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Abstract

This paper investigates whether and how economic policy uncertainty affects corporate debt maturity. Using a large firm-level dataset for four European countries, we find that an increase in economic policy uncertainty is significantly associated with a shortened debt maturity. Moreover, the impacts are stronger for innovation-intensive firms. We use firms' flexibility in changing debt maturity and the deviation to leverage target to gauge the causal relationship, and identify the reduced investment and steepened term structure as the transmission mechanisms.

Keywords: capital structure, corporate investment, debt maturity, economic policy uncertainty

JEL classification: D81, G32

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1 Introduction

The prevalence of short-term borrowing has gained increasing attention since the global financial crisis, as the overreliance on short-term debt lies at the root of the crisis (Brunnermeier 2009). In this paper, we investigate whether and how increased economic policy uncertainty (EPU) affect corporate debt maturity. This question is of great importance because EPU has become a substantial concern in the post-crisis era, amid the COVID-19 crisis in particular, and the policy uncertainty in the US and global economies has already risen to extraordinarily high levels, reflecting the rapidly changing landscape of the economic environment and increasingly diverse policy appeals (Baker et al. 2020, Altig et al. 2020). If EPU creates negative externalities for the financial markets through the debt maturity channel, then policymakers should monitor the debt maturity structure more carefully and take timely actions to prevent the build-up of risks.

This study empirically investigates the effect of policy-related uncertainty on corporate debt maturity with cross country firm-level panel dataset. Using firm-level data can largely mitigate concerns on reverse causality, as it is unlikely that individual firm-specific factors would affect the aggregate EPU, which mainly arises from the implementation of large-scale reforms and specific terms of any political agenda (Baker et al. 2016). Additionally, it allows us to distinguish the firms that are more affected by heightened policy uncertainty and thus identify the underlying mechanism that links policy uncertainty and financial stability. Specifically, we provide new evidence of a causal interpretation between economic policy uncertainty and the shortened debt maturity, and examine its transmission channels of reduced investment and steepened term structure.

Theoretically speaking, economic policy uncertainty could shorten the corporate debt maturity structure in four different ways. First, heightened uncertainty exacerbates agency cost problem between shareholders and debtholders, which could lead to the increased use of short-term debt to address the underinvestment problem (Myers 1977). In addition, the degree of information asymmetry between debtors and creditors increases with economic policy uncertainty (Nagar et al. 2019); thus, firms with good quality have stronger incentives to use short-term debt so that they can signal its project quality to the outside lenders (Flannery 1986, Diamond 1991). Second, an increase in policy uncertainty is likely to exaggerate (or originate from) the disagreement between borrowers (optimists) and lenders (pessimists). Then even after considering the possible rollover risk, a borrower will prefer short-term to long-term contracts (He and Xiong 2012a) due to the improved investment opportunity after interim negative fundamental shocks. Third, the recent evidence suggests that economic policy or political uncertainty reduces asset maturity through decreased investment and increased cash holdings (Gulen and Ion 2015, Kim and Kung 2016, Phan et al. 2019), so the shortened maturity on the asset side is expected to lower the maturity on the liability side (Stohs and Mauer 1996). Fourth, increased policy uncertainty tends to increase the possibility that firms cannot keep their commitment to the current debt structure. As shown in Brunnermeier and Oehmke (2013), a lack of commitment to maturity structure will lead to excessively short maturities.

Using a large sample of over 1.5 million observations over the years from 1996 to 2010 in four European countries, i.e., Germany, France, Italy, and Spain, we find that economic policy uncertainty significantly reduces corporate debt maturity. Specifically, using the news-based index from Baker et al. (2016) as the proxy for economic policy uncertainty, we find that after controlling effects from firm, industry and country characteristics, a 1% increase in economic policy uncertainty is associated with a 0.22% decrease in long-term debt and a 0.08% decrease in debt maturity (long-term debt's fraction in total debt). To establish a causal relationship, we first use the industry-level innovation intensity to proxy firms' need for long-term financing and find that the negative impact on corporate debt maturity is stronger for sectors that have higher innovation intensity. We use innovation intensity to proxy the need for long-term debt because innovation-intensive sectors have more long-term investment in R&D, which is in line with the work of Lerner et al. (2011), who also use patent activity to proxy innovation activity and long-run investment. Second, the influence of uncertainty would only arise among firms that are flexible to adjust debt maturity. Therefore, we construct a treated group consisting of firms whose debt maturity structure is more flexible and find that the debt maturity becomes significantly shorter in the treated firms than in the untreated firms when economic policy uncertainty increases. Third, we use the deviation to leverage target to further identify the causality because we expect to observe a more substantial reduction in leverage and debt maturity when the firms are above their leverage targets (if any) because they are more motivated and have more space to lower debt. Results show that firms above leverage target are more negatively affected by heightened uncertainty and do show larger shortening of debt maturity, and the more the firms are above their leverage target, the stronger the impacts of uncertainty.

Next, we test the transmission channel between economic policy uncertainty and shortened debt maturity and the results suggest that this relationship works through the reduced investment and steepened term structure. On one hand, there are much evidence in the literature showing that increased EPU lowers firm investment (Gulen and Ion 2015, Kim and Kung 2016, Baker et al. 2016, Jens 2017), and the lowered investment could affect debt maturity structure. We find that the shortening of debt maturity is stronger for firms with lower asset redeployability, longer time-to-build, and higher investment intensity. On the other hand, EPU increases the long-term rate and causes a steeper term structure. Using the term structure predicted from uncertainty, we show that more expensive long-term borrowing results in shorter debt maturity. Thus, these findings demonstrate that the shortened debt maturity is the result of both weaker demand and supply, and the supply side force might be relatively stronger as reflected in the increased cost of long-term borrowing.

Then we provide some additional analysis. First, we examine whether the source of EPU matters. We find an insignificant effect of US and global uncertainty and it is the domestic economic policy uncertainty that drives a shorter corporate debt maturity. However, there are heterogeneous effects for export- or import-dependent firms. When the firms have a large export intensity and are more affected by the US or foreign economies, an increase in US and global uncertainty significantly brings deteriorated reduction of long-term debt and shorter debt maturity. Second, we examine whether economic policy uncertainty affects corporate liquidity management. We use firm cash holdings as the dependent variable and find that more economic policy uncertainty is significantly associated with more cash holdings, which is consistent with the findings in the recent literature (Demir and Ersan 2017, Phan et al. 2019). By interpreting firms' cash holding as a proxy for asset maturity, the results also indicate that EPU is associated with shortened asset maturity.

Finally, we perform robustness checks and placebo tests. The main findings remain strong when we use the lagged term of EPU, the precrisis subsample, alternative measurements of sector-level innovation intensity, the level of total debt, long-term debt and short-term debt or additionally control for election and natural disaster shocks. Additionally, we conduct a placebo test using the EPU from other countries, and then, the effect of the falsified economic policy uncertainty becomes insignificant.

Literature Review This paper contributes to the existing literature in three aspects. First, we introduce country-level EPU as a significant determinant of the corporate debt maturity structure. Recently, there has been a growing number of studies demonstrating that country-level factors, including stock market activity, banking sector size, government subsidy, institutional environment, and national culture, exert a first-order influence on the corporate debt structure (Demirguc and Maksimovic 1999, Fan et al. 2012, Zheng et al. 2012). The role of economic policy uncertainty has not yet been systemically studied with one exception: Bussière et al. (2004) show that exchange rate uncertainty is associated with shorter debt maturity and higher output volatility. However, their investigation is at the macro level, and they focus on the impacts of exchange rate uncertainty only. In contrast, we provide cross-country firm-level evidence of a causal relationship between broad EPU and corporate debt maturity.

Second, this paper adds to the growing literature investigating the effect of EPU on various corporate policies. For instance, there are studies estimating the effect of uncertainty on investment (Gulen and Ion 2015, Kim and Kung 2016), merger and acquisition (M&A) activity (Nguyen and Phan 2017, Bonaime et al. 2018), risk premiums (Pastor and Veronesi 2012) and corporate debt financing costs (Waisman et al. 2015). More recently, discussions on the relationship between policy uncertainty and debt maturity are also growing (Pan et al. 2019, Datta et al. 2019). However, our paper significantly differs from them in several aspects. First, our results are mainly based on a cross-country firm-level dataset for the small and medium-sized private enterprises in four European countries, while they are both limited to US-listed firms. In the uncertainty literature, the majority of attention is paid to the US and large public firms, but without doubt, the small and private firms which drive the dynamics of the economy and account for huge share of employment and investment, deserve more attention. Second, we identify the underlying mechanisms as the reduction in investment and steepened term structure, and we use the innovation intensity to proxy firms' need for long-term debt and use the maturity flexibility and deviation to leverage target to trace the causality of the findings. Lastly, we study the different impacts from internal and external uncertainty, and discuss the role of exposure to trade in transmitting external uncertainty to domestic firms.

Third, we contribute to the literature on the financial instability consequences of uncertainty. We connect the EPU with the much-investigated impact of debt maturity on credit risk (Gopalan et al. 2014, He and Xiong 2012a,b, Diamond and He 2014) and suggest a debt maturity channel through which EPU threatens financial stability. The policy implications are that regulators should closely monitor the change in debt maturity structure during episodes of high uncertainty, especially for firms in innovation-intensive industries, to prevent a large shortening in debt maturity and accumulation of financial risk.

The rest of the paper is structured as follows. Section 2 describes the data and variable construction. Section 3 presents the empirical methodology, the baseline results, and the examination of transmission mechanism. Section 4 discusses the relative role of domestic and global uncertainty as well as the impact on cash holdings. Section 5 concludes.

2 Data and Variables

2.1 Debt Maturity and Firm Controls

Our firm-level dataset is obtained from *Orbis*, a database provided by Bureau van Dijk (BvD). In contrast to other widely used firm-level databases, such as *Compustat* and *Worldscope*, which cover large listed companies, most firms in *Orbis* are small and medium-sized enterprises (SMEs). Studies such as Kalemli-Ozcan et al. (2015) and Gopinath et al. (2017) have shown that *Orbis* has a good national coverage, especially in European countries where such reporting is mandated, even for small private firms. In our sample, 98% of the firms are SMEs. SMEs are the primary driver of employment and growth in these economies, and their performance matters a great deal for evaluating the effects of EPU.[1] We use the data of Germany, France, Italy, and Spain in this study because they are the countries that have both high-quality firm-level data and EPU measurements.

We clean the Orbis data following the guidelines of Kalemli-Ozcan et al. (2015) and Gopinath et al. (2017), along with conventional accounting rules. The detailed cleaning steps are provided in Appendix A1. To ensure cross-country comparability, in the regression analysis, we express all financial variables in real 2005 dollars[2]. We drop financial intermediations and only keep nonfinancial corporations. We do not limit the data in the manufacturing sector to have more variations in sector-level characteristics such as innovation intensity. Besides, main findings remain in the subsample considering manufacturing sectors only.

We use the ratio of long-term debt in total debt as the proxy for debt maturity. The caveat is that we do not observe the actual years of debt maturity in the *Orbis* database, but the same proxy approach is widely used in the literature (Barclay et al. 2003, Brockman et al. 2010, Fan et al. 2012, Kim and Kung 2016). Besides, we also use the total-debt-to-assets ratio, the long-term-debt-to-assets ratio, the short-term-debt-to-assets ratio separately to study whether the response to EPU is driven by changes in short- or long-term debt. In the *Orbis* database, the definition of long-term debt is the financial debt to credit institutions (loans and credits) and bonds that mature in more than one year, and short-term debt is the short-term financial debt to credit institutions and part of the long-term financial debt payable within the year. We drop the observations with both zero short- and long-term debt to mitigate the effect of statistical errors. From the summary statistics in Table 1, we can see that the leverage ratio averages at 0.28, and the mean and standard deviation for short-term-debt-to-assets ratio is 0.12 and 0.11, while that for long-term-debt-to-assets ratio is 0.16 and 0.15. Approximately 55.15% of the total debt is long-term, which is similar to the finding of 53% by Fan et al. (2012). In the robustness check, we also use the debt levels instead of asset ratios, and the quality of the findings does not change.

As for firm-level control variables, we use variables that are important for firms' debt maturity structure based on the conventional literature: firm size, defined as the logarithm of total assets; the sales growth rate, calculated as the difference in log sales in current year and previous year; cash flow, defined as the sum of the profit for period and depreciation divided by total assets; tangibility, defined as the ratio of tangible fixed assets to total assets; the SA index based on firm size and age as a proxy of financial constraint (Hadlock and Pierce 2010); profitability defined as the earnings before interest and taxes over assets; and tax ratio calculated as ratio of tax over profits or loss before taxes.

2.2 Innovation Intensity

Following Lerner et al. (2011), we use industry-level innovation intensity to capture firm's demand for long-term debt. Based on the current innovation literature, particularly Hsu et al. (2014) and Hall et al. (2001), we construct three measures of industry innovation intensity using the Li et al. (2014) database[3], which updates the NBER patent database[4] and contains detailed information of all US Patent and Trademark Office (USPTO)-approved patents and citations in the period 1975-2010.

Specifically, $Citation_{jkt}$ is defined as the number of forward patents citing the patents in industry j that are invented by individuals or nongovernment institutions from country k in year t, and the simple count is adjusted using a weighting factor based on Hall et al. (2001), who estimate the shape of the citation-lag distribution. Moreover, we also construct $Originality_{jkt}$ and $Generality_{jkt}$ to capture the impact of patents. A patent's originality is measured as one minus the Herfindahl index of the technology class distribution of all the patents it cites, and a higher value indicates that the patent cites a wider array of patent technology classes. Meanwhile, a patent's generality is measured as one minus the Herfindahl index of the technology class distribution of all the other patents it is cited by, and a higher value indicates that the patent is drawn upon by a more diverse array of subsequent inventions. Then, we aggregate each patent's originality and generality to the country-industry-year level to obtain $Originality_{jkt}$ and $Generality_{jkt}$.

To mitigate the concern that the above measurement is based on the patent data in the US patent office meanwhile the sample is European countries, and to address the limitations that this data ends in 2010 as well, we employ another two methods to measure innovation intensity as robustness check. First, we use the patent applications in the European Patent Office (EPO) and calculate the logarithm of patent numbers for each country-industry-year. Second, we follow Ciccone and Papaioannou (2009) and construct a human capital intensity indicator using the information of the work hours by highly-skilled, medium-skilled, and lowly skilled persons engaged in the World Input-Output Table (WIOD). We calculate the human capital intensity of each industry as the average share of hours by highly skilled persons in the total hours. However, these alternative measurements also have limits: the patent data from the EPO is available for fewer sectors than that from the USPTO, and the human capital intensity is time-invariant and would be absorbed in the firm fixed effect if not interacted with time-varying variables.

There are 22 sectors in our sample based on the ISIC Rev4.0 industry code. There are significant variations between industries. According to the first three measurements, the electrical, electronic, and optical equipment industry is the most innovation-intensive across the three measurements, and the public administration and defense industry is the least innovation-intensive. The patent data from EPO show similar rank to the measurement derived from USPTO. For the human capital intensity, many public and government sectors show a high share of skilled labors, but they fall behind in production-driven innovation in terms of citation and patents. We present the summary statistics of the innovation intensity for each sector in the appendix Table A7. Besides, since SMEs dominate the sample in this study, the degree of innovation activities conducted by SMEs might be a concern. We show that SMEs in our sample countries are active in innovating by dividing the R&D expenditures by size classes as presented in the appendix Figure A2.

2.3 Economic Policy Uncertainty

With the rising political polarization, nationalism and global competition in innovation and frontier technologies, uncertainty matters a great deal for the economic environment and the firms that operate in it. EPU is different from political uncertainty, firm-specific uncertainty, and real macroeconomic uncertainty. It is the result of policy and regulatory shocks, which are difficult to capture, and no widely-accepted and applicable measurements existed until those of Baker et al. (2016), who have provided an innovative measure of EPU mainly based on a textual analysis of newspaper articles regarding policy uncertainty. This methodology has been applied to many non-US countries. We use the EPU index of France, Germany, Spain, and Italy[5] in this study, as they also have good-quality firm-level data in *Orbis*.

Based on Baker et al. (2016), the first step is to count the number of newspaper articles containing the terms "uncertain" or "uncertainty", "economic" or "economy", and one or more policy-relevant terms. Then, the raw EPU count is scaled by a measure of the number of articles in the same newspaper, and each newspaper-level series is standardized to the unit standard deviation prior to 2011. For the four European countries in our sample, the country-level EPU index is the average across newspapers, and the index is normalized to a mean of 100 prior to 2011. The original indices have monthly frequencies, and we take the average in each year to match the annual variables in the *Orbis* database. In the empirical analysis, we take the logarithm of the EPU index.

Figure 1 plots the original monthly EPU for each country. It shows that the EPU value increases during the 2007-2008 financial crisis, the 2011-2012 sovereign debt crisis years, and the Brexit period. The country-level EPU index captures the uncertainty from domestic economic policy. In the empirical analysis, we are also interested in the comparison between the effect of domestic EPU, U.S. EPU, and global EPU. For this purpose, we use the U.S. EPU index, financial uncertainty, macroeconomic uncertainty, and real uncertainty for the US from Jurado et al. (2015), the VIX index, and the GDP-weighted average of national EPU indices for twenty countries[6].

[Figure 1 here]

To control the macroeconomic developments in each country, we use the GDP growth rate, inflation, term structure, and stock market volatility. The GDP growth rate and inflation are from the World Development Indicator (WDI). Term structure is calculated as the difference between ten-year government bond yields and three-month inter-bank rate from OECD. Stock market volatility is measured as the standard deviation of the daily return of the country's equity index for each year, and the price of the equity index is obtained from *Datastream*.

[Table 1 here]

Due to the common availability of data for firm debt maturity, innovation intensity, and EPU, the sample in this study covers France for 1996-2010, Germany for 2003-2010, Spain for 2001-2010 and Italy for 1997-2010. We have more than 3.5 million observations for firm-level debt maturities until 2015, which are used when we do not control for the innovation measurement. When we include innovation intensity and all other firm-level control variables, the number of observations is approximately 1.5 million. Table 1 reports the summary statistics of the key variables used in this paper.

3 Empirical Analysis

3.1 Baseline Results

The baseline empirical specification is shown in the following equation:

$$\begin{aligned} DebtStructure_{ijkt} = \alpha\prime + \beta_1 EPU_{kt} + \beta_2 EPU_{kt} \times Innovation_{jkt} + \beta_3 Innovation_{jkt} \\ + \Gamma X_{ijkt} + \Lambda Y_{kt} + \alpha_i + \gamma_t + \epsilon_{ijkt} \end{aligned} \tag{1}$$

where i, j, k and t indicate firm, industry, country and year, respectively. The dependent variable $DebtStructure_{ijkt}$ is the corporate debt maturity structure and we adopt four measurements for it. To begin with, we use the ratio of total debt to assets, which is also a common indicator for corporate leverage. Then, we use its components of long-term and short-term debt to test whether uncertainty leads to heterogeneous impacts on corporate debt with different maturities. Finally, we use the share of long-term debt in the total debt to proxy the debt maturity structure. EPU_{kt} is the annual economic policy uncertainty indicator from Baker et al. (2016). Both $DebtStructure_{ijkt}$ and EPU_{kt} are expressed in natural logarithm form; thus, the estimated coefficients can be interpreted as elasticity. $Innovation_{jkt}$ is the sector-level innovation intensity measurement. As described in Section 2, we use the citation index in the baseline model and the other four indices in the robustness checks. X_{ijkt} indicates an array of firm characteristics, including firm size, tangibility, cash flow, sales growth, financial constraint, profitability, and tax ratio. The choice of firm-level controls follows the conventional literature of the determinants of capital structure. In addition, Y_{kt} indicates a list of country-level macroeconomic variables, including the GDP growth rate, inflation, term structure, and stock market return volatility. We specify the firm and year fixed effects in α_i and γ_t, and use firm and year two-way clustering in the estimation to account for possible heteroskedasticity.

We are particularly interested in β_1 and β_2. When the dependent variable is one of the three variables of the debt-to-asset ratios, a negative and significant β_1 indicates that increased EPU is associated with lower debt. If the negative impact on long-term debt is greater than that on short-term debt, or if the coefficient is also significantly negative when debt maturity is the dependent variable, then the results imply that higher EPU is associated with shorter debt maturity. In addition, β_2 examines whether industry innovation intensity plays a role in the relationship between EPU and corporate maturity structure. Assuming that firms in the more innovation-intensive sectors need more long-term debt (Lerner et al. 2011) to coordinate long-term R&D expenses, which is not observable in *Orbis* and other firm-level balance sheet databases, the interaction term between EPU and innovation intensity can help us establish a causal interpretation of the relationship between EPU and debt maturity, in the same vein of Rajan and Zingales (1998). Therefore, a significant and negative β_2 would support the finding that higher EPU leads to shorter debt maturity.

It should be noted that when we use the debt maturity as the dependent variable, we have also controlled for total leverage and dealt with the endogeneity issue. It has been an empirical convention since Stohs and Mauer (1996) that debt maturity regressions can be misspecified if leverage is not controlled. Because of the joint determination of leverage and maturity, however, directly adding firm leverage to the right-hand side of the debt maturity regression will result in endogeneity problem and bias in estimates. Hence, we use the two-stage instrument variable (IV) method: we run a regression of leverage in the first stage, and then use the predicted leverage in the second stage when we implement debt maturity regression. Following the literature (Dang 2011, Barclay et al. 2003, Datta et al., Brockman et al. 2010), in the first-stage regression, we use size, profitability, tangibility, non-debt tax shields as possible determinants for corporate leverage, and control for firm and year fixed effects. The first stage results are shown in the appendix Table A8 and demonstrate a large F-statistics (4009.8). After that, we use the predicted leverage in the second-stage debt maturity regression. Among all the control variables here, the non-debt tax shields, defined as the ratio of depreciation over assets, is additionally added to validate the IV estimation.

Existing studies do not provide an unambiguous expectation of the sign of leverage in the debt maturity regression. On one hand, if the liquidity risk hypothesis is true, as shown in Diamond and Verrecchia (1991) and Diamond (1993), leverage and debt maturity exhibit a positive relationship because short-term debt imposes high liquidity risk. On the other hand, according to Myers (1977), firms with higher growth opportunities would shorten the debt maturity while using higher leverage to mitigate the underinvestment problem, then it indicates a negative relationship between leverage and debt maturity. Our empirical findings tend to support the latter view and are in consistence with the results in Barclay et al. (2003) and others.

As shown in Table 2, we gradually add the control variables into the regression. First, we estimate without any controls except the variable of interest EPU_{kt}, then we add other controls except for the sector-level innovation intensity and its interaction with EPU, and finally the full set of controls with a particular interest in the interaction term. The results in the first two columns of each dependent variable demonstrate that the explanatory power of EPU for the debt maturity structure is significant and stable across various specifications. An increase in EPU is significantly associated with a reduction in total debt, but the reduction is exclusively for long-term debt, as the impact on short-term debt is insignificant. As a result, larger uncertainty is associated with a smaller share of long-term debt in the total debt, i.e., shorter debt maturity. More specifically, a 1% increase in EPU is associated with a 0.22% decrease in the ratio of long term-debt-to-assets ratio and a 0.08% decrease in debt maturity.

Then we add the interaction term between the sector innovation intensity and EPU to investigate heterogeneous impacts due to the different needs for long-term debt, under the reasonable assumption that firms in more innovation-intensive sectors tend to rely more on long-term debt to finance its long-term R&D activities. We expect that firms in those sectors should be more affected if EPU casually leads to less long-term debt and shorter debt maturity. The results in columns (3) (6) (9) and (12) in Table 2 support this casual interpretation by showing that the negative impacts of EPU on debt maturity are stronger for firms in innovation-intensive industries. In contrast, there is no such impact on the use of short-term debt. Moreover, as we can see from the table, the estimated coefficient of innovation intensity is both statistically and economically significant: a one-standard-deviation increase in innovation intensity enlarges the impacts of EPU on debt maturity by 16%.

[Table 2 here]

The coefficients of other controls are consistent with the literature. Large firms are usually more diversified, have better reputations in debt markets, and face lower information costs when borrowing, thus, they have more debt and longer debt maturity. For sale growth, Flannery (1986) and Myers (1984) predict that firms with higher growth option and investment opportunity are likely to have lower leverage and use more short-term debt. For cash flow, it is negatively associated with leverage which is consistent with the pecking order theory that debt is used to finance the deficit. For tangibility, based on the hypothesis that collateral supports debt and tangible assets naturally serve as collateral, firms that have more tangible assets tend to have more debt and longer debt maturity. For financial constraint, firms that are more constrained find it more difficult to raise debt financing, especially long-term debt financing. For profitability, the trade-off theory and asymmetric information models predict that profitable firms should be more highly levered to offset corporate taxes, but Titman and Wessels (1988) and Fama and French (2002) show that this is not a common finding and the literature finds profits and leverage to be negatively correlated, and we confirm this finding. For tax ratio, the coefficient is negative because the tax deduction would be higher for long-term debt according to the trade-off theory. For GDP growth, it relates to better expectation and easier borrowing condition so the leverage could be higher when GDP growth is higher. For inflation, higher inflation indicates more inflation risk associated with long-term debt and suggests a negative impact on debt maturity. For term structure, the tax benefits of long-term debt would be higher when the yield curve is steeper, but the higher cost of longer-term debt would discourage long-term borrowing.

As to stock market volatility, if we interpret it as another measurement of uncertainty, it should show the same sign as the EPU index by being negatively correlated with long-term debt. Results show that it is insignificant in most specifications, except positive for short-term debt. The insignificant coefficients may be explained by the advantage of EPU index in capturing policy uncertainty, especially when we use the historical volatility instead of implied volatility in the regression. We show the time series of stock market volatility and EPU for each sample country in Figure A3, where we see that the two series do not completely move in the same way and the timing for the peak of uncertainty is different based on stock market volatility and EPU. Moreover, as we can see later, it shows a different effect for small and large firms.

Finally, to account for the concern that EPU may show heterogeneous impacts across firm size, we perform the baseline regression separately for the subsamples of small, medium, and large firms. Table 3 present the results. It shows that the conclusion of the debt-maturity-shortening effect of EPU holds across firm sizes, and the heterogeneous impact lies in the magnitudes of the coefficients and the interactive role of innovation intensity. First, the scale of impact of EPU increases with firm size. For small firms, a 1% increase in EPU is associated with 0.23% decrease in long-term debt and a reduction of 0.08% in debt maturity. The scale of the impact increases to 0.24% and 0.11% for medium-sized firms and 0.51% and 0.24% respectively for large firms. Besides, the impact of EPU on short-term debt becomes significantly negative for large firms, but as the reduction is smaller than that on long-term debt, so the overall effect on debt maturity is still reducing. Second, the interaction term with innovation intensity becomes insignificant, and its sign becomes positive in the large firm subsample. The reason may be the more financing options for large firms, as we can see the coefficients of cash flow are much weaker or insignificant for large firms, which suggests that the pecking order of financing applies better for SMEs and large firms actually may use more equity financing.

[Table 3 here]

We conduct several robustness checks. First, we use lagged instead of the contemporaneous EPU and the pre-crisis subsample, to alleviate the concern on possible endogeneity and to show that the inclusion of financial turmoil does not drive our results. Second, we use alternative measurements of industry innovation intensity to confirm that our particular choice of indicators does not drive our empirical results. Third, we use the levels of total debt and long-term and short-term debt instead of their ratios to assets as the dependent variables. Fourth, we include more control variables such as political election and natural disaster shocks in the regression. Finally, we conduct a placebo test by using the forged EPU of other economies or mixing up the EPU of our four sample countries. All the tests confirm our main findings that EPU are significantly associated with shorter corporate debt maturity. Due to space limit, detailed discussions and results of the robustness checks are shown in the appendix in Section A2.

3.2 Further Causality Examination

To further establish causality, we identify firms with specific characteristics which would cause them more likely to change debt maturity and then test whether these firms show a stronger reduction in debt maturity with increasing EPU.

3.2.1 The Flexibility of Maturity Adjustment

First, we define a group of treated firms and show that the impact is stronger for the treated group. Increased EPU will only show an effect on debt maturity for firms that can flexibly change their debt maturity structure; if firms are not able to adjust their debt structure, their response to higher EPU should be smaller or even insignificant. Therefore, here we define the treated group as firms whose debt maturity structure can be flexibly adjusted. Specifically, we calculate the standard deviation of each firm's debt maturity across years in our dataset and define a dummy variable $Treated_i$. For this calculation, we require the firms appear more than five years in the data. $Treated_i$ equals 1 if the firm's standard deviation of debt maturity is above the 20th percentile; otherwise, $Treated_i$ is 0. The choice of the cut-off is arbitrary here, we also use 10th, 40th and 50th percentile as the critical value and the results do not change in quality. After that, we interact $Treated_i$ with EPU and innovation intensity and estimate equation (2). The individual term of $Treated_i$ is absorbed in the firm fixed effect.

$$\begin{aligned} DebtStructure_{ijkt} = \alpha\prime + \beta_1\prime EPU_{kt} + \beta_2\prime EPU_{kt} \times Innovation_{jkt} + \beta_3\prime Innovation_{jkt} \\ +\beta_4\prime EPU_{kt} \times Treated_i + \beta_5\prime Innovation_{jkt} \times Treated_i \quad (2) \\ +\beta_6\prime EPU_{kt} \times Innovation_{jkt} \times Treated_i + \Gamma\prime X_{ijkt} + \Lambda\prime Y_{kt} + \alpha_i\prime + \gamma_t\prime + \epsilon_{ijkt}\prime \end{aligned}$$

Table 4 presents the results. In the odd columns, we only use the interaction term between EPU and the treated dummy. The estimates of this interaction term are significantly negative when the dependent variable is total debt, long-term debt and short-term debt and insignificant when it is debt maturity. However, the scale of reduction in short-term debt is weaker than the reduction in long-term debt, which suggests that the treated firms have a stronger maturity-shortening impact when EPU increases. The results of the full specification are shown in the even columns. The triple interaction term confirms that the role of innovation intensity is also strengthened in the treated group, which can be seen in Figure 2 by plotting the estimates in column (8). The results show that innovation intensity plays no role in altering the marginal effect of EPU on debt maturity for the control group, i.e., firms with an inflexible debt maturity structure, but it strengthens the impacts of uncertainty for the treated group. These results confirm the idea that firms with a flexible maturity structure react more to changes in EPU than those without a flexible maturity structure. Such cross-sectional difference indicates that there is a causal relationship running from increased economic policy uncertainty to shorter corporate debt maturity.

[Table 4 here]

[Figure 2 here]

3.2.2 The Deviation to Leverage Target

Second, to strengthen the causality interpretation of our finding, we additionally use the characteristics of dynamic leverage adjustment. As we have concluded that EPU is associated with the reduction in long-term debt and debt maturity, naturally, we would expect that the firms above their leverage target and exceed the target by a larger extent will be more affected and display larger reduction when hit by the uncertainty. If a firm is far below the leverage target, the cost of backward adjustment in the long-run might be too high. Therefore, it is likely to react less to the same amount of changes in EPU.

To identify the different impact of EPU on debt maturity for firms above and below their leverage targets, we first need a proxy of leverage target. For this purpose, we follow Denis and McKeon (2012) and Harford et al. (2009) to calculate a proxy for long-run leverage target. Specifically, we use a double-sided Tobit model censored at 0 and 1 to estimate the following specification for each country-year:

$$\begin{aligned} Leverage_{i,t} = \alpha + \beta_1 Size_{i,t-1} + \beta_2 Tangibility_{i,t-1} + \beta_3 Profitability_{i,t-1} + \\ \beta_4 MedianLeverage_{i,t-1} + \epsilon_{i,t} \end{aligned} \tag{3}$$

The choice of control variables follows Frank and Goyal (2009), who document that the most reliable factors for firm leverage are median industry leverage, asset tangibility, profitability, size, and expected inflation. We can exclude expected inflation from the model because it is uniform across all firms within each country-year. We use the predicted value of leverage as the leverage target $Leverage^*$. There is a branch of literature discussing the estimation of leverage target, however, as leverage target is not the main focus in this paper, we leave the summary of the estimates of equation (3) in the appendix Table A9. Then we calculate the deviation from leverage target as the difference between actual leverage $Leverage_{it}$ and leverage target $Leverage^*$, and define a dummy of above target$_{i,t}$ as 1 if the deviation is positive and as 0 if the deviation is negative.

By interacting the variables of above-target dummy and deviation from the target with innovation intensity and EPU, we investigate whether the impact of increased uncertainty decreases the leverage and debt maturity for above-target firms more than below-target firms. Specifically, we replace the $Treated_i$ in equation (2) with the above target dummy and deviation from leverage target, and we are mostly interested in the coefficient of the triple interaction term. Table 5 present the results. The coefficient of the triple interaction term is significantly negative when the dependent variables are long-term debt or debt maturity, and insignificant or significantly positive when short-term debt is the explained variable. Therefore, these results show that if the firm is above its leverage target and is in the process of deleveraging, the reduction in debt maturity resulted from increasing EPU is much higher than those below their leverage target.

[Table 5 here]

3.3 Transmission Channel

In this section, we investigate the underlying mechanisms through which EPU affects corporate debt maturity. More specifically, we examine whether EPU reduces debt maturity by reducing firm investment or steepening the term structure.

3.3.1 Investment as the Channel

There are two major issues with firm financing in corporate finance theory which have implications for the role of investment in corporate debt maturity. First, the under-investment or debt-overhang problem (Myers 1977) implies that firms with more growth opportunities should use more short-term debt. The reason is the following. Such under-investment problem is caused by the conflicts between stockholders and bondholders over the exercises of firms' investment opportunity set when the firms have more growth options. To control this conflict and to preserve financing flexibility as well as future ability to invest, firms should lower its current leverage or rely more on short-term borrowing. Second, the over-investment or free-cash-flow problem (Jensen 1986) implies that firms with few growth options should use more long-term borrowing. When firms generate substantial cash flows but have few growth opportunities, these cash flows cannot be reinvested profitably, and firms have to distribute the free cash flows to investors. Hence, leverage and long-term debt can benefit these firms by limiting managerial discretion and over-investing (Stulz 1990, Hart and Moore 1998).

When EPU increases, the relative importance of under-investment problem, compared to over-investment problem, increases, especially for the firms in innovation-intensive sectors because they have higher growth opportunity. Moreover, the benefits of short-term debt in mitigating the under-investment problem also increase when the whole economy is highly uncertain(Johnson 2003). Therefore, investment can be seen as the first channel linking EPU and shorter debt maturity.

To test this investment channel, we interact EPU with three measurements of the degree of sensitivity about investment decisions under uncertainty. First, we apply the asset redeployability measurement developed by Kim and Kung (2016), which accounts for the usability of assets within and across industries. As shown in Benmelech (2008) that debt maturity increases in asset salability, we expect that this relationship is strengthened when uncertainty increases. Second, we use the measurement of time-to-build from Brooks (2000), which collects the length of plant investment (number of months, and we transformed into years) from newspapers and trade journal articles and shows that the time-to-build explain approximately one-third of the variation in the persistence of structures investment . We expect that firms with longer time-to-build are more in need of substantial and long-term investment, and thus more affected by the reduction in debt maturity when uncertainty increases. Third, we use the investment intensity measurement from Rajan and Zingales (1998) by calculating the ratio of capital expenditure to net property, plant and equipment[7]. We expect the firms with higher investment intensity more affected by the reduction in investment when uncertainty increases.

If the decreased investment is the channel towards shorter maturity, we would see firms with lower redeployability, longer time-to-build and higher investment intensity to have a larger reduction in debt maturity when EPU increases, and the results in Table 6 confirms that. The coefficients of the interaction term between EPU and redeployability are significantly positive when the dependent variable is long-term debt or debt maturity, and the coefficients when interacting EPU with time-to-build and investment intensity are significantly negative for long-term and debt maturity. A one standard deviation increase in time-to-build and investment intensity enlarges the impact on shorter debt maturity by 22% and 38%.

[Table 6 here]

3.3.2 Term Structure as the Channel

The second possible underlying mechanism is the term structure. In the literature, there are increasing discussions about the impacts of uncertainty on the term structure and one conclusion is that term structure steepens with uncertainty. For instance, Miller (1997) find that political instability and polarization generate inflation uncertainty, which causes the term structure to steepen and reduce the average maturity; Bundick et al. (2017) concludes that unexpected decline in the slope of implied volatility leads to a significant decline in term premia for longer-term bond yields; Scheffel (2016) document depressing government bond yields across the entire term structure following a shock to political risk but the scale of reduction decreases with maturity.

There are three perspectives to link steepened term structure with debt maturity. First, according to the cost of capital, a steepened term structure indicates that long-term debt becomes more expensive than short-term debt, thus firms are more likely to rely less on long-term borrowing. Second, the term structure can be considered a credible signal of future economic performance. In this perspective, the increased term spread would negatively affect leverage (Frank and Goyal 2009). Third, the corporate finance trade-off theory generates an opposite prediction (Myers 1984, Shyam-Sunder and Myers 1999): the tax benefits of long-term debt increase with term structure, and call for more long-term debt and longer debt maturity(Brick and Ravid 1991).

To test whether term structure works as another channel through which economic policy uncertainty causes shorter debt maturity, we first provide empirical evidence to show that EPU does increase term spread. More specifically, we use the three-month interbank rate and ten-year government bond rate to measure short-term and long-term interest rate and use the difference between long-term and short-term rate as term spread. Then we regress the three-term structure variables on EPU and other macroeconomic control variables including GDP growth, inflation, and capital flows. In addition, country fixed effect and time trend are controlled in the estimation. In this test, we have covered all 19 countries with both EPU and term structure data available. We find that higher EPU is associated with a significant increase in the long-term interest rate and insignificant impact on the short-term interest rate, thus a steepened term structure. To save space, we present these results in the appendix in Table A10. Then we perform the firm-level debt maturity structure analysis by replacing the EPU with the predicted term structure from the above regression. From Table 7, the EPU-predicted term structure shows a significant negative impact in reducing long-term debt and shortening debt maturity, regardless of whether the actual term structure is controlled or not. This two-step analysis supports the interpretation that the steepened term structure works as the mechanism behind uncertainty and shorter debt maturity.

[Table 7 here]

4 Discussion

4.1 The Role of US and Global Uncertainty

The existing literature on the impacts of EPU or political uncertainty has mostly relied on U.S. datasets. In this paper, the use of non-US data, i.e., firm-level data for Germany, France, Spain, and Italy, contributes evidence outside the U.S.. However, one possible concern is that the uncertainty in the U.S. has a global impact and it may be the U.S. EPU instead of the domestic EPU that drives the changes in corporate debt maturity in these four European countries (Rey 2015, Miranda-Agrippino and Rey 2020). To address such issues, we replace the domestic EPU in the baseline specification with the U.S. or global EPU indices and add the interaction term between U.S. or global uncertainty and sector innovation intensity. In addition to the U.S. and global EPU index obtained from Baker et al. (2016), we also employ the financial uncertainty, macro uncertainty, and real uncertainty indicators from Jurado et al. (2015), as well as the VIX index obtained from Chicago Board Options Exchange (CBOE).

Table 8 reports the results. It shows that we cannot deter any significant impacts from the U.S. and global policy uncertainty on corporate maturity structure for firms in these European countries, suggesting that it is the domestic EPU that drives the reduction in debt maturity. Besides, following Gulen and Ion (2015) and Phan et al. (2019), who use the residual of the regression of U.S. EPU on Canadian EPU as a proxy for U.S. policy uncertainty, we regress the non-U.S. EPU on U.S. EPU to remove the spillover impact of global uncertainty and use the residual to measure domestic EPU. To obtain the residual, we use the EPU for our sample countries and regress them on the US EPU, VIX index, domestic

GDP growth, and stock market volatility, controlling country fixed effects. Then, we take the residual and use it as the proxy of domestic EPU and redo the baseline regression. We present the results using this residual approach in the appendix in Tables A11 and A12, which show that our baseline findings remain and become stronger when global uncertainty component is eliminated.

[Table 8 here]

However, U.S. and global uncertainty, especially the uncertainty arising from the trade and tax policy, could significantly affect the firms that are highly dependent on international trade. To test this, we use the ratio of import and export in the US or global trade to GDP for each country-industry-year to proxy the dependence on U.S. or global trade, since *Orbis* database does not have high-quality data on firm-level export or import activities. We first obtain the HS six-digit level data from UN COMTRADE and then aggregate the product-level statistics to industry level. We have four trade intensity measurements: US import and export, and global import and export, all expressed in ratios to GDP. Then we interact each trade intensity indicator with the US or global uncertainty measurement. Here we are in particularly interested in the trade and tax-related EPU, so we employ the overall U.S. EPU, global EPU, as well as the sub-categorical EPU in trade and tax.

Results are presented in Table 9. It shows that when U.S. or global uncertainty increases, for firms that are more dependent on the U.S. or global *exports*, they would reduce more on the use of long-term debt. In contrast, for firms that are more dependent on the U.S. or global *imports*, they would be less negatively affected by the external uncertainty. This result is intuitive because if a firm relies more on export (import), then the firm will be more (less) affected by the external environment rather than domestic macroeconomic conditions.

[Table 9 here]

4.2 EPU and Corporate Cash Holdings

According to maturity matching theory (Stohs and Mauer 1996), a decrease in asset maturity as a result of increased uncertainty is expected to lower the debt maturity on the liability side, and vice versa. Thus, we are interested in examining whether EPU is associated with shortened *asset* maturity. However, we do not observe the maturity structure of firms' assets in our dataset, and it is challenging to obtain this information from other available databases. Instead, w observe firms' cash holdings, which are the most liquid asset and the asset with the shortest maturity. Therefore, we use the ratio of cash holdings to assets as a proxy of asset maturity, with higher cash holdings indicating shorter asset maturity, to replace debt maturity as the dependent variable in the baseline specification.

The results are shown in Table 10. We find that EPU has a positive and significant impact on firm cash holdings, which is consistent with the recent evidence in the literature (Xu et al. 2016, Demir and Ersan 2017, Phan et al. 2019). Specifically, a 1% increase in EPU is associated with a 0.14% increase in firm cash holdings. The negative coefficient of the interaction term between EPU and innovation intensity shows that the increase in cash holdings is smaller for firms in sectors with higher innovation intensity, but the overall impact of EPU is still significantly positive. This might be explained by the smaller managerial conservatism of the firms in innovation-intensive industries or the fact that they are less likely to disinvest when uncertainty increases because R&D tends to be long-term and cannot be quickly reserved; meanwhile, these firms are less able to borrow long-term debt, so they expend the accumulated cash holdings during the uncertain period. Overall, the findings of increased cash holdings, which imply a shorter asset maturity, from higher EPU is consistent with our finding that uncertainty leads to shorter debt maturity.

[Table 10 here]

5 Conclusion

This paper examines whether and how economic policy uncertainty affects corporate debt maturity structure. Our baseline result shows that a 1% increase in economic policy uncertainty is associated with a 0.22% decrease in long-term debt and a 0.08% decrease in debt maturity. The impacts of economic policy uncertainty on shortened debt maturity are stronger for innovation-intensive firms, for firms with higher flexibility in changing debt maturity, and also for firms that are above their leverage targets. Besides, we identify that the impact of economic policy uncertainty may work through reduced investment and steeper term structure. Furthermore, it is domestic uncertainty that drives the results, but the U.S. and global uncertainty affects firms that are dependent on exports.

This study has important policy implications. By lowering debt maturity, economic policy uncertainty is particularly harmful to innovation-intensive firms, which are essential for a country's long-term economic development. In addition, the prevalence of short-term borrowing also hurts financial stability. Therefore, regulators should closely monitor the reduction in debt maturity during episodes of high uncertainty, especially for firms in innovation-intensive industries, to prevent a deterioration in financial stability and long-term economic growth.

Notes

1. Using the European Commission criteria that small enterprises are the ones with less than 50 persons employed, medium-sized enterprises are the ones with 50-249 persons employed, and large enterprises are the ones with 250 or more persons employed, we provide evidence in the appendix (see Figure A1) that SMEs play a crucial role in the economy by accounting for more than 99% of the number of firms, 67% of the employment and 56% of the value-added in the EU 28 countries.

2. We first convert all nominal financial variables into nominal official local currencies and then deflate all financial variables using country-level GDP deflator with the 2005 base obtained from WDI, and then divide by the exchange rate of the official currency to the US dollar in the year of 2005.

3. The database is available at `https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/5F1RRI`.

4. The NBER patent database is available at `https://sites.google.com/site/patentdataproject/Home`.

5. For France, Germany, and Italy, we use the index developed by the same team of Baker et al. (2016). The newspapers selected for each country are: *Le Monde* and *Le Figaro* for France, *Handelsblatt* and *Frankfurter Allgemeine Zeitung* for Germany, *Corriere Della Sera* and *La Repubblica* for Italy. For Spain, we use the index by Ghirelli et al. (2019) because they adopted the same methodology and covered more newspapers, including *El Pais*, *El Mundo'*, *La Vanguardia*, *ABC*, *Expansión*,*Cinco Días* and *El Economista*.

6. The twenty countries include Australia, Brazil, Canada, Chile, China, France, Germany, Greece, India, Ireland, Italy, Japan, Mexico, the Netherlands, Russia, South Korea, Spain, Sweden, the United Kingdom, and the United States.

7. In line with the Rajan and Zingales (1998), we use data of U.S. firms over the 1980s from Compustat, as the U.S. capital market is the most developed and listed large firms typically face the least financing frictions. We first obtain the firm-year-level values for numerators and denominators. Then we sum each of them over the years to get firm-level cross-sectional data and calculate the above three ratios. Last, we use the industry median to summarize ratios across firms. By doing this, the fluctuation over time is smoothed, and the outlier problem due to size difference across firms is relieved. Due to space limitations, we refer the calculation details to Rajan and Zingales (1998).

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Figures and Tables

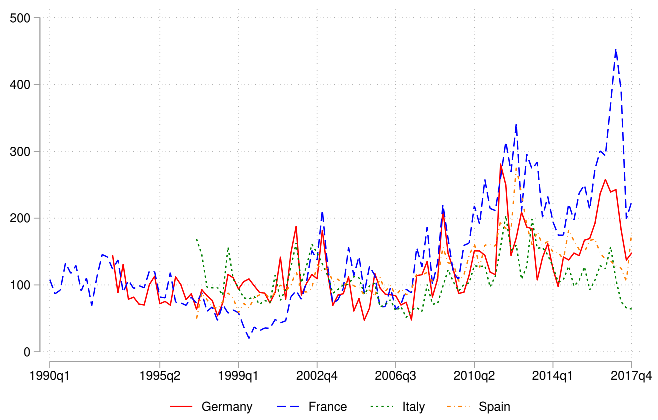

Figure 1: EPU Across Countries and Years

Note: This figure plots the time series of EPU from 1990-2015, while the period is shorter in the empirical analysis due to the availability of other databases.

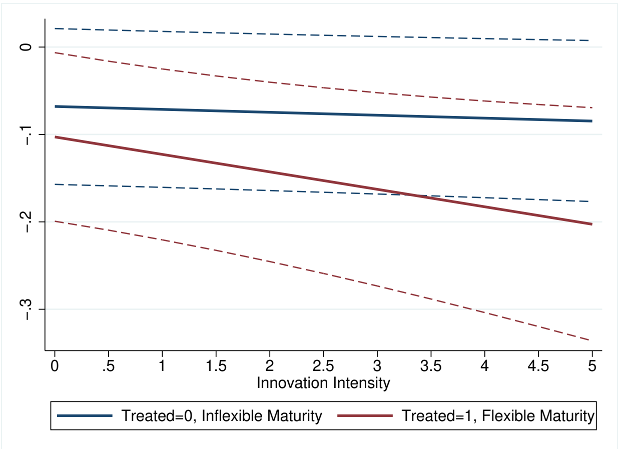

Figure 2: Estimated Marginal Effect of EPU on Debt Maturity: By Treated Group

Note: This figure shows the estimated marginal effect of a 1% increase in EPU on debt maturity at different innovation intensity. The blue solid line shows the point estimates for the untreated group, which is defined as the firms whose standard deviation of debt maturity is below the 20th percentile. The blue dashed lines show the 95% confidence interval of the estimates for the untreated group. The red solid line shows the point estimates for the treated group, which is defined as the firms whose standard deviation of debt maturity is above the 20th percentile. The red dashed lines show the 95% confidence interval of the estimates for the treated group.

Table 1: Summary Statistics

	Mean	Standard Deviation	Min	Max	N
Debt Maturity	55.15	27.72	1.31	99.89	3462904
Total Debt/Asset	0.28	0.19	0.01	0.84	3462948
Short Debt/Asset	0.12	0.11	0.00	0.54	3462912
Long Debt/Asset	0.16	0.15	0.00	0.74	3462922
Size	0.22	1.50	-4.04	5.60	3533536
Sale Growth	0.02	0.42	-15.13	16.57	3533536
Cash Flow	0.08	0.74	-253.22	430.21	3533536
Tangibility	0.25	0.23	0.00	1.00	3533536
SA Index	6.65	1.18	0.27	9.08	3533536
Profitability	0.06	0.09	-0.21	0.49	3462485
Tax Ratio	0.27	0.46	-2.66	3.64	3461611
Innnovation Intensity-Citation	0.26	1.06	0.00	21.86	1854967
Innnovation Intensity-Originality	0.80	2.97	0.00	36.71	1854967
Innnovation Intensity-Generality	0.57	2.30	0.00	33.17	1854967
LN(EPO Patent Number)	4.87	1.30	-0.12	8.87	1240532
Human Capital Intensity	0.16	0.09	0.07	0.57	3365089
Ln(EPU)	4.88	0.36	3.63	5.63	3533536
Ln(US EPU)	4.75	0.29	4.21	5.06	3533536
Ln(US Financial Uncertainty)	-0.11	0.19	-0.38	0.20	3533536
Ln(US Macro Uncertainty)	-0.38	0.14	-0.57	-0.12	3533536
Ln(US Real Uncertainty)	-0.44	0.07	-0.56	-0.31	3533536
Ln(VIX)	2.96	0.33	2.45	3.69	3533536
GDP Growth	0.32	2.15	-5.57	4.17	3533536
Inflation	1.64	1.17	-0.50	4.08	3533536
Term Structure	2.08	1.55	-0.65	5.28	3533536
Stock Market Volatility	1.47	0.51	0.63	2.53	3533536

Table 2: Baseline Results: EPU and Corporate Debt Maturity Structure

Note: This table presents the estimation results from the regression of debt structure or maturity variables on EPU, EPU interacted with innovation intensity and the control variables. The dependent variable is the ratio of total debt to total assets (*Total*) in columns (1)-(3), the ratio of long-term debt to total assets (*Long*) in columns (4)-(6), the ratio of short-term debt to total assets (*Short*) in columns (7)-(9), and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*) in columns (10)-(12). EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016) and innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Total			Long			Short			Maturity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ln(EPU)	-0.194***	-0.145***	-0.138***	-0.309***	-0.216***	-0.221**	-0.086	-0.076	-0.026	-0.115**	-0.090*	-0.082*
	(0.000)	(0.000)	(0.007)	(0.000)	(0.004)	(0.031)	(0.288)	(0.298)	(0.539)	(0.029)	(0.079)	(0.100)
Ln(EPU) × Innnovation Intensity			-0.006			-0.018*			0.005			-0.013*
			(0.204)			(0.080)			(0.567)			(0.079)
Innnovation Intensity			0.028			0.079*			-0.018			0.052*
			(0.150)			(0.073)			(0.627)			(0.090)
Size		0.246***	0.288***		0.349***	0.422***		0.162***	0.146***		0.871***	0.427*
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.058)
Sale Growth		-0.007***	-0.011***		-0.001	-0.016**		-0.016***	-0.004		0.007	-0.004
		(0.000)	(0.005)		(0.798)	(0.026)		(0.000)	(0.431)		(0.103)	(0.516)
Cash Flow		-0.210**	-0.262***		-0.170**	-0.181***		-0.223**	-0.330***		0.132***	0.123***
		(0.013)	(0.001)		(0.015)	(0.001)		(0.022)	(0.002)		(0.001)	(0.002)
Tangibility		1.268***	1.220***		2.445***	2.625***		0.359***	0.229***		4.818***	2.808**
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.001)		(0.000)	(0.014)
SA Index		-0.074***	-0.113***		-0.087***	-0.172***		-0.091***	-0.052**		-0.012	-0.061**
		(0.000)	(0.000)		(0.009)	(0.002)		(0.000)	(0.040)		(0.539)	(0.018)
Profitability		-0.697***	-0.782***		-0.474***	-0.564***		-0.966***	-1.026***		-2.907***	-0.979
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.262)
Tax Ratio		-0.006***	-0.005***		-0.011***	-0.006**		-0.003*	-0.005***		-0.004**	-0.000
		(0.000)	(0.000)		(0.000)	(0.032)		(0.068)	(0.009)		(0.029)	(0.824)
GDP Growth		0.009**	0.001		-0.010	0.011		0.030***	-0.030**		-0.018***	0.010
		(0.018)	(0.862)		(0.139)	(0.483)		(0.000)	(0.013)		(0.001)	(0.293)
Inflation		-0.016**	0.008		-0.087***	-0.045*		0.058**	0.073***		-0.064***	-0.053***
		(0.041)	(0.474)		(0.000)	(0.082)		(0.025)	(0.001)		(0.003)	(0.003)
Term Structure		0.025***	0.081***		0.037***	0.070		0.008	0.135***		0.006	-0.013
		(0.001)	(0.001)		(0.005)	(0.119)		(0.485)	(0.005)		(0.423)	(0.665)
Stock Market Volatility		0.019	-0.023		-0.029	0.069		0.079*	-0.135		-0.030	0.095
		(0.458)	(0.703)		(0.594)	(0.592)		(0.071)	(0.158)		(0.431)	(0.183)
Leverage											-16.514***	-6.302
											(0.000)	(0.180)
Constant	-0.648***	-0.783***	-0.610*	-0.940***	-1.383***	-1.167*	-2.365***	-2.113***	-2.305***	4.313***	7.708***	5.444***
	(0.000)	(0.001)	(0.074)	(0.004)	(0.002)	(0.067)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	3225868	3084537	1519357	3225868	3084537	1519357	3225868	3084537	1519357	3225868	2981827	1481887
Adjusted R2	0.718	0.735	0.769	0.603	0.627	0.651	0.590	0.594	0.624	0.487	0.499	0.528
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table 3: Baseline Results by Size Classes: EPU and Debt Maturity Structure

Note: This table presents the estimation results separately for the subsamples of small, medium-sized and large firms, from the regression of debt structure or maturity variables on EPU, EPU interacted with innovation intensity and the control variables. Columns (1)-(4) report the resulting using small-sized firms (less than 50 employees), columns (5)-(8) report the resulting using medium-sized firms (between 50 and 250 employees), and columns (9)-(12) report the resulting using large firms (over 250 employees). For each subsample, the dependent variables are total debt to total assets (*Total*), long-term debt to total assets (*Long*), short-term debt to total assets (*Short*) and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*), respectively. EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016) and innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Small				Medium				Large			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total	Long	Short	Maturity	Total	Long	Short	Maturity	Total	Long	Short	Maturity
Ln(EPU)	-0.142***	-0.226**	-0.023	-0.082*	-0.136**	-0.240**	0.018	-0.105*	-0.331***	-0.511***	-0.464***	-0.236**
	(0.004)	(0.021)	(0.571)	(0.099)	(0.018)	(0.031)	(0.779)	(0.081)	(0.005)	(0.004)	(0.002)	(0.020)
Ln(EPU) × Innnovation Intensity	-0.007*	-0.017*	-0.001	-0.011*	-0.002	-0.015	0.016	-0.015*	0.013	0.010	0.050	0.009
	(0.077)	(0.052)	(0.826)	(0.087)	(0.812)	(0.217)	(0.272)	(0.088)	(0.489)	(0.679)	(0.126)	(0.441)
Innnovation Intensity	0.034**	0.076**	0.009	0.043	0.014	0.072	-0.071	0.064*	-0.056	-0.047	-0.190	-0.046
	(0.041)	(0.041)	(0.707)	(0.102)	(0.637)	(0.173)	(0.278)	(0.071)	(0.498)	(0.671)	(0.196)	(0.367)
Observations	1399411	1399411	1399411	1364698	105444	105444	105444	103987	12678	12678	12678	11480
Adjusted R2	0.769	0.649	0.617	0.522	0.773	0.669	0.687	0.575	0.784	0.718	0.712	0.596
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table 4: Causality: EPU Interacted with Treated Group

Note: This table presents the estimation results from the regression of debt structure or maturity variables on EPU, the full interaction terms between EPU, the treated dummy, and the innovation intensity, and the control variables. The dependent variable is the ratio of total debt to total assets (*Total*) in columns (1)-(2), the ratio of long-term debt to total assets (*Long*) in columns (3)-(4), the ratio of short-term debt to total assets (*Short*) in columns (5)-(6), and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*) in columns (7)-(8). EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016), the innovation intensity is the number of forward patents citing the patents in this industry, and the dummy of treated firm takes the value of one if the standard deviation of its debt maturity across all years is above the 20th percentile. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Total		Long		Short		Maturity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln(EPU)	-0.081	-0.079	-0.139	-0.131	0.046	0.051	-0.058	-0.068
	(0.131)	(0.145)	(0.186)	(0.217)	(0.268)	(0.246)	(0.280)	(0.157)
Ln(EPU)× Treated	-0.055***	-0.054***	-0.072***	-0.067***	-0.052**	-0.062**	-0.015	-0.035*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.038)	(0.011)	(0.305)	(0.062)
Ln(EPU)× Innovation Intensity		-0.012		-0.010		-0.032*		-0.003
		(0.228)		(0.413)		(0.082)		(0.206)
Treated × Innnovation Intensity		-0.025		0.065		-0.189		0.066*
		(0.572)		(0.256)		(0.100)		(0.090)
Ln(EPU) × Innovation Intensity × Treated		0.007		-0.014		0.042		-0.017*
		(0.464)		(0.280)		(0.105)		(0.065)
Innnovation Intensity	0.004	0.051	0.000	0.042	0.004	0.150*	-0.004	0.015
	(0.100)	(0.257)	(0.918)	(0.453)	(0.297)	(0.076)	(0.200)	(0.207)
Observations	965005	965005	965005	965005	965005	965005	947677	947677
Adjusted R2	0.748	0.748	0.621	0.621	0.607	0.607	0.517	0.517
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table 5: Causality: EPU Interacted with Deviation to Leverage Target

Note: This table presents the estimation results from the regression of debt structure or maturity variables on EPU, the full interaction terms between EPU, the above leverage target dummy or the deviation to leverage target, and the innovation intensity, and the control variables. The dependent variable is the ratio of total debt to total assets (*Total*) in columns (1)-(2), the ratio of long-term debt to total assets (*Long*) in columns (3)-(4), the ratio of short-term debt to total assets (*Short*) in columns (5)-(6), and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*) in columns (7)-(8). EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016), the innovation intensity is the number of forward patents citing the patents in this industry. We first estimate the long-term leverage target using the specification in equation 3, and define the dummy of above leverage target if the actual leverage is above the long-run target, and calculate the deviation to target as the difference between actual leverage and the long-run target. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Total		Long		Short		Maturity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln(EPU)	-0.159***	-0.074*	-0.224**	-0.116	-0.070	-0.025	-0.063	-0.042
	(0.003)	(0.092)	(0.038)	(0.203)	(0.100)	(0.465)	(0.265)	(0.395)
Ln(EPU) × Above Leverage Target	0.152***		0.202***		0.063**		0.048**	
	(0.000)		(0.000)		(0.026)		(0.029)	
Above Leverage Target	-0.105		-0.317*		0.234**		-0.200*	
	(0.306)		(0.080)		(0.050)		(0.052)	
Innnovation Intensity × Above Leverage Target	0.167***		0.325***		-0.000		0.148***	
	(0.001)		(0.000)		(0.992)		(0.010)	
Ln(EPU) × Innnovation Intensity × Above Leverage Target	-0.038***		-0.077***		0.003		-0.036***	
	(0.001)		(0.000)		(0.778)		(0.007)	
Ln(EPU) × Deviation from Leverage Target		0.748***		1.066***		0.143*		0.312***
		(0.000)		(0.000)		(0.089)		(0.003)
Deviation from Leverage Target		0.545		-0.750		2.818***		-1.271***
		(0.158)		(0.314)		(0.000)		(0.006)
Innnovation Intensity × Deviation from Leverage Target		0.607***		1.361***		-0.377*		0.745***
		(0.004)		(0.000)		(0.067)		(0.000)
Ln(EPU) × Innnovation Intensity × Deviation from Leverage Target		-0.134***		-0.316***		0.104**		-0.180***
		(0.007)		(0.000)		(0.041)		(0.000)
Ln(EPU) × Innnovation Intensity	0.007	-0.015*	0.017	-0.022	-0.008	-0.010	0.010	-0.007
	(0.361)	(0.062)	(0.248)	(0.168)	(0.500)	(0.309)	(0.297)	(0.452)
Innnovation Intensity	-0.026	0.073**	-0.073	0.100	0.037	0.058	-0.044	0.025
	(0.394)	(0.035)	(0.247)	(0.141)	(0.459)	(0.179)	(0.269)	(0.524)
Observations	731985	731985	731985	731985	731985	731985	719957	719957
Adjusted R2	0.844	0.921	0.680	0.723	0.661	0.684	0.569	0.570
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table 6: Transmission Channel: Investment

Note: This table presents the estimation results from the regression of debt structure or maturity variables on EPU, EPU interacted with industry-level characteristics related to investment decisions including redeployability, time-to-build, and investment intensity, and the control variables. The asset redeployability index developed by Kim and Kung (2016) is controlled and interacted with EPU in columns (1)-(4), the time-to-build is the length of plant investment (number of years) from Brooks (2000), and the investment intensity is calculated using the ratio of capital expenditure to net property, plant and equipment based on Rajan and Zingales (1998). For each category of investment characteristics, the dependent variables are total debt to total assets (*Total*), long-term debt to total assets (*Long*), short-term debt to total assets (*Short*) and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*), respectively. EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016), the innovation intensity is the number of forward patents citing the patents in this industry. We first estimate the long-term leverage target using the specification in equation 3, and define the dummy of above leverage target if the actual leverage is above the long-run target, and calculate the deviation to target as the difference between actual leverage and the long-run target. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Redeployability				Time-to-Build				Investment Intensity			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total	Long	Short	Maturity	Total	Long	Short	Maturity	Total	Long	Short	Maturity
Ln(EPU)	-0.181***	-0.237***	-0.092	-0.052	-0.146***	-0.179**	-0.109*	-0.033	-0.009	-0.035***	-0.008	-0.025***
	(0.000)	(0.000)	(0.240)	(0.304)	(0.000)	(0.030)	(0.095)	(0.559)	(0.190)	(0.001)	(0.504)	(0.002)
Ln(EPU) × Redeployability	0.082**	0.053***	0.026	-0.033								
	(0.013)	(0.007)	(0.577)	(0.291)								
Redeployability	-0.714**	-0.857***	0.067	-0.112								
	(0.019)	(0.000)	(0.806)	(0.744)								
Ln(EPU) × Time-to-Build					0.008***	0.001	0.015***	-0.007*				
					(0.006)	(0.894)	(0.005)	(0.051)				
Ln(EPU) × Investment Intensity									-0.654***	-0.871***	-0.323***	-0.208***
									(0.000)	(0.000)	(0.000)	(0.000)
Observations	2642406	2642406	2642406	2554007	1431094	1431094	1431094	1393978	3083985	3083985	3083985	2981300
Adjusted R2	0.738	0.629	0.600	0.503	0.737	0.611	0.618	0.515	0.735	0.627	0.594	0.499
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table 7: Transmission Channel: Term Structure

Note: This table presents the estimation results from the regression of debt structure or maturity variables on the EPU predicted term structure, the EPU predicted term structure interacted with innovation intensity, and the control variables. The dependent variable is the ratio of total debt to total assets (*Total*) in columns (1)-(2), the ratio of long-term debt to total assets (*Long*) in columns (3)-(4), the ratio of short-term debt to total assets (*Short*) in columns (5)-(6), and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*) in columns (7)-(8). The EPU predicted term structure is the fitted value of term structure based on the results in column (3) of Table A10, the innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, actual term structure is the actual difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Total		Long		Short		Maturity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EPU Predicted Term Structure	-0.204***	-0.181***	-0.309***	-0.291***	-0.061	-0.020	-0.104*	-0.109**
	(0.000)	(0.002)	(0.003)	(0.008)	(0.291)	(0.657)	(0.056)	(0.047)
EPU Predicted Term Structure × Innnovation Intensity	-0.003	-0.003	-0.007	-0.007	0.000	0.000	-0.004	-0.004
	(0.274)	(0.298)	(0.275)	(0.275)	(0.947)	(0.953)	(0.340)	(0.342)
Innnovation Intensity	0.009*	0.008	0.012	0.011	0.005	0.003	0.003	0.004
	(0.070)	(0.153)	(0.287)	(0.342)	(0.605)	(0.780)	(0.685)	(0.670)
Observations	1519357	1519357	1519357	1519357	1519357	1519357	1481887	1481887
Adjusted R2	0.769	0.769	0.651	0.651	0.624	0.624	0.528	0.528
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table 8: Discussion: The Role of US and Global Uncertainty

Note: This table presents the estimation results from the regression of debt maturity on US or global EPU, US or global EPU interacted with innovation intensity and the control variables. The dependent variable is the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*). The US and Global EPU indices used in column (1) and (6) are the economic policy uncertainty indices using the methodology in Baker et al. (2016).The US financial uncertainty, macroeconomic uncertainty and real uncertainty used in columns (2)-(4) are from Jurado et al. (2015). The VIX used in column (5) is the CBOE volatility index to measure the stock market's expectation of volatility implied by S&P 500 index options. Innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

DepVar	Maturity					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(US EPU) × Innnovation Intensity	0.007					
	(0.206)					
Ln(US Financial Uncertainty) × Innnovation Intensity		0.014				
		(0.104)				
Ln(US Macro Uncertainty) × Innnovation Intensity			-0.025*			
			(0.081)			
Ln(US Real Uncertainty) × Innnovation Intensity				-0.030		
				(0.167)		
Ln(VIX) × Innnovation Intensity					0.004	
					(0.338)	
Ln(Global EPU) × Innnovation Intensity						0.008
						(0.233)
Innnovation Intensity	-0.036	-0.001	-0.014**	-0.018	-0.014	-0.040
	(0.169)	(0.690)	(0.045)	(0.120)	(0.210)	(0.197)
Observations	1481887	1481887	1481887	1481887	1481887	1475150
Adjusted R2	0.528	0.528	0.528	0.528	0.528	0.529
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table 9: Discussion: Heterogeneous Impact for Import- and Export-Dependent Firms

Note: This table presents the estimation results from the regression of debt maturity variables on US or global EPU, US or global EPU interacted with sector import and export intensity, and the control variables. US EPU, as well as its two subcategories of trade- and tax-related EPU, and global EPU are the economic policy uncertainty indices using the methodology in Baker et al. (2016). US import (export) intensity is calculated as the ratio of import(export) from(to) US to GDP, Global import (export) intensity is calculated as the ratio of import(export) from(to) the rest of the world to GDP. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

DepVar	Maturity			
	(1)	(2)	(3)	(4)
Ln(US EPU) × US Import Intensity	0.258***			
	(0.000)			
Ln(US EPU) × US Export Intensity	-0.195***			
	(0.003)			
Ln(US EPU-Trade) × US Import Intensity		0.244***		
		(0.002)		
Ln(US EPU-Trade) × US Export Intensity		-0.200***		
		(0.005)		
Ln(US EPU-Tax) × US Import Intensity			0.140***	
			(0.000)	
Ln(US EPU-Tax) × US Export Intensity			-0.102***	
			(0.002)	
Ln(Global EPU) × Global Import Intensity				0.028***
				(0.002)
Ln(Global EPU) × Global Export Intensity				-0.018**
				(0.015)
US Import Intensity	-1.136***	-0.794**	-0.521***	
	(0.002)	(0.023)	(0.008)	
US Export Intensity	0.897***	0.697**	0.425***	
	(0.005)	(0.015)	(0.006)	
Global Import Intensity				-0.161***
				(0.001)
Global Export Intensity				0.096**
				(0.012)
Observations	1274713	1274713	1274713	1271746
Adjusted R2	0.497	0.497	0.497	0.498
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Controls	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table 10: Discussion: Economic Policy Uncertainty and Firm Cash Holding

Note: This table presents the estimation results from the regression of cash holding on the EPU, EPU interacted with innovation intensity, and the control variables. The dependent variable is the ratio of cash holding to total assets, the EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016), and the innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, actual term structure is the actual difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. We control firm and year fixed effects and cluster standard errors at firm-year level.

DepVar	Ln(Cash Holding/Asset)		
	(1)	(2)	(3)
Ln(EPU)	0.289***	0.139**	0.159***
	(0.002)	(0.021)	(0.007)
Ln(EPU) × Innnovation Intensity			-0.024**
			(0.027)
Innnovation Intensity			0.093*
			(0.052)
Observations	3129233	2991868	1473851
Adjusted R2	0.632	0.642	0.662
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
Controls	NO	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year

Internet Appendix

A1 Orbis Data Clean Process

The original data is denominated in current US dollars. In the following basic clean steps before deflation, we do not change the currency units because we use criteria based on ratios and do not reply on absolute values. But in the deflation part, we convert all financial variables in local official currencies[8] and then deflate using country-sector-level or country-level price index. In TFP estimation, we keep the values in deflated local currency, but in later cross-country regression, we convert them into 2005 US dollars by multiplying the 2005 exchange rate.

1. We limit the sample to unconsolidated accounts with or without a consolidated companion and deal with the firm-year duplicates.

    - We require consolidation codes equal U1 or U2, due to the double counting problem when both consolidated account of the parent (with all its subsidiaries) and the unconsolidated account of the parent (without subsidiaries) are reported.
    - Then deal with the firm-year duplicates using the following steps: (1)for the duplicates in firm ID and specific close date, we use the flow variable operating revenue to keep the one with largest values.(2) we generate the year from the close date by using the current year if the month is later than June and using the last year if the month is earlier than June. (3) then for each firm-year, we keep the one with the latest reporting date, if there still are duplicates then we keep and the one with the largest operating revenue.

2. We clean basic reporting mistakes.

    - Drop the observations that have missing information on total assets, operating revenues, sales and employment simultaneously,
    - Drop the firms if any one of these variables are negative in any year: total assets, employment, sales and tangible fixed assets.

- Drop the firms if the number of employees exceed two millions in any year.
- Drop the observations with missing, zero or negative values for operating revenue or total assets.

3. We check the internal consistency of balance sheet information.

   - Exclude extreme values by dropping observations that are below the 0.1 percentile or above the 99.9 percentile of the distribution of each of the following ratios: (1) fixed assets (the sum of tangible fixed assets, intangible fixed assets and other fixed assets) to total fixed assets; (2) the sum of stocks, debtors and other current assets to total current assets; (3) the sum of fixed assets and current assets to total assets; (4) the sum of capital and other shareholder funds to total shareholder funds; (5) the sum of long-term debt and other non-current liabilities as a ratio of total non-current liabilities; (6) the sum of loan, creditors and other current liabilities to total current liabilities; (7) the sum of non-current liabilities, current liabilities and shareholder funds to total shareholder funds and liabilities.

4. We check the data quality in a further way.

   - Drop the firms implying non-positive age values in any year.
   - Calculate liabilities as the difference between total shareholder funds & liabilities and the shareholder funds, then drop the observations if the value is negative or zero. In another way, liabilities can be computed as the sum of current liabilities and noncurrent liabilities, we generate the ratio of the two variables of liabilities and drop the observations if the ratio is greater than 1.1 or lower than 0.9.
   - Drop observations with negative current liabilities, noncurrent liabilities, current assets, loans, creditors, other current liabilities or long-term debt.
   - Drop the observations if their long-term debts are higher than the liability.

- Construct net worth as the difference between total assets and liability, then drop the observations if net worth does not equal to shareholder funds.
- Drop observations with missing, zero or negative values for the wage bill variable.
- Drop observations with negative values for intangible fixed assets, and drop observations with missing or zero values for tangible fixed assets.
- Calculate the ratio of tangible fixed asset to total assets and drop if the ratio is greater than one.
- Drop observations with negative depreciation values.
- Calculate the capital-labor ratio where capital stock is the sum of tangible and intangible fixed assets, and drop the firms if they have a capital-labor ratio in the bottom 0.1 percentile, and drop the firm-year observations with a capital-labor ratio higher than the 99.9 percentile or lower than the 0.1 percentile.
- Drop observations with negative shareholder funds, and drop the observations with the ratio of other shareholder funds to total assets in the bottom 0.1 percentile.
- Calculate two leverage indicators: the ratio of tangible fixed assets to shareholder funds and the ratio of total assets to shareholder funds, and then drop extreme values in the bottom 0.1 or top 99.9 percentile of the distribution of the two ratios.
- Calculate the value added as the difference between operating revenues and material costs, then drop the observations with negative value of value added.
- Construct the ratio of wage bill to value added and drop extreme values in the bottom 1 percentile or the top 99 percentile if the ratio exceeds 1 at the 99th percentile, or change the extreme threshold to 0.1 percentile and 99.9 percentile if the ratio does not exceed 1 at the 99th percentile. We also drop the observations with the ratio higher than 1.1.

A2 Robustness Check

First, we exclude the financial crisis years to mitigate the shocks on debt maturity from the economic downturn, which are usually accompanied by higher EPU. Additionally, some studies use the lagged term of EPU as the explanatory variable. Although we believe that the adjustment of the debt structure is within the current stage, especially when we use annual data, we still perform this robustness check and show the results using the lagged term for the pre-crisis period[9] in Table A1. Compared with the baseline results in Table 2, the results here are even stronger, as the scale of the coefficients is even larger, and the impact on short-term debt becomes significantly positive. With this model specification, a 1% increase in EPU in the last period is significantly associated with a 0.47% decrease in long-term debt, a 0.38% increase in short-term debt and a 0.28% decrease in debt maturity.

Second, we use alternative measures as our proxy for the industry-level innovation intensity. $Originality_{jkt}$ and $Generality_{jkt}$ reflect the fundamental importance of the innovation being patented and the distribution of the citation. Higher $Originality_{jkt}$ indicates that the innovation in this industry is more independent and novel, while higher $Generality_{jkt}$ indicates that the innovation activities can be more applicable and valuable for other industries. Besides, the patent number data is from the EPO to mitigate the concern of European firms mainly filing patents in European patent office, and the human capital intensity is to capture the investment in skilled labors for each industry. Table A2and A3 present the results using these measurements instead of the general citation indicator to interact with EPU. Again, the main findings remain that higher EPU is associated with a significant reduction in long-term debt and debt maturity, and the shortened maturity is more substantial in more innovation-intensive industries.

Third, we use the logarithm of debt levels to replace the debt-to-assets ratios as the dependent variable to test the impact of EPU on the amount of total debt, long-term debt, and short-term debt. Table A4 shows the results. Generally speaking, the estimated coefficients here are similar to those in the baseline results. On average, a 1% increase in EPU is associated with a 0.14% decrease in the total debt amount and a 0.20% decrease in the long-term debt amount, and there is no significant change in the short-term debt amount. Additionally, the negative impacts on total and long-term debt are stronger for firms in more innovation-intensive industries.

Fourth, we add additional control variables of political election and the shock of natural disaster. The variable *Election* is a dummy variable. It equals one if a country has a parliamentary, presidential or general election in that year; otherwise, it is zero. Natural disaster shock data are from Baker and Bloom (2013), who construct them based on the number and scale of damage caused by extreme weather events such as droughts, earthquakes, epidemics, floods, extreme temperatures, insect infestations, avalanches, landslides, storms, volcanoes, fires and hurricanes for each country-year. We control political and natural disaster shocks to mitigate the concern of omitted variables and the endogeneity of EPU. Table A5 shows that political and natural uncertainties are not driving the results, and the baseline findings remain to hold in the data.

Finally, we conduct a placebo test by using the falsified EPU index for each country. We construct three sets of falsified EPU: using the EPU of Asian countries (China, South Korea, Japan and Singapore), using the EPU of Latin American countries (Mexico, Colombia, Chile and Brazil), and using the mixed EPU within the four sample countries. Table A6 shows the results from one of the combinations[10]. All variables of interest become insignificant using these falsified EPU values. These results indicate that it is the actual domestic economic policy uncertainty that is associated with decreased corporate debt maturity.

Table A1: Robustness Check: Lagged EPU and Pre-Crisis Subsample

Note: This table presents the estimation results from the regression of debt structure or maturity variables on lagged EPU, lagged EPU interacted with innovation intensity and the control variables using the subsample of pre-crisis (before 2008) periods. The dependent variable is the ratio of total debt to total assets (*Total*) in columns (1)-(3), the ratio of long-term debt to total assets (*Long*) in columns (4)-(6), the ratio of short-term debt to total assets (*Short*) in columns (7)-(9), and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*) in columns (10)-(12). Lagged EPU is the one-year lagged economic policy uncertainty index using the methodology in Baker et al. (2016) and innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Total			Long			Short			Maturity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ln(Lagged EPU)	-0.161*	-0.197**	-0.190**	-0.421**	-0.482***	-0.474***	0.289***	0.379***	0.376***	-0.263***	-0.281***	-0.280***
	(0.087)	(0.011)	(0.015)	(0.019)	(0.004)	(0.006)	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.003)
Ln(Lagged EPU) × Innnovation Intensity			-0.004			-0.006			0.002			-0.002
			(0.241)			(0.365)			(0.799)			(0.632)
Innnovation Intensity			0.023			0.031			-0.010			0.008
			(0.180)			(0.342)			(0.769)			(0.689)
Observations	797925	754686	754683	797925	754686	754683	797925	754686	754683	764243	740038	740036
Adjusted R2	0.775	0.792	0.792	0.653	0.678	0.678	0.649	0.654	0.654	0.555	0.561	0.561
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table A2: Robustness Check: Other Innovation Intensity Measurement

Note: This table presents the estimation results from the regression of debt structure or maturity variables on EPU, EPU interacted with innovation intensity and the control variables. Columns (1)-(4) and columns (5)-(8) respectively report the results using the originality index and generality index to measure innovation intensity. As described in Section 2.2, patent originality is measured as one minus the Herfindahl index of the technology class distribution of all the patents it cites, and patent generality is calculated as one minus the Herfindahl index of the technology class distribution of all the other patents it is cited by. Each patent's originality and generality is aggregated to the country-industry-year level. EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016). Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Originality				Generality			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total	Long	Short	Maturity	Total	Long	Short	Maturity
Ln(EPU)	-0.139***	-0.220**	-0.030	-0.079	-0.138***	-0.218**	-0.031	-0.078
	(0.007)	(0.032)	(0.474)	(0.135)	(0.008)	(0.033)	(0.459)	(0.140)
Ln(EPU) × Innovation	-0.003	-0.008*	0.003	-0.005*	-0.004	-0.012*	0.005	-0.008**
	(0.124)	(0.088)	(0.432)	(0.096)	(0.102)	(0.050)	(0.285)	(0.046)
Innovation	0.014*	0.033*	-0.010	0.020	0.018*	0.050*	-0.019	0.032*
	(0.099)	(0.092)	(0.513)	(0.120)	(0.078)	(0.052)	(0.345)	(0.058)
Observations	1519357	1519357	1519357	1481887	1519357	1519357	1519357	1481887
Adjusted R2	0.769	0.651	0.624	0.528	0.769	0.651	0.624	0.528
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table A3: Robustness Check: Other Innovation Intensity Measurement

Note: This table presents the estimation results from the regression of debt structure or maturity variables on EPU, EPU interacted with innovation intensity and the control variables. Columns (1)-(4) and columns (5)-(8) respectively report the results using the logarithm of patent number in the European Patent Office (EPO) and the human capital intensity index to measure innovation intensity. As described in Section 2.2, here we use the patent information from EPO instead of USPTO. Human capital intensity is captured by the share of hours worked by highly-skilled persons in the total hours. EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016). Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Ln(Patent Number)				Human Capital Intensity			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total	Long	Short	Maturity	Total	Long	Short	Maturity
Ln(EPU)	-0.129***	-0.089	-0.156**	0.041	-0.080**	-0.134*	-0.025	-0.052
	(0.001)	(0.321)	(0.029)	(0.528)	(0.012)	(0.055)	(0.738)	(0.331)
Ln(EPU) × Innovation	-0.001	-0.014*	0.013	-0.013**	-0.411***	-0.540***	-0.305***	-0.126**
	(0.753)	(0.060)	(0.109)	(0.042)	(0.000)	(0.000)	(0.000)	(0.014)
Innovation	0.005	0.064*	-0.074*	0.058**				
	(0.731)	(0.055)	(0.069)	(0.049)				
Observations	1075986	1075986	1075986	1046592	2937285	2937285	2937285	2842254
Adjusted R2	0.752	0.625	0.617	0.500	0.735	0.625	0.596	0.499
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table A4: Robustness Check: Debt Level

Note: This table presents the estimation results from the regression of the level of total debt, long-term debt or short-term debt on EPU, EPU interacted with innovation intensity and the control variables. The dependent variable is the logarithm of the total debt level in columns (1)-(3), the logarithm of the long-term debt level in columns (4)-(6), and the logarithm of the short-term debt level in columns (7)-(9). EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016) and innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Ln(Total Debt)			Ln(Long-term Debt)			Ln(Short-term Debt)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(EPU)	-0.160***	-0.138***	-0.135***	-0.262***	-0.197***	-0.203**	-0.046	-0.062	-0.027
	(0.002)	(0.000)	(0.008)	(0.000)	(0.005)	(0.037)	(0.623)	(0.351)	(0.489)
Ln(EPU) × Innnovation Intensity			-0.007			-0.020**			0.008
			(0.114)			(0.048)			(0.323)
Innnovation Intensity			0.032*			0.086**			-0.032
			(0.081)			(0.043)			(0.363)
Observations	3159205	3024930	1485710	3157765	3022667	1484969	3157972	3022099	1483446
Adjusted R2	0.886	0.917	0.933	0.783	0.819	0.840	0.794	0.811	0.837
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table A5: Robustness Check: Controlling Political Election and Natural Disaster

Note: This table presents the estimation results from the regression of debt structure or maturity variables on EPU, EPU interacted with innovation intensity and the control variables. The dependent variable is the ratio of total debt to total assets (*Total*) in columns (1)-(3), the ratio of long-term debt to total assets (*Long*) in columns (4)-(6), the ratio of short-term debt to total assets (*Short*) in columns (7)-(9), and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*) in columns (10)-(12). EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016) and innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. We additionally control the dummy indicating that a country is having a parliamentary, presidential or general election in that year, and the shock of natural disaster from Baker and Bloom (2013). In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Total			Long			Short			Maturity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ln(EPU)	-0.210***	-0.149***	-0.132***	-0.316***	-0.194***	-0.203**	-0.110	-0.100*	-0.022	-0.088	-0.043	-0.069
	(0.000)	(0.000)	(0.003)	(0.000)	(0.009)	(0.028)	(0.162)	(0.094)	(0.605)	(0.149)	(0.323)	(0.177)
Ln(EPU) × Innnovation Intensity			-0.005			-0.017*			0.005			-0.011*
			(0.208)			(0.083)			(0.548)			(0.070)
Innnovation Intensity			0.027			0.073*			-0.019			0.047*
			(0.151)			(0.075)			(0.607)			(0.084)
Parlimentary or Presidential Election Year	0.013	0.009	-0.012	0.008	0.001	-0.016	0.020	0.019	-0.008	-0.008	-0.009	-0.005
	(0.212)	(0.319)	(0.313)	(0.641)	(0.964)	(0.512)	(0.242)	(0.274)	(0.512)	(0.494)	(0.415)	(0.700)
Natural Disaster	0.053*	0.048	0.004	0.040	-0.170***	-0.065	0.089	0.294**	0.007	-0.021	-0.216***	-0.073*
	(0.059)	(0.192)	(0.890)	(0.473)	(0.009)	(0.314)	(0.323)	(0.047)	(0.872)	(0.650)	(0.008)	(0.070)
Observations	2668261	2545579	1519357	2668261	2545579	1519357	2668261	2545579	1519357	2527122	2464267	1481887
Adjusted R2	0.735	0.751	0.769	0.619	0.642	0.651	0.605	0.609	0.624	0.510	0.515	0.528
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table A6: Placebo Test Using Falsified EPU

Note: This table presents the estimation results from the falsification test by regressing debt maturity on falsified EPU, falsified EPU interacted with innovation intensity and the control variables. The dependent variables are the debt maturity defined as the ratio of long-term debt to total debt. We use the EPU of Asian economies(specifically, the EPU of China for Germany, Japan for France, Singapore for Italy, and Korea for Spain) in columns (1)-(2), the EPU of Latin economies(specifically, the EPU of Colombia for Germany, Chile for France, Mexico for Italy, and Brazil for Spain) in columns (3)-(4), the disordered EPU(specifically, the EPU of Italy for Germany, Spain for France, France for Italy, Germany for Spain) in columns (5)-(6). EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016) and innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Placebo EPU: Asian Economies		Placebo EPU: Latin Economies		Placebo EPU: Disordered	
	(1)	(2)	(3)	(4)	(5)	(6)
Placebo Asian EPU	-0.122	-0.127				
	(0.142)	(0.160)				
Placebo Asian EPU × Innnovation Intensity	0.007	-0.006				
	(0.165)	(0.434)				
Placebo Asian EPU × Treated		0.015				
		(0.390)				
Placebo Asian EPU × Innnovation Intensity × Treated		0.016				
		(0.193)				
Placebo Latin EPU			0.037	0.068		
			(0.250)	(0.104)		
Placebo Latin EPU × Innnovation Intensity			0.001	-0.014		
			(0.755)	(0.162)		
Placebo Latin EPU × Treated				-0.019		
				(0.159)		
Placebo Latin EPU × Innnovation Intensity × Treated				0.016		
				(0.178)		
Placebo Disordered EPU					-0.049	-0.009
					(0.295)	(0.842)
Placebo Disordered EPU × Innnovation Intensity					0.003	0.012
					(0.411)	(0.127)
Placebo Disordered EPU × Treated						-0.023
						(0.182)
Placebo Disordered EPU × Innnovation Intensity × Treated						-0.012
						(0.184)
Innnovation Intensity × Treated		-0.072		-0.074		0.049
		(0.168)		(0.157)		(0.242)
Innnovation Intensity	-0.034	0.027	-0.009	0.064	-0.015	-0.050
	(0.134)	(0.430)	(0.615)	(0.156)	(0.301)	(0.154)
Observations	1434130	915113	1481887	947677	1459600	934312
Adjusted R2	0.532	0.525	0.528	0.517	0.529	0.520
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

A3 Additional Figures and Tables

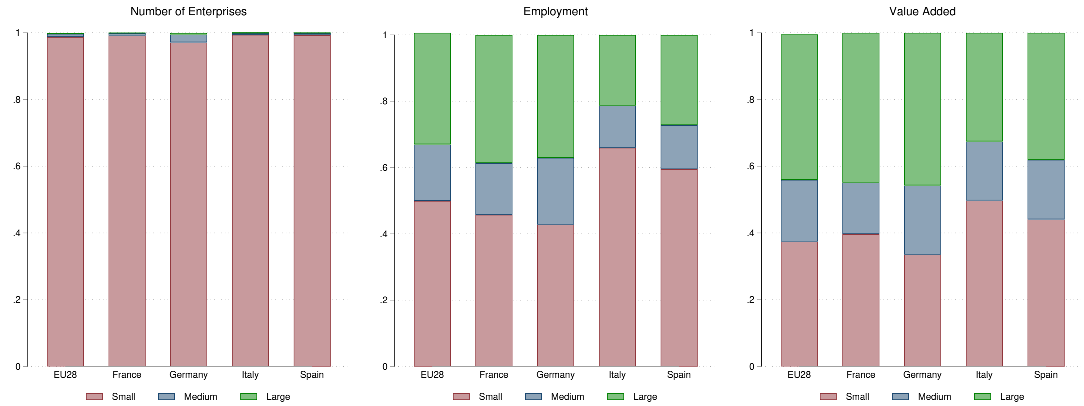

Figure A1: The Importance of SMEs In Europe and the Four Sample Countries

Note: This figure plots the share of small, medium and large firms in the number of firms, total employment and total value added in the economies of EU28, Germany, France, Italy and Spain in the year of 2015. The data source is Eurostat.

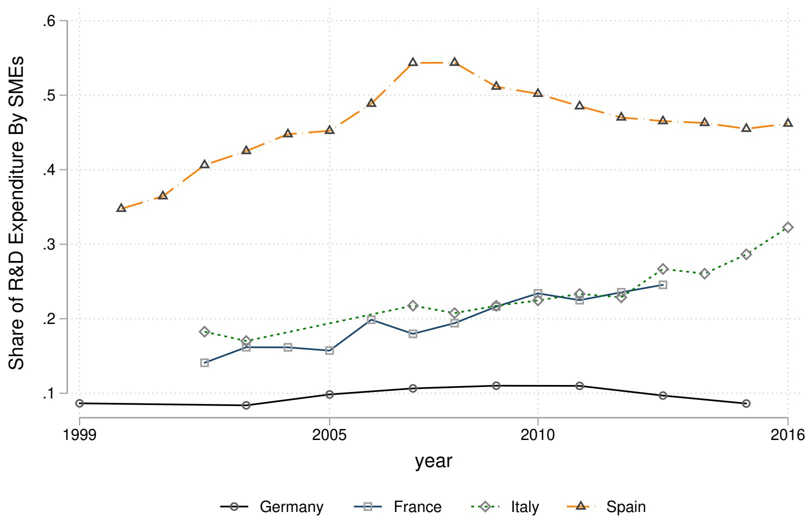

Figure A2: Share of R&D Expenditures By SMEs

Note: This figure plots the time series of the share of R&D expenditures by SMEs in Germany, France, Italy and Spain from 1999-2016. The data source is Eurostat.

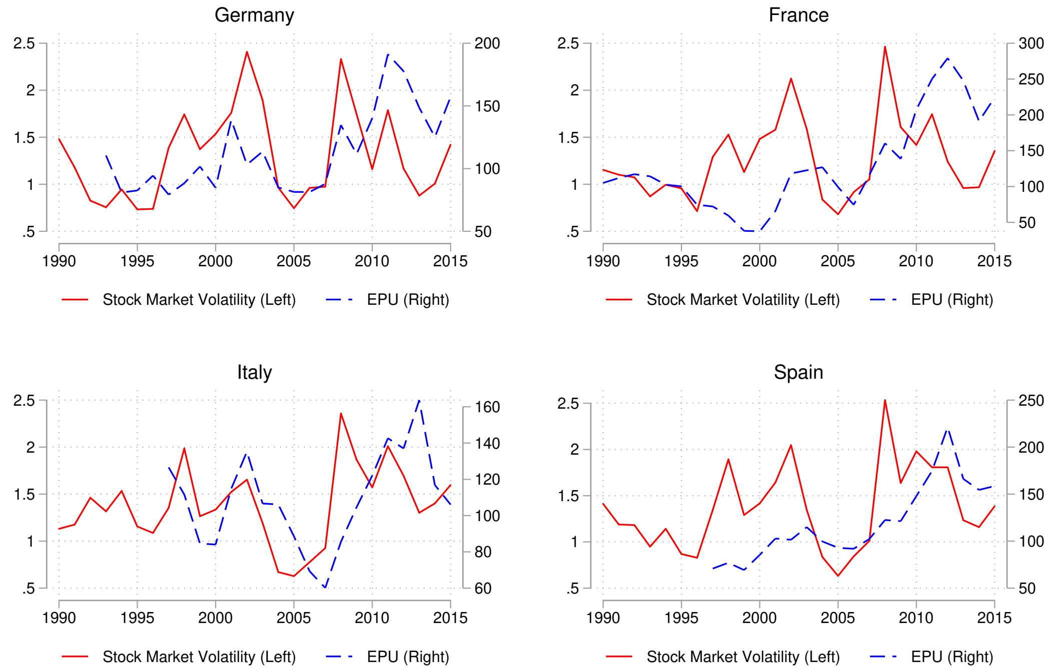

Figure A3: Time Series of Stock Market Volatility and EPU

Note: This figure graphs the time series of stock market volatility and EPU for the sample countries: Germany, France, Italy and Spain. Stock market volatility is the standard deviation of the daily return of the country's equity index. EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016)

Table A7: Summary Statistics: Innovation Activities by Sector

Sector (ISIC Rev. 4 Sector Code)	Innovation-Citation Mean (Std.Dev.)	Innovation-Originality Mean (Std.Dev.)	Innovation-Generality Mean (Std.Dev.)	Ln(EPO Patent) Mean (Std.Dev.)	Human Capital Intensity Mean
Agriculture, forestry and fishing	0.0009	0.0047	0.0036		0.071
(D01T03)	(0.0023)	(0.0202)	(0.0157)		
Mining and quarrying	0.1489	0.5943	0.4360		0.141
(D05T09)	(0.2675)	(1.0200)	(0.8182)		
Food products, beverages and tobacco	0.0679	0.3696	0.2642	3.846	0.125
(D10T12)	(0.1075)	(0.6238)	(0.5125)	(0.571)	
Textiles, wearing apparel, leather and related products	0.0509	0.2250	0.1923	3.836	0.119
(D13T15)	(0.0755)	(0.4314)	(0.3886)	(0.753)	
Wood and paper products, and printing	0.3281	1.0196	0.7519	3.538	0.132
(D16T18)	(0.5554)	(1.8783)	(1.6271)	(0.794)	
Chemical, rubber, plastics, fuel products and other non-metallic mineral products	1.6208	5.6266	3.8882	6.702	0.139
(D19T23)	(2.7379)	(7.9126)	(6.1439)	(0.660)	
Basic metals and fabricated metal products, except machinery and equipment	0.1975	1.0827	0.7775	5.283	0.128
(D24T25)	(0.3265)	(1.8036)	(1.4557)	(0.708)	
Electrical, electronic and optical equipment	2.6091	6.5037	4.7589	7.111	0.145
(D26T27)	(3.8336)	(8.2066)	(6.6496)	(0.764)	
Machinery and equipment	1.0125	3.1634	2.4444	6.936	0.134
(D28)	(1.6464)	(4.4139)	(3.6801)	(0.741)	
Transport equipment	1.3301	5.1376	3.8546	5.741	0.135
(D29T30)	(2.6943)	(6.1049)	(5.0657)	(0.884)	
Furniture; other manufacturing; repair and installation of machinery and equipment	1.8045	5.1773	3.6278	5.883	0.123
(D31T33)	(2.6156)	(7.6803)	(6.1461)	(0.652)	
Electricity, gas, steam, water supply	0.0096	0.0354	0.0234		0.213
(D35T39)	(0.0183)	(0.0566)	(0.0399)		
Construction	0.1207	0.2379	0.1621	4.465	0.099
(D41T43)	(0.2194)	(0.4380)	(0.3476)	(0.588)	
Wholesale and retail trade, repair of motor vehicles and motorcycles	0.0375	0.1421	0.1042		0.141
(D45T47)	(0.0730)	(0.2746)	(0.2268)		
Transport and Storage	0.0049	0.0167	0.0114		
D49T53	(0.0084)	(0.0266)	(0.0220)		
Accommodation and food service activities	0.0067	0.0235	0.0169		0.090
D55TD56	(0.0105)	(0.0477)	(0.0406)		
Information and communication	0.2858	0.5584	0.3789	3.235	0.155
(D58T63)	(0.3921)	(0.6906)	(0.5648)	(0.800)	
Administrative and support service activities	0.0264	0.0887	0.0628		0.374
(D68T83)	(0.0410)	(0.1638)	(0.1273)		
Public administration and defence; compulsory social security	0.0002	0.0008	0.0009		0.327
(D84)	(0.0003)	(0.0015)	(0.0017)		
Education	0.0004	0.0019	0.0014		0.570
(D85)	(0.0009)	(0.0108)	(0.0086)		
Human health and social work activities	0.0046	0.0084	0.0063		0.352
(D86T88)	(0.0082)	(0.0153)	(0.0129)		
Arts, entertainment and recreation	0.3256	0.4078	0.2844		0.207
(D90T99)	(0.4797)	(0.6534)	(0.5012)		
Total	0.2574	0.7890	0.5639	4.868	0.162
	(1.0598)	(2.9541)	(2.2858)	(1.299)	(0.092)

Table A8: Additional Results: Leverage Regression in the First Stage

Note: This table presents the estimation results from the regression of leverage on firm size, tangibility, profitability and non-debt tax shields. Leverage is the ratio of total debt to total assets, firm size is the logarithm of total assets, tangibility is the ratio of tangible fixed assets to total assets, profitability is the earnings before interest and taxes over assets, non-debt tax shield is the ratio of depreciation over assets. We control the predicted leverage from this regression in the second stage analysis when debt maturity is the dependent variable. Non-debt tax shields are not controlled in the second stage to validate the IV approach. We control firm and year fixed effects and cluster standard errors at firm-year level.

	(1) Dep: Leverage
Size	0.047***
	(0.000)
Tangibility	0.218***
	(0.000)
Profitability	-0.185***
	(0.000)
Non-debt Tax Shields	0.028
	(0.297)
Constant	0.221***
	(0.000)
Observations	2995551
Adjusted R2	0.763
F-Statistics	4009.800
Firm FE	YES
Year FE	YES
Clustering	Firm-Year

Table A9: Additional Results: Summary of Leverage Target Estimation

Note: This table summarizes the results of estimating a tobit model to predict leverage target as specified in equation 3. The value of predicted leverage is restricted to lie between zero and 1. The estimations are done for the firm observations in each country-year. This table presents the means and standard deviations for the estimated coefficients for each control variable.

Estimated Coefficients	Mean (Standard Deviation)
$Size_{i,t-1}$	-0.004
	(0.01)
$Tangibility_{i,t-1}$	0.143
	(0.067)
$Profitability_{i,t-1}$	-0.165
	(0.078)
$IndustryMedianLeverage_{i,t-1}$	0.546
	(0.200)
Estimated leverage target	0.288
	(0.075)
Average number of firms in country-year regressions	59,908

Table A10: Additional Results: EPU and Term Structure

Note: This table presents the estimation results from the cross-country regression of short-term interest rate, long-term interest rate and term structure on EPU, inflation, GDP growth and capital flows. Short-term interest rate is the three-month inter-bank rate and long-term interest rate is the ten-year government bond yields, and term structure is the difference between long-term and short-term interest rate. EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016), GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, and capital flows are the ratio of net capital inflows to GDP. In this regression, we use all the available country-year observations from 1982 to 2015 in 19 countries which have both the interest rate data and the EPU data, and control country fixed effects and year trend.

	(1)	(2)	(3)
	Short-term Interest Rate	Long-term Interest Rate	Term Structure
Ln(EPU)	0.219	0.481**	0.793***
	(0.477)	(0.027)	(0.001)
Inflation	0.739***	0.146***	-0.380***
	(0.000)	(0.009)	(0.000)
GDP Growth	-0.046	-0.256***	-0.190**
	(0.293)	(0.000)	(0.014)
Capital Flow	-0.031	-0.047	-0.049
	(0.299)	(0.237)	(0.267)
Constant	8.692***	10.787***	-0.688
	(0.000)	(0.000)	(0.509)
Observations	351	352	340
Adjusted R2	0.830	0.722	0.352
Trend	YES	YES	YES
Country FE	YES	YES	YES

Table A11: Additional Results: Regressing Domestic EPU on US EPU

Note: This table presents the estimation results from the regression of domestic EPU on US EPU, VIX, domestic GDP growth and stock market volatility. The residual from the regression is used as a proxy for complete domestic economic policy uncertainty after excluding the impact from US, and it is used in the regression of Table A12. We control country fixed effects and cluster the standard errors at country-year level.

	(1)
	Ln(Domestic EPU)
Ln(US EPU)	0.977**
	(0.014)
Ln(VIX)	-0.208
	(0.180)
Stock Market Volatility	-0.131
	(0.129)
GDP Growth	-0.028
	(0.394)
Constant	0.972
	(0.346)
Observations	87
Adjusted R2	0.434
Country FE	YES
Clustering	Country-Year

Table A12: Additional Results: Residual Economic Policy Uncertainty

Note: This table presents the estimation results from the regression of debt structure or maturity variables on residual EPU, residual EPU interacted with innovation intensity and the control variables. The dependent variable is the ratio of total debt to total assets (*Total*) in columns (1), the ratio of long-term debt to total assets (*Long*) in columns (2), the ratio of short-term debt to total assets (*Short*) in columns (3), and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*) in columns (4). Residual EPU is the residual by regressing the EPU for our sample countries on the US EPU, VIX index, domestic GDP growth, and stock market volatility, controlling country fixed effects. Then, we use the residual as the proxy of complete domestic EPU and redo the baseline regression. EPU is the economic policy uncertainty index using the methodology in Baker et al. (2016) and innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	(1) Total	(2) Long	(3) Short	(4) Maturity
Residual EPU	-0.134***	-0.213**	-0.031	-0.077
	(0.009)	(0.038)	(0.473)	(0.153)
Residual EPU × Innnovation Intensity	-0.015**	-0.037**	0.016	-0.023**
	(0.019)	(0.010)	(0.165)	(0.012)
Innnovation Intensity	0.000	-0.007	0.006*	-0.008***
	(0.889)	(0.109)	(0.092)	(0.007)
Observations	1519357	1519357	1519357	1481887
Adjusted R2	0.769	0.651	0.624	0.528
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Controls	YES	YES	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Table A13: Additional Results: Lagged EPU and Full Period

Note: This table presents the estimation results from the regression of debt structure or maturity variables on lagged EPU, lagged EPU interacted with innovation intensity and the control variables. The dependent variable is the ratio of total debt to total assets (*Total*) in columns (1)-(3), the ratio of long-term debt to total assets (*Long*) in columns (4)-(6), the ratio of short-term debt to total assets (*Short*) in columns (7)-(9), and the debt maturity defined as the ratio of long-term debt to total debt (*Maturity*) in columns (10)-(12). Lagged EPU is the one-year lag of the economic policy uncertainty index using the methodology in Baker et al. (2016) and innovation intensity is the number of forward patents citing the patents in this industry. Firm size is the logarithm of total assets, sale growth is the difference in log sales in the current year and previous year, cash flow is the sum of the profit for period and depreciation divided by total assets, tangibility is the ratio of tangible fixed assets to total assets, the SA index is the proxy of financial constraint based on firm size and age (Hadlock and Pierce 2010), profitability is the earnings before interest and taxes over assets, tax ratio is the ratio of tax over profits or loss before taxes, GDP growth is the annual GDP growth rate, inflation is the annual change of consumer price index, term structure is the difference between ten-year government bond yields and three-month inter-bank rate, stock market volatility is the standard deviation of the daily return of the country's equity index. In the debt maturity regression, we adopt the IV method to estimate leverage in the first stage using size, profitability, tangibility, non-debt tax shields and then use the predicted leverage in the second stage. Non-debt tax shield is the ratio of depreciation over assets. We control firm and year fixed effects and cluster standard errors at firm-year level.

	Total			Long			Short			Maturity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ln(Lagged EPU)	-0.125***	-0.061*	-0.017	-0.218***	-0.063	-0.068	-0.035	-0.057	0.087*	-0.076*	0.002	-0.047
	(0.003)	(0.078)	(0.713)	(0.003)	(0.366)	(0.466)	(0.574)	(0.288)	(0.065)	(0.096)	(0.959)	(0.335)
Ln(Lagged EPU) × Innnovation Intensity			-0.014***			-0.030**			0.014			-0.015**
			(0.006)			(0.011)			(0.102)			(0.034)
Innnovation Intensity			0.067***			0.132**			-0.060			0.065**
			(0.004)			(0.010)			(0.123)			(0.040)
Observations	3220647	3079484	1514302	3220647	3079484	1514302	3220647	3079484	1514302	3048515	2976823	1476885
Adjusted R2	0.718	0.735	0.769	0.603	0.627	0.651	0.590	0.594	0.625	0.494	0.499	0.528
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
Clustering	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year	Firm-Year

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