σ_epu_global* is positively associated with cash holdings to total assets at 1%. This suggests that the volatility of the global measure of economic policy of Baker, Bloom, and Davis (2016) also has an important impact on firm cash holdings, as well as the country-specific indices tested in other tables.

While not the focus of this paper, it is interesting to note that the coefficient of *σ_epu_global* is about 50% larger than the coefficient on *σ_epu.*

(Please insert Table 7 about here)

4.6 Instrumented variables

In this section we control for endogeneity by adopting an instrumented variable approach. Our instrument is political fractionalization (*pol_frac*). Political fractionalization is the probability that two deputies picked at random from the legislature will be of different parties from the Database of Political Institutions.

However, we are also concerned that cash holdings can be influenced by the quality of the respective polity. While the quality of the polity is not necessarily related to the concentration of the polity (parliamentary systems are more concentrated compared to USA-style for instance), as a precaution we orthogonalize *pol_frac* against rule of law and control of corruption from the World Bank governance indicators; as well as democracy (the level of institutional democracy from Polity IV), and a dummy variable that is assigned "1" if country has an English legal origin and "0" otherwise. We do this in order to separate out political fractionalization (or concentration) from the overall quality of the polity in general. We then substitute the residuals from Equation 2 for the independent variable *pol_frac*. This new variable is now referred to in the text as *resid_pol_frac*.[5]

[5] As noted by prior studies, the residuals in the first equation may result from an incompletely specified model, and so when variables are estimated from estimated residuals, estimated findings can lose accuracy (Pagan, 1986). Substituting the residuals from a first equation is an example of what Pagan (1984) classifies as a type-two generated regressor. Such models with "generated regressors" may lead to uncertainties in interpretation (Oxley and McAleer, 1993). However, we consider the use of the orthogonalization procedure in this context to be a reasonable trade-off.

$$pol\_frac = \alpha + \phi_1 rule\_law + \phi_2 control\_corruption + \phi_3 common\_law + \phi_4 democracy + \varepsilon \quad (2)$$

We reason that political fractionalization, once orthogonalized against the quality of the polity, is not correlated with firm cash holdings; however; it is related to the volatility of EPU, as it shapes the believability of news. If polities are more fractionalized, the reliability of announcements of public figures is diminished. The believability of public figures to correctly reflect levels of uncertainty is diminished; and so, uncertainty about levels of EPU will be heightened. This is evidenced in the results: the association of political fractionalization is positively significant, consistent with firms' being less comfortable to invest when there is more political fractionalization.

Results, reported in Table 8, show that this two-stage modeling also evidences that cash holdings are increased with uncertainty of uncertainty, with the fitted value of *σ_epu* being significant at 1%.

(Please insert Table 8 about here)

4.7 Tests on alternative samples

In this section, we investigate whether our results are driven by particular regions or economies, since we have an unbalanced dataset with differing number of firms from each country. This analysis is important as it may provide us with some interesting findings at the regional level on the relationship between cash holdings and uncertainty. Consequently, we re-estimate our baseline model for different samples based on locations reflecting the natures of economies. Table 9 reports the results using the same set of independent variables as Model 3 of Table 3. Specifically, in various models, we examine our full sample excluding Japan and the US (the US and Japan are the largest markets); excluding BRICs (as they are considered more volatile economies); excluding European Union (EU) countries; and excluding non-EU countries.[6] While we find that the coefficient of interest (on *σ_epu)* is largest for the non-EU countries sample, overall *σ_epu* is consistently positively significant across all these differing samples at 1% significance level. This indicates results are not driven by choices of country or region.

[6] We consider that EU firms may interact differently with cash holdings than the rest of the world as the European Central Bank plays a major role in formulating economic policies for the EU countries as a whole.

(Please insert Table 9 about here)

5. Discussion

Overall, results across a variety of models and tests affirm consistently a strong positive association of firm cash holdings and the volatility of uncertainty. In a number of models across several tables, we investigate the association of uncertainty of uncertainty with cash holding. In various models, we control for a wide array of firm-level variables; as well as national governance and national culture. We also investigate alternative measures of cash holding as well as both the standard deviation of country-specific indices of EPU and the global index of EPU. We also control for endogeneity with an instrument variable for the standard deviation of policy uncertainty. Across these tests, the standard deviation of EPU, the uncertainty of uncertainty, is highly statistically significant. Importantly, we also test the relative importance of the uncertainty of EPU compared to EPU in terms of impacting firm cash holdings. We find that uncertainty regarding EPU is vastly more economically significant than EPU itself in determining cash levels of firms. Specially, a 1 percentage-point increase in the volatility of EPU results in an increase in firm cash holdings of 2–7 percentage points (or higher in some models), clearly indicating the importance of changes in EPU to firms' cash holdings. Results are robust to differing samples of countries and controlling for endogeneity.

6. Conclusions

As observed by Drobetz et al. (2018) and many others, the measure of Economic Policy Uncertainty (EPU) of Baker, Bloom, and Davis (2016) has been widely applied in finance research. However, related aspects of this very useful measure of uncertainty have only lightly been considered. First, the impact of the uncertainty regarding the measuring of EPU on firm decisions has not generally been considered. Second, there has been little consideration of what current levels of EPU imply about future levels of EPU vis-à-vis uncertainty about what the levels of uncertainty will be in the future. Further, more specifically to cash holdings, Baker, Bloom, and Davis (2016) themselves note the importance of changes in uncertainty impacting investments. Cash is held against the possibility that uncertainty will change (lessen) and cash

will be applied to investment. And so, the volatility of uncertainty is likely very important as a determinant for firm cash holdings. In short, the impact of uncertainty of uncertainty has only lightly been investigated, with regard to the widespread use of the Baker, Bloom, and Davis (2016) measure.

We examine the impact of the volatility of EPU on firm cash holdings. Using the news-based index developed by Baker, Bloom, and Davis (2016) for twenty-two countries, we find that when there is greater volatility of economic uncertainty, firms hold more cash. Importantly, we also find that the ex post volatility of EPU is far more economically impacting on firm cash holdings and EPU itself. In other words, regarding firm cash holdings, Knightian uncertainty matters much more than uncertainty. We expect that both academics and practitioners will be interested in our findings regarding the role of *uncertainty of uncertainty* on firm cash holdings.

References

Abel, Andrew B., and Janice C. Eberly, (1996), "Optimal investment with costly reversibility", *Review of Economic Studies* 63 (4) pp. 581–593.

Abel, Andrew B., and Janice C. Eberly, (1994), "A unified model of investment under uncertainty", *American Economic Review* 84 (5) pp. 1369.

Antonakakis, Nikolaos, Ioannis Chatziantoniou, and George Filis, (2014), "Dynamic spillovers of oil price shocks and economic policy uncertainty", *Energy Economics* 44 pp. 433–447.

Arif, Salman, Nathan Marshall, and Teri Lombardi Yohn, (2016), "Understanding the relation between accruals and volatility: A real options–based investment approach", *Journal of Accounting and Economics* 62 (1) pp. 65–86.

Arouri, Mohamed, Christophe Estay, Christophe Rault, and David Roubaud, (2016), "Economic policy uncertainty and stock markets: Long-run evidence from the US", *Finance Research Letters* 18 pp. 136–141.

Ashraf, Badar Nadeem, and Yinjie Shen, (2019), "Economic policy uncertainty and banks' loan pricing", *Journal of Financial Stability* 44 (1) pp. 1–12 100695.

Attig, Najah, Sadok El Ghoul, Omrane Guedhami, and Xiaoyan Zhan, (2019), "Dividends and economic policy uncertainty: International evidence", forthcoming *Journal of Corporate Finance*.

Baker, Scott R., Nicholas Bloom, and Steven J. Davis, (2016), "Measuring economic policy uncertainty", *Quarterly Journal of Economics* 131 (4) pp. 1593–1636.

Berger, Allen N, Omrane Guedhami, Hugh Hoikwang Kim, and Xinming Li, (2018), "Economic policy uncertainty and bank liquidity hoarding", Working paper University of South Carolina.

Bernanke, Ben S., (1983), "Irreversibility, uncertainty, and cyclical investment", *Quarterly Journal of Economics* 98 (1) pp. 85–106.

Bertola, Guiseppe, and Ricardo J Caballero, (1994), "Irreversibility and aggregate investment", *Review of Economic Studies* 61 (2) pp. 223–246.

Biais, Bruno, Denis Hilton, Karine Mazurier, and Sébastien Pouget, (2005), "Judgmental overconfidence, self-monitoring and trading performance in an experimental financial market", *Review of Economic Studies* 72 (2) pp. 287–312.

Bigelli, Marco, and Javier Sánchez–Vidal, (2012), "Cash holdings in private firms", *Journal of Banking and Finance* 36 (1) pp. 26–35.

Bloom, Nicholas, (2009), "The impact of uncertainty shocks", *Econometrica* 77 (3) pp. 623–685.

Bloom, Nicholas, (2014), "Fluctuations in uncertainty", *Journal of Economic Perspectives* 28 (2) pp. 153–76.

Bonaime, Alice, Huseyin Gulen, and Mihai Ion, (2018), "Does policy uncertainty affect mergers and acquisitions?", *Journal of Financial Economics* 129 (3) pp. 531–558.

Bordo, Michael D, John V Duca, and Christoffer Koch, (2016), "Economic policy uncertainty and the credit channel: Aggregate and bank level US evidence over several decades", *Journal of Financial Stability* 26 pp. 90–106.

Breuer , Wolfgang, Marc Oliver Rieger, and Can Kalender Soypak, (2017), "Ambiguity aversion and cash holdings", *Review of Finance* 21 (5) pp. 1933–1974.

Caprio, Lorenzo, Mara Faccio, and John J. McConnell, (2011), "Sheltering corporate assets from political extraction", *Journal of Law, Economics, and Organization* 29 (2) pp. 332–354.

Carnap, Rudolf, (1950), *Logical Foundations of Probability* (University of Chicago Press, Chicago).

Chen, Deqiu, Sifei Li, Jason Zezhong Xiao, and Hong Zou, (2014), "The effect of government quality on corporate cash holdings", *Journal of Corporate Finance* 27 pp. 384–400.

Chen, Jiun–Lin, Z. Tingting Jia, and Ping–Wen Sun, (2016), "Real option component of cash holdings, business cycle, and stock returns", *International Review of Financial Analysis* 45 pp. 97–106.

Chen, Yangyang, Paul Y. Dou, S. Ghon Rhee, Cameron Truong, and Madhu Veeraraghavan, (2015), "National culture and corporate cash holdings around the world", *Journal of Banking and Finance* 50 pp. 1–18.

Çolak, Gönül, Ali Gungoraydinoglu, and Özde Öztekin, (2018), "Global leverage adjustments, uncertainty, and country institutional strength", *Journal of Financial Intermediation* 35 (A) pp. 41–56.

Das, T. K., and Bing–Sheng Teng, (1998), "Between trust and control: Developing confidence in partner cooperation in alliances", *Academy of Management Review* 23 (3) pp. 491–512.

Datta, Sudip, Trang Doan, and Mai Iskandar-Datta, (2019), "Policy uncertainty and the maturity structure of corporate debt", *Journal of Financial Stability* 44 (1) pp. 1–17

Datta, Deepa, Juan M Londono, Bo Sun, Daniel O Beltran, Thiago R.T. Ferreira, Matteo M Iacoviello, Mohammad R Jahan–Parvar, Canlin Li, Marius Rodriguez, and John H Rogers, (2017), "Taxonomy of Global Risk, Uncertainty, and Volatility Measures", *FRB International Finance Discussion Paper* (1216) pp. 1–46.

Demir, Ender, and Oguz Ersan, (2017), "Economic policy uncertainty and cash holdings: Evidence from BRIC countries", *Emerging Markets Review* 33 pp. 189–200.

Demir, Ender, Giray Gozgor, Chi Keung Marco Lau, and Samuel A Vigne, (2018), "Does economic policy uncertainty predict the Bitcoin returns? An empirical investigation", *Finance Research Letters* 26 pp. 145–149.

Dittmar, Amy, Jan Mahrt–Smith, and Henri Servaes, (2003), "International corporate governance and corporate cash holdings", *Journal of Financial and Quantitative analysis* 38 (1) pp. 111–133.

Dixit, Avinash, and Robert S. Pindyck, (1994), *Investment Under Uncertainty* (Princeton University Press, Princeton, N. J.).

Djankov, S., La Porta, R., Lopez–de–Silanes, F. and Shleifer, A., 2008. The law and economics of self–dealing. *Journal of Financial Economics* 88(3), pp.430–465.

Drobetz, Wolfgang, Sadok El Ghoul, Omrane Guedhami, and Malte Janzen, (2018), "Policy uncertainty, investment, and the cost of capital", *Journal of Financial Stability* 39 pp. 28–45.

Dudley, Evan, and Ning Zhang, (2016), "Trust and corporate cash holdings", *Journal of Corporate Finance* 41 pp. 363–387.

Ellsberg, Daniel, (1961), "Risk, ambiguity, and the Savage axioms", *Quarterly Journal of Economics* 75 (4) pp. 643–669.

Elton, Edwin J., (1999), "Expected return, realized return, and asset pricing tests", *Journal of Finance* 54 (4) pp. 1199–1220.

Epstein, Larry G., and Tan Wang, (1994), "Intertemporal asset pricing under Knightian uncertainty", *Econometrica* 62 (2) pp. 283–322.

Goodell, John W, Richard J McGee, and Frank McGroarty, (2020), "Election uncertainty, economic policy uncertainty and financial market uncertainty: A prediction market analysis", *Journal of Banking and Finance* 110 105684.

Gulen, Huseyin, and Mihai Ion, (2015), "Policy uncertainty and corporate investment", *Review of Financial Studies* 29 (3) pp. 523–564.

Han, Seungjin, and Jiaping Qiu, (2007), "Corporate precautionary cash holdings", *Journal of Corporate Finance* 13 (1) pp. 43–57.

Harford, Jarrad, Robert Dam, and Vineet Bhagwat, (2016), "The real effects of uncertainty on merger activity", *Review of Financial Studies* 29 (11) pp. 3000–3034.

Harford, Jarrad, Sattar A Mansi, and William F Maxwell, (2008), "Corporate governance and firm cash holdings in the US", *Journal of Financial Economics* 87 (3) pp. 535–555.

Hart, Oliver D., (2001), "Financial contracting", *Journal of Economic Literature* 39 (4) pp. 1079–1100.

Hofstede, Geert, (2001), *Culture's Consequences* (Sage Publications, London).

Hubbard, R Glenn, (1994), "Investment under uncertainty: keeping one's options open", *Journal of Economic Literature* 32 (4) pp. 1816–1831.

Hugonnier, Julien, Semyon Malamud, and Erwan Morellec, (2014), "Capital supply uncertainty, cash holdings, and investment", *Review of Financial Studies* 28 (2) pp. 391–445.

Im, Hyun Joong, Heungju Park, and Gege Zhao, (2017), "Uncertainty and the value of cash holdings", *Economics Letters* 155 pp. 43–48.

Ju, Nengjiu, and Jianjun Miao, (2012), "Ambiguity, learning, and asset returns", *Econometrica* 80 (2) pp. 559–591.

Kang, Wensheng, and Ronald A Ratti, (2013), "Oil shocks, policy uncertainty and stock market return", *Journal of International Financial Markets, Institutions and Money* 26 pp. 305–318.

Kim, Hyunseob, and Howard Kung, (2016), "The asset redeployability channel: How uncertainty affects corporate investment", *Review of Financial Studies* 30 (1) pp. 245–280.

Klijn, Erik–Hans, Jurian Edelenbos, and Bram Steijn, (2010), "Trust in governance networks: Its impact and outcomes", *Administration and Society* 42 (2) pp. 193–221.

Knight, Frank H., (1921), *Risk, Uncertainty, and Profit* (Houghton Mifflin, Boston).

Ko, Jun–Hyung, and Chang–Min Lee, (2015), "International economic policy uncertainty and stock prices: Wavelet approach", *Economics Letters* 134 pp. 118–122.

Kusnadi, Yuanto, and KC John Wei, (2011), "The determinants of corporate cash management policies: Evidence from around the world", *Journal of Corporate Finance* 17 (3) pp. 725–740.

Lopez–de–Silanes, F, RF La Porta, A Shleifer, and RW Vishny, (1997), "Trust in large organizations", *American Economic Review* 87 (2) pp. 333–338.

Liu, Li, and Tao Zhang, (2015), "Economic policy uncertainty and stock market volatility", *Finance Research Letters* 15 pp. 99–105.

Maenhout, Pascal J, (2004), "Robust portfolio rules and asset pricing", *Review of Financial Studies* 17 (4) pp. 951–983.

Markus, Hazel Rose, and Shinobu Kitayama, (1998), "The cultural psychology of personality", *Journal of Cross–Cultural Psychology* 29 (1) pp. 63–87.

Muth, John, (1961), "Rational expectations and the theory of price movements", *Econometrica* 29 pp. 299–306.

Neamtiu, Monica, Nemit Shroff, Hal D White, and Christopher D Williams, (2014), "The impact of ambiguity on managerial investment and cash holdings", *Journal of Business Finance and Accounting* 41 (7–8) pp. 1071–1099.

Nguyen, Nam H, and Hieu V Phan, (2017), "Policy uncertainty and mergers and acquisitions", *Journal of Financial and Quantitative Analysis* 52 (2) pp. 613–644.

Nishimura, Kiyohiko G, and Hiroyuki Ozaki, (2007), "Irreversible investment and Knightian uncertainty", *Journal of Economic Theory* 136 (1) pp. 668–694.

Opler, Tim, Lee Pinkowitz, René Stulz, and Rohan Williamson, (1999), "The determinants and implications of corporate cash holdings", *Journal of Financial Economics* 52 (1) pp. 3–46.

Oxley, Les, and Michael McAleer, (1993), "Econometric issues in macroeconomic models with generated regressors", *Journal of Economic Surveys* 7 (1) pp. 1–40.

Pagan, Adrian, (1986), "Two stage and related estimators and their applications", *Review of Economic Studies* 53 (4) pp. 517–538.

Pagan, Adrian, (1984), "Econometric issues in the analysis of regressions with generated regressors ", *International Economic Review* 25 (1) pp. 221–247.

Pástor, Ľuboš, and Pietro Veronesi, (2013), "Political uncertainty and risk premia", *Journal of Financial Economics* 110 (3) pp. 520-545.Pindyck, Robert S, (1993), "Investments of uncertain cost", *Journal of Financial Economics* 34 (1) pp. 53–76.

Poppo, Laura, and Todd Zenger, (2002), "Do formal contracts and relational governance function as substitutes or complements?", *Strategic Management Journal* 23 (8) pp. 707–725.

Ramirez, Andres, and Solomon Tadesse, (2009), "Corporate cash holdings, uncertainty avoidance, and the multinationality of firms", *International Business Review* 18 (4) pp. 307–403.

Rodrik, Dani, (1991), "Policy uncertainty and private investment in developing countries", *Journal of Development Economics* 36 (2) pp. 229–242.

Routledge, Bryan R, and Stanley E Zin, (2009), "Model uncertainty and liquidity", *Review of Economic Dynamics* 12 (4) pp. 543–566.

Runde, Jochen, (1994), "Keynesian uncertainty and liquidity preference", *Cambridge Journal of Economics* 18 (2) pp. 129–144.

Schwartz, Shalom H., (1994), "Beyond individualism/collectivism: new cultural dimensions of values", in Uichol Kim, Harry C. Tiandis, Cigdem Kagitcibasi, Sang–Chin Choi, and Gene Yoon, (eds), *Individualism and Collectivism: Theory, Method, and Applications* (London: Sage Publications) pp. 85–123.

Shao, Liang, Chuck C Y Kwok, and Ran Zhang, (2013), "National culture and corporate investment", *Journal of International Business Studies* 44 (7) pp. 745–763.

Spamann, Holger, (2010), "The "Anti–Directors Rights Index" revisited", *Review of Financial Studies* 23 (2) pp. 467–486.

Stulz, René M, (2005), "The limits of financial globalization", *Journal of Finance* 60 (4) pp. 1595–1638.

Veracierto, Marcelo L., (2002), "Plant–level Iireversible investment and equilibrium business cycles", *American Economic Review* 92 (1) pp. 181–197.

Williamson, Oliver E., (1988), "Corporate finance and corporate governance", *Journal of Finance* 43 (3) pp. 567–592.

Wisniewski, Tomasz Piotr, and Brendan John Lambe, (2015), "Does economic policy uncertainty drive CDS spreads?", *International Review of Financial Analysis* 42 pp. 447–458.

Table 1. Descriptive statistics

Country	Obs	Firms	Start year	*csh_assts*	*σ_epu*	*epu*	*size*	*leverage*	*roa*	*payout*	*σ_cf*	*mktbk*	*sls_grwth*	*wrkng_cap*	*σ_stk_mkt*
Australia	15,405	1,517	1998	0.560	0.417	4.593	3.533	0.146	0.118	0.020	0.411	3.179	0.687	0.024	0.039
Brazil	3,797	279	1993	0.315	0.555	4.889	6.622	0.289	0.012	0.025	0.060	4.216	0.283	0.005	0.076
Canada	10,948	1,094	1993	0.386	0.449	4.903	4.922	0.219	–0.032	0.025	0.588	2.059	0.295	0.012	0.039
Chile	2,520	158	1993	0.231	0.312	4.594	5.875	0.231	0.052	0.043	0.066	2.132	0.326	0.043	0.040
China	27,622	2,806	1995	0.371	0.684	5.044	6.135	0.246	0.366	0.015	0.899	3.068	0.631	0.031	0.072
France	8,543	532	1993	0.277	0.482	4.874	5.791	0.211	0.004	0.015	0.070	2.580	0.568	0.088	0.051
Germany	8,233	540	1993	0.295	0.427	4.773	5.646	0.199	0.000	0.021	0.100	3.023	0.396	0.131	0.057
Greece	3,136	228	1998	0.216	0.407	4.709	5.148	0.332	–0.007	0.019	0.044	6.687	0.164	0.039	0.082
Hong Kong	14,167	1,019	1998	0.454	0.521	4.814	5.263	0.199	0.211	0.026	0.602	2.529	0.290	0.082	0.058
India	21,176	2,087	2003	0.148	0.324	4.600	4.443	0.301	0.030	0.012	0.053	2.088	0.253	0.097	0.062
Ireland	721	53	1993	0.347	0.373	4.591	5.968	0.246	–0.011	0.021	0.088	4.001	0.257	0.034	0.050
Italy	3,036	209	1997	0.255	0.280	4.659	6.394	0.274	–0.009	0.016	0.044	2.027	0.189	0.028	0.058
Japan	60,664	3,336	1993	0.326	0.214	4.642	5.914	0.222	0.016	0.011	0.030	1.635	0.181	0.088	0.055
South Korea	21,293	1,605	1993	0.310	0.449	4.816	5.257	0.245	0.008	0.010	0.068	1.471	0.263	0.060	0.053
Mexico	1,381	86	1996	0.268	0.362	4.353	6.926	0.249	0.035	0.021	0.046	1.925	0.107	0.042	0.053
Netherlands	1,228	110	2003	0.257	0.277	4.515	6.582	0.241	–0.056	0.047	0.138	3.439	0.104	0.051	0.049
Russia	1,902	228	1997	0.256	0.575	4.937	6.932	0.272	0.053	0.019	0.076	2.689	0.110	0.008	0.102
Singapore	6,253	530	2003	0.345	0.284	4.726	4.753	0.204	0.011	0.045	0.197	2.165	0.140	0.124	0.045
Spain	1,511	122	2001	0.262	0.410	4.675	6.830	0.324	0.033	0.024	0.090	3.841	0.142	–0.006	0.055
Sweden	3,687	244	1993	0.256	0.131	4.527	5.338	0.185	–0.006	0.030	0.087	3.136	0.218	0.124	0.051
UK	14,896	1,347	1997	0.335	0.511	4.923	4.831	0.175	–0.188	0.031	0.251	3.127	0.197	0.046	0.040
USA	44,891	2,638	1993	0.339	0.307	4.713	6.719	0.228	0.027	0.038	0.105	2.957	0.119	0.120	0.040

Table lists by country the respective number of observations, firms; as well as the starting year of EPU data. Country-level means for baseline variables are also listed. Variables are defined in Appendix A

Table 2: Descriptive statistics and summary of data sources

Variable	obs	Mean	Median	σ	5th%	95th%
σ_epu	277,010	0.333	0.270	0.259	0.022	0.861
epu	277,010	0.383	0.301	0.284	0.107	0.942
csh_assts	277,010	4.751	4.753	0.414	4.146	5.450
size	277,010	5.621	5.504	2.099	2.268	9.345
leverage	277,010	0.227	0.197	0.202	0.000	0.593
roa	277,010	0.020	0.026	35.656	–0.329	0.147
payout	277,010	0.021	0.006	0.283	0.000	0.078
σ_cf	277,010	0.297	0.027	26.085	0.004	0.320
mktbk	277,010	1.982	1.440	432.286	0.260	7.720
sls_grwth	277,010	0.096	0.061	7.731	–0.395	0.875
wrkng_cap	277,010	0.075	0.078	0.249	–0.302	0.469
gdp	277,010	28.582	28.631	1.241	26.155	30.413
gdpgr	277,010	0.025	0.018	0.031	–0.014	0.084
rule_law	277,010	1.104	1.406	0.745	–0.434	1.824
σ_stk_mkt	277,010	0.053	0.048	0.027	0.021	0.098

Table lists the number of observations, mean, standard deviations, median, 5th and 95th percentile values. Variables are defined in Appendix A. Minimum and maximum; and sources of variables used in regressions reported in Tables 1 and 3–4

Table 3: Initial regression results

	csh_assts				
	1	**2**	**3**	**4**	**5**
σ_epu	0.057***	0.058***	0.055***	0.054***	0.368***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
size		–0.004***	–0.005***	–0.005***	–0.005***
		(0.005)	(0.000)	(0.000)	(0.000)
leverage		–0.183***	–0.182***	–0.182***	–0.183***
		(0.000)	(0.000)	(0.000)	(0.000)
roa		–0.007	0.010	0.006	0.028
		(0.249)	(0.249)	(0.250)	(0.247)
payout		0.006***	0.006***	0.006***	0.006***
		(0.001)	(0.001)	(0.001)	(0.001)
σ_cf		0.008**	0.007**	0.007**	0.007**
		(0.024)	(0.029)	(0.029)	(0.029)
mktbk		0.010***	0.010***	0.010***	0.010***
		(0.000)	(0.000)	(0.000)	(0.000)
sls_grwth		–0.037*	–0.038*	–0.038*	–0.036*
		(0.080)	(0.074)	(0.075)	(0.087)
wrkng_cap		0.010**	0.009**	0.009**	0.010**
		(0.028)	(0.046)	(0.045)	(0.035)
gdp			0.014***	0.014***	0.012***
			(0.000)	(0.000)	(0.000)
gdpgr			0.078***	0.080***	0.076***
			(0.001)	(0.001)	(0.002)
rule_law			0.037***	0.037***	0.030***
			(0.000)	(0.000)	(0.000)
σ_stk_mkt			0.079****	0.079***	0.068***
			(0.001)	(0.001)	(0.002)
epu				0.001	0.016***
				(0.521)	(0.000)
*σ_epu*epu*					–0.055***
					(0.000)
Regression type	Fixed effect panel regression				
Firm FE	Yes				
Year FE	Yes				
Observations	277,010	277,010	277,010	277,010	277,031
Adjusted R–square	0.030	0.170	0.214	0.214	0.231

*Significant at 10% level, **significant at 5% level; ***significant at 1% level. Variables are defined in Appendix A. P–values in parentheses.

Table 4: Controlling for national culture

	csh_assts	
	1	**2**
σ_epu	0.034*** (0.000)	0.043*** (0.000)
idv	–0.124*** (0.000)	
uai	0.076*** (0.000)	
egal		0.086*** (0.000)
harmony		0.044*** (0.000)
σ_epu idv*	–0.096*** (0.000)	
σ_epu uai*	0.093*** (0.000)	
*σ_epu*egal*		0.030*** (0.000)
*σ_epu*harmony*		0.019*** (0.003)
size	–0.010*** (0.000)	–0.010*** (0.000)
leverage	–0.207*** (0.000)	–0.207*** (0.000)
roa	–0.009 (0.243)	–0.005 (0.246)
payout	0.006*** (0.002)	0.006*** (0.002)
σ_cf	0.007** (0.032)	0.007** (0.034)
mktbk	0.011*** (0.000)	0.011*** (0.000)
sls_grwth	–0.025* (0.072)	–0.027* (0.060)
wrkng_cap	–0.004 (0.315)	–0.005 (0.232)
gdp	0.026*** (0.000)	0.013*** (0.000)
gdpgr	0.007 (0.763)	0.035 (0.125)
rule_law	0.070*** (0.000)	0.059*** (0.000)
σ_stk_mkt	0.092*** (0.000)	0.085*** (0.000)
Regression type	Random effects panel regression	
Industry FE	Yes	
Year FE	Yes	
Observations	277,010	277,010
Adjusted R square	0.268	0.274

*Significant at 10% level, **significant at 5% level; ***significant at 1% level. Variables are defined in Appendix A. P–values in parentheses.

Table 5: Controlling for national governance

	csh_assts	
	1	**2**
σ_epu	0.037*** (0.000)	0.075*** (0.000)
shrhldr_rghts	0.069*** (0.000)	
*σ_epu * shrhldr_rghts*	–0.032*** (0.000)	
cntrl_corruption		0.102*** (0.000)
*σ_epu * cntrl_corruption*		–0.055*** (0.000)
size	–0.010*** (0.000)	–0.010*** (0.000)
leverage	–0.205*** (0.000)	–0.208*** (0.000)
roa	–0.032 (0.247)	–0.008 (0.244)
payout	0.006*** (0.002)	0.006*** (0.003)
σ_cf	0.007** (0.035)	0.007** (0.031)
mktbk	0.011*** (0.000)	0.011*** (0.000)
sls_grwth	–0.028* (0.060)	–0.028* (0.060)
wrkng_cap	–0.004 (0.343)	–0.004 (0.398)
gdp	0.009*** (0.000)	0.018*** (0.000)
gdpgr	0.023 (0.321)	0.052** (0.025)
rule_law	0.063*** (0.000)	0.049*** (0.000)
σ_stk_mkt	0.074*** (0.001)	0.080*** (0.000)
Regression method	Random effects panel	
Industry FE	Yes	
Year FE	Yes	
Observations	277,010	277,010
Adjusted R–square	0.282	0.257

*Significant at 10% level, **significant at 5% level; ***significant at 1% level. Variables are defined in Appendix A. P–values in parentheses.

Table 6: Robustness tests: Alternative measures of cash holding

	1	2	3	4	5
	cash_sls	***Δcash***	***ccc***	***Δccc***	***csh_net_assts***
σ_epu	0.077*** (0.000)	0.029** (0.019)	–0.019*** (0.004)	–0.034*** (0.000)	0.063*** (0.000)
size	0.244** (0.026)	0.113*** (0.000)	0.202*** (0.000)	0.018*** (0.000)	0.002 (0.143)
leverage	–0.461* (0.058)	–0.346*** (0.000)	0.750*** (0.000)	0.158*** (0.000)	0.082*** (0.000)
roa	0.008* (0.060)	–0.002** (0.048)	–0.005 (0.583)	–0.007 (0.812)	0.005 (0.216)
payout	0.033*** (0.000)	–0.046 (0.135)	0.032*** (0.000)	0.015*** (0.000)	0.007*** (0.003)
σ_cf	0.008 (0.602)	0.066*** (0.000)	0.011 (0.257)	–0.004 (0.250)	0.006* (0.059)
mktbk	0.059 (0.168)	–0.177*** (0.000)	–0.056*** (0.000)	0.004 (0.792)	0.091*** (0.002)
sls_grwth	–0.080** (0.048)	0.290*** (0.004)	–0.047* (0.083)	–0.319*** (0.007)	–0.031* (0.059)
wrkng_cap	–0.158 (0.400)	0.225*** (0.000)	0.802*** (0.000)	0.302*** (0.000)	–0.004 (0.517)
gdp	0.045** (0.026)	–0.086*** (0.000)	–0.058*** (0.000)	0.004* (0.060)	0.017*** (0.000)
gdpgr	1.910* (0.067)	–0.242** (0.023)	–0.410*** (0.000)	0.034 (0.154)	0.056** (0.045)
rule_law	0.166** (0.031)	0.083*** (0.000)	0.047** (0.013)	0.043*** (0.003)	0.028*** (0.000)
σ_stk_mkt	0.277 (0.250)	0.824*** (0.000)	–0.428*** (0.002)	0.110 (0.246)	0.130*** (0.000)
Regression method			Fixed effect panel regression		
Firm FE			Yes		
Year FE			Yes		
Observations	275,626	275,025	227,617	227,498	260,502
Adjusted R–square	0.179	0.177	0.161	0.162	0.198

*Significant at 10% level, **significant at 5% level; ***significant at 1% level. Variables are defined in Appendix A. P–values in parentheses.

Table 7. Robustness test: Global volatility of EPU

	Model 1
	csh_assts
σ_epu_global	0.084*** (0.000)
size	–0.011*** (0.000)
leverage	–0.208*** (0.000)
roa	0.009 (0.243)
payout	0.006*** (0.001)
σ_cf	0.007** (0.046)
mktbk	0.011*** (0.000)
sls_grwth	–0.029 (0.103)
wrkng_cap	–0.002 (0.631)
gdp	0.017*** (0.000)
gdpgr	–0.024 (0.314)
rule_law	0.035*** (0.000)
σ_stk_mkt	0.054** (0.017)
Regression type	Fixed effects panel regression
Observations	264,832
Adjusted R square	0.349
Industry FE	Yes
Year FE	Yes

*Significant at 10% level, **significant at 5% level; ***significant at 1% level. Variables are defined in Appendix A. P–values in parentheses.

Table 8: Robustness tests: Controlling for endogeneity with instrumented variable

	Model	
	1	**2**
	σ_epu	***csh_assts***
resid_pol_frac	0.097*** (0.000)	
fitted_σ_epu		2.201*** (0.000)
size	0.041*** (0.001)	–1.445*** (0.000)
leverage	–0.003*** (0.062)	–0.381*** (0.000)
roa	–0.007** (0.524)	–0.027 (0.569)
payout	0.008*** (0.049)	0.027 (0.073)
σ_cf	0.036** (0.086)	0.008 (0.025)
mktbk	0.010*** (0.000)	0.009*** (0.000)
sls_grwth	–0.023 (0.429)	–0.018 (0.083)
wrkng_cap	–0.030*** (0.013)	0.012*** (0.005)
gdp	0.135*** (0.000)	0.322*** (0.000)
gdpgr	–0.807*** (0.000)	–1.830*** (0.000)
rule_law	0.114*** (0.000)	0.314*** (0.000)
σ_stk_mkt	0.788*** (0.000)	2.006*** (0.000)
Regression type	Fixed effect panel regression	
Observation	232,167	232,167
Firm. fixed effects	yes	
Year fixed effects	yes	
Excluded instrument test	105.09*** (0.000)	
Kleibergen–Paap LM	106.12*** (0.000)	

*Significant at 10% level, **significant at 5% level; ***significant at 1% level. Variables are defined in Appendix A. P–values in parentheses.

Table 9: Testing on differing country samples

	csh_assts			
	1 **No Japan or USA**	**2** **No BRICs**	**3** **Only EU**	**4** **Only Non-EU**
σ_epu	0.051*** (0.000)	0.068*** (0.000)	0.033*** (0.000)	0.070*** (0.000)
size	–0.007*** (0.000)	–0.007*** (0.000)	–0.001 (0.857)	–0.006*** (0.000)
leverage	–0.218*** (0.000)	–0.181*** (0.000)	–0.166*** (0.000)	–0.186*** (0.000)
roa	0.018 (0.248)	0.028 (0.205)	0.008 (0.105)	0.026 (0.231)
payout	0.005*** (0.000)	0.006*** (0.000)	0.032*** (0.005)	0.005*** (0.000)
σ_cf	0.007** (0.041)	0.009 (0.221)	0.049*** (0.000)	0.007** (0.043)
mktbk	0.011*** (0.000)	–0.003 (0.309)	–0.061 (0.490)	0.010*** (0.000)
sls_grwth	–0.052* (0.061)	–0.041* (0.082)	–0.013 (0.307)	–0.047* (0.085)
wrkng_cap	–0.007 (0.183)	0.032*** (0.000)	0.065*** (0.000)	–0.001 (0.849)
gdp	–0.005 (0.239)	0.065*** (0.000)	–0.010 (0.547)	0.011*** (0.001)
gdpgr	0.067** (0.014)	0.179*** (0.000)	0.127** (0.040)	0.106*** (0.000)
rule_law	0.020*** (0.005)	0.044*** (0.000)	0.064*** (0.000)	0.050*** (0.000)
σ_stk_mkt	–0.016 (0.459)	0.390*** (0.000)	0.086 (0.319)	0.078*** (0.001)
Regression method	Fixed effect panel regression			
Firm FE	Yes			
Year FE	Yes			
Observations	171,455	222,513	41,955	235,055
Adjusted R–square	0.215	0.140	0.137	0.267

*Significant at 10% level, **significant at 5% level; ***significant at 1% level. Variables are defined in Appendix A. P–values in parentheses.

Appendix A: Variable definitions and sources

Variable	Definition
σ_epu	Standard deviation of the monthly country-specific economic policy uncertainty (*epu*) index over the twelve months ending in the month of the fiscal year-end. Source: Baker et al. (2016).
size	Log transformation of book value of the total assets of the firm at the end of the financial year (in million US$). Source: Worldscope.
leverage	Total debt divided by total assets of the firm at the end of the financial year. Source: Worldscope.
roa	EBIT divided by total assets of the firm at the end of the financial year. Source: Worldscope.
payout	Sum of common cash dividend paid and share repurchases divided by total assets of the firm at the end of the financial year. Source: Worldscope.
σ_cf	Standard deviation of the past three financial year net income divided by the total assets of the firm. Source: Worldscope.
mktbk	Market to book value of the firm at the end of the financial year. Source: Worldscope.
sales_grwth	Annual change in the total sales of the firm. Source: Worldscope.
wrkng_cap	Total working capital divided by total assets of the firm at the end of the financial year. Working capital is the difference between the current assets and current liabilities. Source: Worldscope.
gdp	Log transformation of the country–specific GDP at the end of the financial year (in constant 2010 million US$). Source: World Development Indicators.
gdpgr	Country-specific GDP per capita growth at the end of the financial year. Source: World Development Indicators.
rule_law	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and, in particular, the quality of contract enforcement. Source: World Governance Indicators.
idv	Country-specific individualism index. Source: Hofstede (2001).
uai	Country-specific uncertainty avoidance index. Source: Hofstede (2001).
egal	Country-specific egalitarianism index. Source: Schwartz (1994).
harmony	Country-specific harmony index. Source: Schwartz (1994).
shrhldr_rghts	Country-specific shareholder rights index. Source: Djankov et al. (2008), and Spamann (2010).
cntrl_corruption	Country-specific perceived levels of public sector corruption, as determined by expert assessments and opinion surveys at the end of the financial year. Source: Transparency International.
Δcash	Annual change in cash and short-term investments of the firm. Source: Worldscope.
csh_assts	Cash and short-term investments divided by total assets of the firm at the end of the financial year. Source: Worldscope.
csh_sls	Cash and short-term investments divided by total sales of the firm at the end of the financial year. Source: Worldscope.
Δccc	Annual change in cash conversion cycle of the firm. Source: Worldscope.
ccc	Natural log of cash conversion cycle of the firm at the end of the financial year (in calendar days). The cash conversion cycle is the sum of the average number of days inventory is held and the average number of days it takes for the firm to receive the money for the goods sold minus the average number of days it takes for the firm to pay its bills for the goods sold. We drop firms with negative CCC days. Data is sourced from Worldscope .
csh_net_assts	Cash and short–term investments divided by total assets minus short-term debt of the firm at the end of the financial year. Source: Worldscope
σ_epu_global	Standard deviation of the monthly global economic policy uncertainty (*global_epu*) index over the twelve months ending in the month of the fiscal year end. Source: Baker et al. (2016)
σ_stk_mkt	Stock market volatility. The standard deviation of the weekly equally weighted benchmark country-specific stock index. Country-specific equally weighted benchmark index values from Datastream.
pol_frac	Probability that two deputies picked at random from the legislature will be of different parties. Source: Database of Political Institutions.

Appendix B: Pearson correlation coefficients

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	cash_ta	1.000																			
2	*cash_sls*	0.636	1.000																		
3	*Δcash*	0.102	0.100	1.000																	
4	*ccc*	–0.208	0.023	–0.009	1.000																
5	*Δccc*	–0.010	0.106	–0.016	0.140	1.000															
6	*csh_net_assts*	0.921	0.591	0.109	–0.177	0.008	1.000														
7	*σ_epu*	0.128	0.165	0.018	–0.080	–0.011	0.142	1.000													
8	*epu*	0.134	0.123	–0.020	–0.060	–0.009	0.145	0.775	1.000												
9	*size*	–0.068	–0.042	–0.039	0.275	–0.020	0.025	0.029	0.057	1.000											
10	*leverage*	–0.411	–0.207	–0.015	0.127	–0.001	–0.095	–0.005	–0.016	0.212	1.000										
11	*roa*	–0.011	–0.014	0.013	0.007	0.000	–0.011	–0.005	–0.004	0.034	–0.003	1.000									
12	*payout*	0.020	0.009	–0.009	0.007	0.004	0.013	0.003	0.002	0.009	–0.022	–0.045	1.000								
13	*σ_cf*	0.010	0.012	0.014	–0.006	0.003	0.007	0.007	0.001	–0.025	–0.007	–0.298	0.014	1.000							
14	*mktbk*	0.004	0.003	0.001	–0.005	0.002	0.003	0.006	0.001	–0.009	–0.005	–0.002	0.001	0.001	1.000						
15	*sls_grwth*	0.000	0.003	0.022	0.001	–0.008	–0.001	0.003	0.002	–0.003	0.000	0.000	0.000	0.008	0.001	1.000					
16	*wrkng_cap*	0.078	–0.033	0.025	0.238	0.009	–0.093	–0.029	–0.005	–0.189	–0.448	0.033	0.002	–0.019	–0.005	0.000	1.000				
17	*gdp*	0.031	–0.069	–0.038	0.083	–0.033	0.038	0.020	0.141	0.251	–0.022	0.010	0.001	–0.012	0.001	–0.002	0.065	1.000			
18	*gdpg*	–0.026	0.057	0.044	0.070	0.011	–0.011	0.119	–0.079	–0.090	0.058	0.008	–0.007	0.001	0.010	0.009	–0.050	–0.062	1.000		
19	*rule_law*	0.066	–0.023	–0.027	–0.131	–0.007	0.021	–0.273	–0.139	0.033	–0.140	–0.010	0.015	0.006	–0.010	–0.004	0.092	–0.060	–0.605	1.000	
20	*σ_stk_mkt*	–0.015	0.007	0.014	0.040	0.012	0.011	0.099	0.114	–0.020	0.067	0.000	–0.011	0.001	0.001	0.006	–0.047	–0.093	0.060	–0.360	1.000

Appendix C: Controlling for differing levels of uncertainty

	csh_assts			
	Bottom decile of *epu*	Bottom quartile of *epu*	Top quartile of *epu*	Top decile *of epu*
	1	**2**	**3**	**4**
σ_epu	0.224***	0.137***	0.034***	0.011***
	(0.000)	(0.000)	(0.000)	(0.004)
size	–0.009*	–0.003	–0.007**	–0.009*
	(0.057)	(0.145)	(0.013)	(0.072)
leverage	–0.199***	–0.178***	–0.218***	–0.225***
	(0.000)	(0.000)	(0.000)	(0.000)
roa	–0.006*	0.002*	–0.002**	0.015
	(0.063)	(0.081)	(0.037)	(0.264)
payout	0.036*	0.027**	0.003*	0.018***
	(0.098)	(0.032)	(0.075)	(0.006)
σ_cf	0.013	0.009	0.007***	0.018
	(0.406)	(0.465)	(0.000)	(0.116)
mktbk	0.001	0.001	–0.002	–0.001
	(0.901)	(0.647)	(0.413)	(0.983)
sls_grwth	–0.005*	–0.002*	–0.014*	–0.005*
	(0.053)	(0.082)	(0.051)	(0.081)
wrkng_cap	0.010	0.021***	–0.014	–0.009
	(0.493)	(0.007)	(0.112)	(0.594)
gdp	–0.006***	0.064***	0.017**	0.078***
	(0.797)	(0.000)	(0.044)	(0.001)
gdpgr	0.949***	0.160***	0.288***	0.866
	(0.000)	(0.004)	(0.000)	(0.982)
rule_law	0.021	0.063***	0.130***	0.054
	(0.491)	(0.000)	(0.000)	(0.270)
σ_stk_mkt	0.077***	0.049*	0.092*	0.365***
	(0.003)	(0.066)	(0.057)	(0.000)
Regression type	Fixed effect panel regression			
Firm FE	Yes			
Year FE	Yes			
Observations	27,992	68,071	68,129	27,745
Adjusted R–square	0.157	0.129	0.160	0.127

This table reports the results of tests on subsamples based on levels of economic policy uncertainty. *Significant at 10% level, **significant at 5% level; ***significant at 1% level. Variables are defined in Appendix A. P-values in parentheses.