Corporate Social Responsibility, Policy Uncertainty, and Corporate Debt Maturity Structure*

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Abstract

This study investigates the effect of firms' ESG performance on the impact of policy uncertainty on corporate debt maturity structure decisions, using a sample of 3,296 US industrial firms and 27,019 firm-year observations. The findings reveal that ESG performance mitigates perceived refinancing and mispricing risks, leading to an extension of debt maturity structure during high policy uncertainty periods. 2SLS regression models demonstrate the significant weakening effect of firms' ESG performance on the debt maturity shortening impact of policy uncertainty. The influence of firm characteristics on ESG's moderating effect is also examined, with results indicating that firm size weakens and financial constraints strengthen the effect. Practically, the findings suggest that firms can leverage ESG to hedge against perceived risks and adjust their debt maturity structure towards an optimal level.

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Keywords: Policy uncertainty; Environmental, Social, and Governance (ESG); Moderating effect; Debt maturity; Capital structure

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1 Introduction

The maturity structure of corporate debt significantly influences corporate behaviour and carries crucial asset pricing implications (Morris, 1976; Gürkaynak et al., 2022). Essentially, a firm's debt maturity structure is intimately connected to the trade-off between short-term and long-term associated risks (Barclay & Smith Jr., 1995). Shorter maturities mitigate agency conflicts and provide companies with greater financing flexibility (Dangl & Zechner, 2021), while long-term obligations provide benefits for firms addressing tax issues (Leland & Toft, 1996).

Previous research has identified various firm characteristics, such as size, executive compensation, ownership structure, CEO inside debt holdings, and CEO overconfidence, as factors influencing corporate debt maturity structure decisions from agency conflict and internal control mechanisms perspective (Morris, 1976; Myers, 1977; Diamond, 1991; Guedes & Opler, 1996; Datta et al., 2005; Dang & Phan, 2016; Huang et al., 2016). As an exogenous macroeconomic uncertainty, policy uncertainty (PU) stems from the future changes of national policies, substantially affecting corporate behaviour and decision making (Gulen & Ion, 2016; Kaviani et al., 2020). Recent geopolitical shifts have sparked interest in the consequences of macro market shocks on financial markets and firm-level research, leading to increased policy uncertainty. Policy uncertainty can dampen firms' financing and investment decisions as it is a non-diversifiable exogenous shock to firms (Duong et al., 2020), and having significant negative effects on corporate debt maturity structure as firms opt for shorter debt maturities to convey positive signals to offset higher perceived risks during adverse times (Datta et al., 2019).

Environmental, Social, and Governance (ESG) require firms to prioritise not only shareholder interests but also the achievement of social goals (Renneboog et al., 2008). ESG activities have garnered increasing attention from investors, policymakers, and firms, due to their potential to attract socially responsible investors and consumers and foster loyal stakeholder relationships (Drempetic et al., 2020; Galema et al., 2008). Recent studies suggest that firms with better ESG performance may face lower perceived systematic risks through improved stakeholder relationships (Cheung, 2016; Chen et al., 2021). However, existing literature has provided limited investigation on the interplay of ESG and policy uncertainty on influencing a firm's debt maturity structure decisions.

To address this knowledge gap, we aim to examine whether firms' ESG performance moderates the relationship between policy uncertainty and corporate debt maturity structure. Therefore, we seek to answer the following research questions: How does a firm' ESG performance moderate the effects of policy uncertainty on corporate debt maturity structure? Do firm characteristics matter on ESG performance's moderating effects?

Our study contributes to the existing literature on corporate debt financing, specifically concerning debt maturity structure decisions, policy uncertainty, and ESG performance. Firstly, this paper is the first to investigate the moderating effect of ESG on the impacts of policy uncertainty on corporate debt maturity structure decisions, enriching the growing body of literature on ESG's role in corporate financing and governance. Although firms cannot control policy uncertainty levels and are often passively affected

by policy uncertainty shocks, resulting in adjustments to their debt maturity structure choices—such passive policy adjustments may be costly and inefficient. Investors can also benefit from this study by using a firm's ESG performance and debt maturity decisions as quality indicators, particularly during periods of heightened policy uncertainty. As for policymakers, they can utilise the results and implications of this study to make informed decisions and develop supportive policies that can assist firms in managing policy uncertainty while encouraging the adoption of ESG activities.

Secondly, we propose that a firm's ESG performance can moderate the relationship between policy uncertainty and firms' debt maturity choices, introducing a new dimension to understanding how firms with varying ESG performance determine their debt financing structure respond to macro factors. This provides new insight into the relationship between firms' non-financial performance and macroeconomic shocks. This research, therefore, offers valuable contributions to the understanding of corporate debt maturity structure decisions and the interplay between policy uncertainty and ESG performance, with practical applications for a range of stakeholders.

In this study, we investigate the moderating effect of ESG on the relationship between policy uncertainty and corporate debt maturity structure decisions. Using a sample of 3,296 unique US firms and 27.019 firm-year observations from 1991 to 2019, we find that higher ESG performance weakens the negative relationship between policy uncertainty and corporate debt maturity structure decisions. This result supports Peng et al.'s (2023) argument that ESG may act as a hedging strategy against the negative impact of policy uncertainty on firms.

Additionally, we test the moderating effect of ESG's sub-dimensions on the adverse influence of policy uncertainty on corporate debt maturity structure. Our findings indicate all three dimensions: environmental, social, and social dimension of ESG performance mitigate the debt maturity shortening effects of policy uncertainty. The moderating effect of ESG appears to significantly influence policy uncertainty's negative impact on corporate debt maturity structure through future monetary and fiscal policy uncertainty channels and expiring tax code provisions. However, the moderating effect of ESG does not seem to be significantly affected by news-coverage policy-related uncertainty.

Our results remain robust when using alternative measures of corporate debt maturity structure. Datta et al. (2019) argue that firm characteristics may substantially influence the relationship between policy uncertainty and corporate debt maturity structure choices. We, therefore, examine the triple moderating effects to test whether these firm characteristics, such as firm size, growth opportunity, and financially constraints, will significantly affect the moderating effect of ESG on the relationship between policy uncertainty and corporate debt maturity structure choices. Our results suggest firm size and financial constraints will significantly influence the moderating effect of ESG on the adverse effect of policy uncertainty on corporate debt maturity structures.

The rest of the article is structured as follows: Section 2 provides a comprehensive review of the existing literature on debt maturities, policy uncertainty, and ESG activities, highlighting the gaps in the literature that our study aims to address. In section 3, we describe the sampling method and data collection, as well as the methodologies used

in our analysis. Section 4 presents the results of our analysis model, providing insights into the relationship between economic policy uncertainty, ESG activities, excessive cash holdings, and corporate debt maturity structure decisions. In Section 5, we show the empirical results and test our hypotheses. Section 6 concludes.

2 Literature Review and Hypotheses Development

Firms determine their debt maturity structure by balancing the refinancing risk of short-term debt and the mispricing risk of long-term debt. Shorter maturities carry higher refinancing risks than longer debts (Harford et al., 2014). Frequent refinancing can impose greater default risk on companies and underestimate their continuous values (Mayer et al., 2013; Diamond, 1993). Hong & Kacperczyk (2009) indicate that investors' perceptions of negative characteristics related to a firm are crucial in a firm's financing processes. Short-term debt requires more frequent rollovers or extensions than long-term debt and may result in rollover and liquidation risks if firms face financing difficulties (Brunnermeier & Yogo, 2009).

During times of negative macroeconomic shocks, investors often perceive a bleak outlook for the economy, leading to a decrease in overall investment levels in the market (Froot et al., 1993; Gulen & Ion, 2015). Such external negative shocks introduce financial frictions in firms' debt financing and exacerbate the challenges of securing funds for corporations (Gungoraydinoglu et al., 2017). Policy uncertainty has long been regarded as a macro risk factor, with heightened uncertainty obscuring the investment activities (Brogaard & Detzel, 2015; D'Mello & Toscano, 2020; Favara et al., 2021). The more pronounced difficulty of refinancing relative to mispricing risks may prompt firms to opt for issuing more long-term debt.

Additionally, a firm's insiders are typically better informed than outsiders and lead to greater information asymmetry problems. Long-term debt has severer mispricing risks and greater information asymmetry than short-term debt (Flannery, 1986). Datta et al (2019) claim that policy uncertainty amplifies information asymmetry issues, which in turn, positively affects the mispricing risks of long-term debt. This has encouraged firms to avoid mispricing risk by avoiding long-term debt. Therefore, this dampening effect on profitability causes firms to become more averse to the mispricing risks associated with long-term debt. Moreover, outsiders may perceive less information asymmetry in a firm with shorter debt maturity structure, as primary borrowers of short-term debt, such as banks and private lenders, are regarded advantageous in monitoring and accessing more information over public borrowers (Krishnaswami et al., 1999). In such situations, firms may choose to reduce their debt maturity structure and send positive signals to the market.

Buchanan et al. (2018) suggest that CSR-focused firms may experience a more significant loss of firm value during crises due to heightened refinancing risks, resulting from the exacerbation of CSR overinvestment effects amid periods of uncertainty. Besides, socially responsible companies may exhibit reduced flexibility in responding to negative

shocks, rendering ESG stocks less predictable and more influenced by market dynamics (Becchetti et al., 2015).

According to the *signalling theory*, high ESG firms tend to signal their high quality to the market by using more short-term debt (Benlemlih, 2017). Policy uncertainty elevates the information asymmetry issues (Flannery, 1986), and strengthen the short-term debt's signalling effect, resulting in more access in short-term debt. Benlemlih (2017) also claims that high ESG firms will apply more short-term debt to manage ESG overinvestment problems, as short-term debt will receive more frequent monitor from borrowers. High policy uncertainty may exacerbate the agency problem associated with debt (Julio & Yook, 2012), and ESG firms may apply more short-term debt to resolve these agency problems.

However, Lins et al. (2017) argue that firms with a stronger emphasis on corporate social responsibility (CSR) consistently yield positive returns during financial crises. Non-financial performance, as indicated by firms' ESG, provides robust social capital to buffer against negative external shocks. High-ESG firms are widely acknowledged to have higher short-term valuations and lower perceived risks, which can counteract value underestimation problems (Edmans, 2011; El Ghoul et al., 2011). Consequently, firms excelling in ESG activities acquire strong social capital and face lower refinancing/liquidation risks than their counterparts with weaker ESG performance. Such firms may be inclined to shorten their debt maturity structure since the drawbacks of increasing short-term debt are mitigated to some extent (Barclay & Smith Jr., 1995). In this case, firms with better ESG performance may offset portion of the perceived risks imposed by policy uncertainty and choose a shorter debt maturity structure.

On the other hand, Cheng et al. (2014) propose that ESG-focused firms tend to exhibit greater transparency, lower information asymmetry, and reduced exposure to mispricing risks. During times of heightened policy uncertainty, the overemphasis on ESG may intensify the liquidation problem during the periods of high uncertainty, promoting firms to extend their debt maturity structure (Buchanan et al., 2018). High-ESG firms may be more susceptible to profitability challenges during high uncertainty periods, leading them to avoid short-term debt with elevated liquidation risks. To some extent, firms with higher ESG performance may prefer to issue more long-term debt under times of heightened policy uncertainty. Therefore, we propose Hypothesis 1:

*H1.*Higher ESG performance will weaken the shortening effect of policy uncertainty on corporate debt maturity structure.

Growth opportunities are considered to influence underinvestment problems and refinancing risks (Myers, 1977, Jensen, 1986). Short-term debt correlates with diminished underinvestment problems, yet higher refinancing risks (Johnson, 2003). Therefore, a firm's debt maturity structure may be influenced by trade-offs between underinvestment and refinancing risks associated with short-term debt. Datta et al. (2019) argue that policy uncertainty mitigates underinvestment problems and increases refinancing risks, thereby narrowing the refinancing difficulty gap between short-term and long-term

debt. As a result, firms exhibiting higher growth opportunities are more likely to extend their debt maturities than those with low growth opportunities. However, Axelson et al. (2009) counter that underinvestment problems worsen during challenging times when good deals might be difficult to finance. In situations of high policy uncertainty, investors become more cautious in assessing liquidity risks associated with investment opportunities, thereby exacerbating underinvestment problems. Firms prioritising ESG performance tend to have higher employee and customer loyalty, potentially augmenting investment efficiency during bad times (Benlemlih & Bitar, 2018). In such situations, superior ESG performance may alleviate underinvestment problems and encourage longer corporate debt maturity choices. Accordingly, we propose H2a.

*H2a.*The moderating effect of ESG will be strengthened in high growth opportunities firms.

Smaller firms, which lack the economies of scale necessary to reduce issuing costs, may gravitate toward long-term debt to mitigate flotation costs (Barclay & Smith Jr., 1995; Stohs & Mauer, 1996). During periods of high policy uncertainty, smaller firms may confront even greater challenges and be limited in their ability to lengthen their debt maturity structure due to increased financial frictions. Therefore, policy uncertainty amplifies refinancing risks and may prompt the market to favour long-term debt.

Enhanced ESG performance can lead to more frequent external monitoring and reduced flotation costs (Ge & Liu, 2015), further contributing to a shorter debt maturity structure. Exceptional ESG performance can serve as a valuable instrument in mitigating the heightened financial frictions associated with short-term debt, thus diminishing the motivation of larger firms to choose long-term debt. However, small firms are less likely to engage in ESG than larger firms, as they are constrained by limited resources (Udayasankar, 2008). Therefore, we propose H2b.

*H2b.*The moderating effect of ESG will be weakened in larger firms.

Financially constrained firms are typified by substantial agency costs or insufficient resources and capacity to capitalise on investment opportunities (Korajczyk & Levy, 2003). Such firms typically face higher refinancing and mispricing risks compared to financially unconstrained firms, which possess greater flexibly in adjusting their debt maturities (Datta et al., 2019). Policy uncertainty exacerbates financial constraints and increases firms' exposure to liquidation risk (Nguyen & Phan, 2017). Diminished debt capacity leads to greater information asymmetry and agency costs, thereby increasing mispricing risks (Hahn & Lee, 2009). Financially constrained firms may lack the debt capacity to access long-term debt, forcing them to opt for short-term debt. Short-term debt offers a higher level of monitoring, ensuring that these firms strive to enhance their financial situation and address their agency issues. Outstanding ESG performance endows firms with improved financing capacity through higher stakeholder involvement (lower agency costs) and increased transparency (lower information asymmetry) (Cheng et al., 2014).

Reduced mispricing costs may enable firms to adopt a longer debt maturity structure. Therefore, we propose H2c.

*H2c.*The moderating effect of ESG will be strengthened in high financial constrained firms.

3 Samples and Methodology

3.1 Sample Description

Our dataset comprises financial data for all US firms available on COMPUSTAT and the Centre for Research in Security Prices (CRSP) database from 1991 to 2019. Following Barclay & Smith Jr. (1995), we select firms with Standard Industrial Classification (SIC) codes ranging from 2000 to 5999 for our analysis. We define long-term debt as debt with a maturity of over one year up to five years and assess the debt maturity structure by calculating the percentage of total debt maturing over three years. To eliminate potentially erroneous data, we exclude observations with total debt maturity less than 0

We employ the MSCI ESG (formerly KLD, Kinder, Lydenburg, and Domini) database, which offers detailed ESG scoring subsections. In line with prior ESG studies, we compute the ESG score using the criteria displayed in Appendix 2 (Kim et al., 2014; Benlemlih, 2017). Additionally, we measure economic policy uncertainty using the EPU index based on news information proposed by Baker et al. (2016), which has been widely adopted as a proxy for policy uncertainty in recent literature (Bretscher et al., 2018; Hanley & Hoberg, 2019). In summary, our sample ranges from fiscal year 1991 to 2019, which consists totally 27,019 firm-year observations, representing 3,296 unique firms.

3.2 Multivariable Regressions

Acknowledging the strong endogeneity that exists between debt maturity and leverage (Barclay & Smith Jr., 1995; Johnson, 2003; Chen et al., 2021), which often change simultaneously, our study employs a two-stage least squares (2SLS) regression analysis, as has been done in previous research (Johnson, 2003; Datta et al., 2019). In the first-stage OLS regression, the dependent variable is the firm's endogenous leverage, defined as 100*(long-term debt-to-market) / (book value of total assets), following Custódio et al. (2013). We use the subsequent regression models as first-stage OLS regressions:

$$\begin{aligned} Leverage_{it} = f(&EPU_{it}, MTB_{it}, Size_{it}, Size_{it}^2, CAPEX_{it}, \\ &FA_{it}, AM_{it}, SAI_{it}, REG_{it}, RET\_STD_{it}, TLCF_{it}) \end{aligned} \tag{1}$$

For second-stage regressions, the dependent variable is D3, representing the percentage of total debt maturing in more than three years to total debt (Barclay & Smith Jr., 1995; Custódio et al., 2013). We employ the predicted leverage from the first-stage regression as an independent variable to address the endogeneity problem:

$$\begin{aligned} D3_{it} = f(EPU_{it}, MTB_{it}, Size_{it}, Size_{it}^2, SAI_{it}, \hat{Leverage}_{it}, \\ AM_{it}, CAPEX_{it}, TS_{it}, AE_{it}, REG_{it}, RET\_STD_{it}, Prof_{it} \end{aligned} \tag{2}$$

For alternative measurements of debt maturity structure, we use D1, percentage of total debt maturing in more than one year, and D5, percentage of total debt maturing in more than five years.

3.2.1 Independent Variables

The independent variables used in the multivariate regressions include the EPU index, a proxy for policy uncertainty. We also employ sub-indices of EPU: NEWS, TAX, CPI, and FED, which are utilised in subsequent tests, while NEWS represents the news-coverage policy uncertainty from top 10 US newspapers; TAX is the expiring tax code provisions; CPI and FED represent expected monetary and fiscal policy uncertainty, respectively.

We use market-to-book ratio (MTB) to signify a firm's growth opportunity, which is calculated as the difference of market value of total asset and the book value of total equity, divided by the book value of total assets. Firm size is measured using the market value of total assets. The CAPEX variable controls for a firm's investment, calculated as capital expenditure divided by the book value of total assets multiplied by 100. We also control for the term structure of interest rates (TS), as Brick & Ravid (1985) suggest that firms adjust their debt maturity structure to take advantage of tax shield resulting from changes in term structure. Since firms tend to align the maturity of their assets and liabilities to minimise agency problems, we include asset maturity (AM) in the regressions. AM is defined as the product of (gross property, plant, and equipment divided by total assets) and (gross property, plant, and equipment divided by depreciation plus the ratio of current assets to total assets).

Abnormal earnings (AE) is used to evaluate firm quality, calculated as earnings in year t+1 minus earnings in year t, divided by the market value of equity. Higher quality firms are expected to issue more short-term debt to signal their quality. The REG is a dummy variable that equals one if the firm belongs to regulated industries and zero otherwise. We follow Barclay & Smith Jr. (1995) to classify regulated industries, including railroads (SIC code 4011), trucking (4210 & 4213), airlines (4512), telecommunications (4812 & 4813), and gas and electric utilities (4900-4939). Managers in regulated firms have less discretionary power over future investments than those in unregulated firms; therefore, regulated firms are predicted to hold more long-term debt. Finally, RET_STD is used

to control for return volatility since risk-averse borrowers tend to shorten debt maturity. This variable is defined as the standard deviation of the natural logarithm of stock returns during the fiscal year, multiplied by the market value of equity and divided by the market value of total assets. Lastly, the operating loss carryforwards (TLCF) is a dummy variable used in the first-stage regression to address the endogeneity problem. TLCF is set to one for firms with operating loss carryforwards, and zero otherwise.

SAI represents the degree of firm constraints faced, with higher SA scores indicating greater financial difficulties. We measure SAI according to Hadlock & Pierce's (2010) formula:

$$SAI_{it} = -0.737 + log(Size_{it}) + 0.043 * log(Size^2)_{it} - 0.040 * FirmAge_{it} \quad (3)$$

By including these variables as instruments, we can better control for factors that may influence a firm's leverage and thus improve the accuracy of our multivariable regression analysis.

4 Empirical Results

4.1 Descriptive Statistics

Table 1 provides a detailed summary of the descriptive statistics related to debt maturity structure, firm characteristics, policy uncertainty, and ESG for US industrial firms between 1991 and 2019.

Panel A illustrate the distribution of total debt with maturities spanning from over one year to five years. On average, 71.06% of total debt matures in over one year, exhibiting a mean of 88.63%; 47.23% matures in over three years with a mean of 56.47%; and 30.02% matures in over five years, demonstrating a mean of 18.13%.

Panel B showcases the primary characteristic variables for the chosen US industrial firms. We present the mean, standard deviation, median, and quartiles for control variables. The average firm size amounts to $14,947.78 million, accompanied by a standard deviation of $44,022.77 million. The market-to-book ratio (MTB) displays a mean of 2.15 and a standard deviation of 1.47. Regarding the proxy for financial constraints, the SA index (SAI) demonstrates an average value of -6.23 across our selected sample. With a standard deviation of 1.61 and a median of -5.99, the majority of SAI values are negative. Lastly, the endogenous leverage has a mean of 25.01% and a standard deviation of 22.30%. For CAPEX, we have a mean of 5.02% with a standard deviation of 4.47%.

Panel C presents the descriptive statistics for policy uncertainty. Our main regression variable, EPU, represents a mean of 95.28 and a standard deviation of 27.80. In regard to sub-indices of policy uncertainty, CPI has a mean of 81.82 and standard deviation of 27.82; FED has a mean of 105.82 and standard deviation of 47.15; TAX has a mean of 109.34 and a standard deviation of 47.50; NEWS has a mean of 122.39 and a standard deviation of 33.32.

Table 1: Descriptive statistics for Selected sample from 1991–2019.

Panel A: Distribution of total debt maturing from the fiscal year end						
% of debt maturing in more than	Mean	SD	25^{th} percentile	Median	75^{th} percentile	Obs.
1 year	71.06	36.25	58.82	88.63	98.04	27,019
2 years	55.11	40.20	0.00	71.71	91.60	27,019
3 years	47.23	38.75	0.00	56.47	83.03	27,019
4 years	39.13	36.46	0.00	39.01	71.69	26,590
5 years	30.02	32.70	0.00	18.13	57.67	25,926
Panel B: Statistics for main variables at the fiscal year end						
Firm characteristics	Mean	SD	25^{th} percentile	Median	75^{th} percentile	Obs.
Firm size ($millions)	14,947.78	44,022.77	928.57	2790.72	9784.50	27,019
MTB	2.15	1.47	1.24	1.65	2.46	27,019
SAI	−6.23	1.61	−7.17	−5.99	−5.03	27,019
Leverage (%)	19.01	19.27	1.89	14.07	29.85	27.019
Asset_Maturity (years)	4.08	5.79	1.23	2.19	4.27	26,570
CAPEX (%)	5.02	4.47	2.05	3.82	6.60	27,019
Term_Structure (%)	1.66	1.07	0.72	1.93	2.60	27,019
ABN_Earnings (%)	0.61	12.33	−1.82	0.39	2.20	26,093
RET_STD	0.10	0.07	0.05	0.08	0.13	27,019
Fixed_Assets (%)	54.15	36.81	24.06	46.01	79.52	27,019
Profitability (%)	10.23	20.38	8.07	12.53	17.60	27,019
Panel C: Descriptive Statistics for Policy Uncertainty						
Policy uncertainty	Mean	SD	25^{th} percentile	Median	75^{th} percentile	Obs.
EPU	95.28	27.80	64.99	92.59	118.64	27,019
CPI	81.82	27.82	63.32	76.04	94.45	27,019
FED	105.82	47.15	66.89	102.62	140.62	27,019
TAX	109.34	47.50	68.11	110.36	138.42	27.019
NEWS	122.39	33.32	90.60	127.85	147.65	27,019

Panel D summarise the ESG and its sub-dimensions. ESG shows a mean of 0.06 with a standard deviation of 2.10. While only the Governance dimension has a negative mean of -0.16, accompanied by a standard deviation of 0.55.

4.2 Pearson Correlation Matrices

Table 2 showcases the Pearson correlation coefficients for the main variables used in our multivariate regressions analyses. Upon examining Table 2, we highlight the following relationships among our variables: the correlation coefficient of D3 and Lev. is 0.44, indicating a positive linear relationship exists between debt maturity and leverage. This association suggests a potential endogenous relationship between these two variables. Additionally, ESG exhibits no significant linear relationships with all other variables, suggesting ESG might serve as a potential exogenous variable of our multivariate regressions.

Table 3 presents the correlations between ESG, EPU, and sub-indices of EPU and

Table 1: Countinued

Panel D: Descriptive Statistics for Environment, Social, and Governance						
ESG	Mean	SD	25^{th} percentile	Median	75^{th} percentile	Obs.
Overall ESG scores	0.06	2.10	−1.00	0.00	1.00	27,019
Environment dimension (E)	0.07	1.11	0.00	0.00	0.00	27,019
Social dimension (S)	0.14	1.39	−1.00	0.00	1.00	27,019
Governance dimension (G)	−0.16	0.55	0.00	0.00	0.00	27.019

Notes: This table presents the annual descriptive statistics for the selected variables, encompassing mean, standard deviation, 25^{th} percentile, median, 75^{th} percentile, and total observations. The dependent variable is *D3*, which denotes the percentage of debt maturing in more than three years. The key explanatory variables are *ESG* and *EPU*. *ESG* stands for KLD ESG performance score. *EPU* refers to Baker et al.'s (2016) policy uncertainty index. The market-to-book ratio, denoted as *MTB*, is calculated by dividing *Size* by the book value of total assets. *Size* denotes a firm's market value, which is computed as the product of stock price and common shares outstanding, added to the book value of total assets, and subtracted from the book value of equity. *SAI* is the financial constraints measure following Hadlock & Pierce (2010). Lev. serves as the leverage measure of a firm, calculated by dividing long-term total debt by the market value of total assets. *AM* refers to the maturity of assets within a firm, while *CAPEX* presents the percentage of a firm's capital expenditure relative to the book value of its total assets. *Term* denotes the term structure of the interest rate. *ABNE*, or abnormal earning, is calculated by subtracting earnings in year t from those in year t+1, then dividing the result by the market value of equity. *REG* denotes the regulated industries following Barclay & Smith (1995). *RET_STD* denotes stock return volatility, obtained by multiplying the standard deviation of the natural logarithm of yearly stock return by the market equity of asset ratio. *Profitability* is assessed as the ratio of operating income before depreciation to total assets. *FA* indicates the firm's fixed asset concentration, measured by the ratio of net Property, Plant, and Equipment (PPE) to total assets.

ESG. Among these components, TAX and FED exhibit the strongest associations with the aggregate index, displaying correlation coefficients of 0.94 and 0.94, respectively. In contrast, the CPI factor demonstrates the weakest relationship with EPU, with a correlation coefficient of 0.65. Furthermore, ESG and its sub-dimensions do not exhibit any linear relationships with any component of policy uncertainty.

5 Multivariate Analysis

In this section, we present the multivariate results of our study, aiming to investigate the effect of policy uncertainty on corporate debt maturity structure decisions within the context of firm-specific ESG performance, and explore the extent to which a firm's ESG performance influences this relationship. We employ a 2SLS regression model to analyse the data and assess the relationships between corporate debt maturity structure, policy uncertainty, and the moderating effect of ESG. The dataset consists of 27,019 firm-year observations, covering the period from 1991 to 2019. The results are reported in Table 4.

Table 2: Pearson correlation matrix for selected samples of variables.

	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	-16
1. D3	1.00															
2. ESG	0.03	1.00														
3. EPU	−0.03	0.01	1.00													
4. MTB	−0.21	0.07	−0.09	1.00												
5. Size	0.06	0.16	−0.03	0.04	1.00											
6. SAI	−0.28	−0.20	0.06	0.04	−0.53	1.00										
7. Lev	0.44	−0.07	0.05	−0.43	0.02	−0.18	1.00									
8. AM	0.09	−0.01	0.00	−0.02	0.02	−0.10	0.17	1.00								
9. CAPEX	0.04	0.01	−0.03	0.00	0.02	−0.03	0.03	0.24	1.00							
10. Term	−0.06	−0.06	0.57	−0.07	−0.07	0.10	−0.01	−0.02	−0.04	1.00						
11. ABNE	−0.00	−0.03	0.08	−0.01	−0.02	0.03	0.09	−0.03	−0.03	0.10	1.00					
12. REG	0.04	0.03	−0.01	−0.08	0.10	−0.05	0.14	0.08	0.24	−0.01	0.00	1.00				
13. RET_STD	−0.31	−0.10	0.11	0.23	−0.16	0.43	−0.38	−0.10	−0.06	0.09	0.05	−0.09	1.00			
14. Profitability	0.10	0.06	−0.01	−0.09	0.08	−0.25	−0.02	−0.07	0.18	−0.02	−0.09	0.05	−0.28	1.00		
15. FA	0.18	0.01	0.02	−0.25	0.07	−0.22	0.27	0.36	0.55	0.01	0.03	0.25	−0.27	0.19	1.00	
16. TLCF	0.08	0.02	−0.02	−0.05	0.03	−0.02	0.16	−0.04	−0.18	−0.03	0.02	−0.06	0.03	−0.20	−0.12	1.00

Notes: This table presents the correlations for the selected variables annually. The dependent variable is *D3*, which denotes the percentage of debt maturing in more than three years. The key explanatory variables are *ESG* and *EPU*. *ESG* stands for KLD ESG performance score. *EPU* refers to Baker et al.'s (2016) policy uncertainty index. The market-to-book ratio, denoted as *MTB*, is calculated by dividing *Size* by the book value of total assets. *Size* denotes a firm's market value, which is computed as the product of stock price and common shares outstanding, added to the book value of total assets, and subtracted from the book value of equity. *SAI* is the financial constraints measure following Hadlock & Pierce (2010). Lev. serves as the leverage measure of a firm, calculated by dividing long-term total debt by the market value of total assets. *AM* refers to the maturity of assets within a firm, while *CAPEX* presents the percentage of a firm's capital expenditure relative to the book value of its total assets. *Term* denotes the term structure of the interest rate. *ABNE*, or abnormal earning, is calculated by subtracting earnings in year t from those in year t+1, then dividing the result by the market value of equity. *REG* denotes the regulated industries following Barclay & Smith (1995). *RET_STD* denotes stock return volatility, obtained by multiplying the standard deviation of the natural logarithm of yearly stock return by the market equity of asset ratio. *Profitability* is assessed as the ratio of operating income before depreciation to total assets. *FA* indicates the firm's fixed asset concentration, measured by the ratio of net Property, Plant, and Equipment (PPE) to total assets.

5.1 Baseline Regression

Table 4 presents the 2SLS regression results for the impact of policy uncertainty (EPU) on the percentage of debt maturing in more than three years (D3), and the moderating effect of ESG on the relationship between policy uncertainty and corporate debt maturity structure. We control for industry fixed effects for all 2SLS regression models, and p-values are calculated using clustering and White's heteroskedasticity-corrected standard errors.

Initially, we examine the relationships between policy uncertainty and corporate debt maturity structure, as shown in Model 1. The findings algin with those of Datta et al. (2019), illustrating that firms tend to reduce their debt maturity structure during periods of heightened policy uncertainty. Specifically, a one-unit increase in EPU corresponds to a 0.055 percentage point decrease in D3, a result that is statistically significant at the 1% level. The introduction of additional control variables in Model 2 to 4 does not alter the

Table 3: Pearson correlation matrix for Environment, Social, and Governance (ESG), economic policy uncertainty index and its alternative measurements

	EPU	*NEWS*	*TAX*	*FED*	*CPI*	*ESG*	*E*	*S*	*G*
EPU	1.00								
NEWS	0.72	1.00							
TAX	0.94	0.73	1.00						
FED	0.94	0.71	0.99	1.00					
CPI	0.65	0.35	0.47	0.46	1.00				
ESG	0.01	0.19	0.02	0.03	−0.11	1.00			
E dimension	0.05	0.19	0.09	0.09	−0.12	0.71	1.00		
S dimension	−0.01	0.11	−0.02	−0.02	−0.04	0.79	0.21	1.00	
G dimension	−0.06	0.05	−0.03	−0.04	−0.10	0.38	0.17	0.05	1.00

Notes: This table presents the correlations for ESG and EPU's sub-indices. See Appendix 1 for variable definitions.

negative coefficient of EPU, reinforcing the robustness of this finding.

In Model 3, we introduce an interaction term between EPU and ESG. The interaction shows a positive coefficient (0.019) at 1% significance level. Suggesting that ESG performance mitigates the negative influence of policy uncertainty on corporate debt maturity structure. This interaction effect along with the continued negative coefficient on EPU, confirms that stronger ESG performance weakens the negative impact of policy uncertainty on corporate debt maturity structure.

Importantly, our results bear not only statistical significance but also economic significance. With each unit increase in ESG score, the negative impact of EPU on corporate debt maturity structure is reduced by 0.019 percentage points. This suggests that a firm improving its ESG performance from the lowest (-11) to the highest observed score (14) in our sample could mitigate the effect of EPU by approximately 0.475 percentage points on debt maturity structure, which supports our H1.

To account for potential bias arising from missing data, we further control for variable AM and ABN_Earning in Model 2 and 4. These models also uphold the significant moderating effect of ESG performance on the relationship between policy uncertainty and corporate debt maturity structure. Taken together, our results emphasise the value of strong ESG performance as a strategy to manage the risk associated with policy uncertainty, thereby enabling firms to maintain a more stable debt maturity structure over time.

5.2 How does Firm Characteristics Moderate ESG's Moderating Effect?

In Table 5, we present a series of tests examining the triple moderating effects to investigate how certain firm characteristics influence the moderating effect of ESG performance on the relationship between policy uncertainty and corporate debt maturity structure. We consider three main firm characteristics: MTB, which represents a firm's growth op-

Table 4: Baseline Regression

Dependent Variable	= D3			
	(1)	(2)	(3)	(4)
EPU	−0.055***	−0.051***	−0.054***	−0.049***
	(0.001)	(0.005)	(0.001)	(0.005)
ESG	0.754***	0.792***	1.056***	0.763***
	(0.001)	(0.000)	(0.001)	(0.001)
ESG*EPU			0.019***	0.018***
			(0.000)	(0.000)
Controls				
MTB	1.521*	1.469	1.571*	1.520*
	(0.075)	(0.105)	(0.069)	(0.097)
Size	8.429***	8.102***	8.276***	7.954***
	(0.001)	(0.001)	(0.001)	(0.001)
Size2	−0.964***	−0.917***	−0.950***	−0.903***
	(0.001)	(0.001)	(0.001)	(0.001)
SAI	−4.842***	−5.019***	−4.814***	−4.995***
	(0.000)	(0.000)	(0.000)	(0.000)
$\hat{\text{L}}$everage	1.276***	1.291***	1.285***	1.300***
	(0.000)	(0.000)	(0.000)	(0.000)
CAPEX	0.343***	0.369***	0.346***	0.373***
	(0.003)	(0.003)	(0.003)	(0.003)
Term_Structure	−0.575	−0.376	−0.415	−0.222
	(0.171)	(0.406)	(0.342)	(0.636)
REG	−3.314***	−3.453***	−3.288***	−3.428***
	(0.000)	(0.000)	(0.000)	(0.000)
RET_STD	−0.344	−0.229	−0.237	−0.118
	(0.758)	(0.851)	(0.834)	(0.924)
Prof	11.985***	11.863***	12.067***	11.972***
	(0.001)	(0.002)	(0.001)	(0.000)
AM		−0.002		0.000
		(0.992)		(0.999)
ABN_Earnings		−1.306***		−1.306***
		(0.000)		(0.000)
Intercept	10.257**	8.399	9.264*	7.379
	(0.047)	(0.136)	(0.080)	(0.201)
Industry FE	YES	YES	YES	YES
Adjusted R-square	0.283	0.280	0.282	0.280
N	27,019	25,566	27,019	25,566

Notes: The table shows the second-stage results from a 2SLS regression model, in which the dependent variable is D3 (percentage of debt maturing in more than three years). Predicted leverage, $\hat{\text{l}}$everage, is from the first-stage regression where dependent variable is Lev. Independent variables in the first regression are EPU, MTB, Size, Size2, CAPEX, FA, AM, SAI, REG, RET_STD, TLCF. Please refer to Appendix 1 for a comprehensive definition of these variables. * denotes statistical significance at the 10% level. ** denotes statistical significance at the 5% level. *** denotes statistical significance at the 1% level.

portunities; Size, which serves as a proxy for a firm's scale; and SAI, which reflects the degree of financial constraints a firm face.

Table 5: Triple moderating effects of firm characteristics on ESG's moderating effect on the relationship between policy uncertainty and corporate debt maturity structure.

Dependent Variable	=D3					
	(1)	(2)	(3)	(4)	(5)	(6)
EPU	−0.053***	−0.054***	−0.053***	−0.050***	−0.054***	−0.050***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.003)
EPU*MTB	0.024***	0.025***				
	(0.000)	(0.000)				
ESG*MTB		0.341**				
		(0.044)				
EPU*MTB*ESG		0.003				
		(0.508)				
EPU*Size			0.083	−0.026		
			(0.858)	(0.956)		
ESG*Size				−0.165*		
				(0.075)		
EPU*Size*ESG				−0.004**		
				(0.031)		
EPU*SAI					0.002	0.002
					(0.752)	(0.635)
ESG*SAI						0.080
						(0.331)
EPU*SAI*ESG						0.004**
						(0.021)
ESG	0.736***	0.820***	0.728***	0.914***	0.732***	0.824***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
EPU*ESG	0.018***	0.020***	0.019***	0.023***	0.019***	0.024***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	8.951*	9.316*	9.310*	8.480	9.320*	8.658
	(0.092)	(0.084)	(0.078)	(0.110)	(0.078)	(0.104)
Controls	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Adjusted R-square	0.282	0.284	0.283	0.281	0.283	0.282
N	27,019	27,019	27,019	27,019	27,019	27,019

Notes: The table shows the second-stage results from a 2SLS regression model, in which the dependent variable is D3 (percentage of debt maturing in more than three years). MTB, Size, and SAI are the test variables. Predicted leverage, $\hat{\text{l}}$everage, is from the first-stage regression where dependent variable is Lev. Independent variables in the first regression are EPU, MTB, Size, Size2, CAPEX, FA, AM, SAI, REG, RET_STD, TLCF. Please refer to Appendix 1 for a comprehensive definition of these variables. * denotes statistical significance at the 10% level. ** denotes statistical significance at the 5% level. *** denotes statistical significance at the 1% level.

From Model 2, we find no evidence supporting the hypothesis that MTB significantly moderates the impact of ESG on the negative relationship between policy uncertainty and corporate debt maturity structure. The triple interaction term EPU*MTB*ESG shows an insignificant strengthening effect with a coefficient of 0.003. This suggests that a firm's growth opportunities do not significantly influence the moderating role of ESG performance on policy uncertainty's impact on corporate debt maturity structure.

Consequently, we cannot accept Hypothesis 2a.

Contrarily, the firm size, as per Model 4, exhibits a significant negative coefficient of -0.0004, significant at the 5 level. This implies that the moderating role of ESG performance on the negative relationship between policy uncertainty and corporate debt maturity structure weakens as firms grow larger. Specifically, a shift from the 25th percentile to the 75th percentile in firm size reduces ESG performance's moderating effect by approximately 0.0944 percentage points. This finding provides evidence that firm size has a diminishing impact on the moderating effect of ESG performance, supporting Hypothesis 2b.

Finally, Model 6 reveals a significant positive coefficient of 0.004 for SAI at the 5% significance level. This indicates that the degree of a firm's financial constraints enhances the moderating effect of ESG performance. Specifically, as a firm's financial constraints increases from the 25th to the 75th percentile, the moderating effect of ESG on the relationship between policy uncertainty and corporate debt maturity structure strengthens by about 0.856 percentage points. This suggests that for firms under greater financial constraints, higher ESG performance can more effectively counteract the negative impact of economic policy uncertainty. This supports Hypothesis 2c.

5.3 The Moderating Effect of ESG's Sub-dimensions

To explore which specific sub-component of ESG moderates the relationship between policy uncertainty and corporate debt maturity structure most effectively, we examine the moderating effects of the Environmental, Social, and Governance dimensions individually. This granular analysis provides valuable insights for firms looking to strategically improve specific aspects of their ESG performance to mitigate the negative effect of policy uncertainty on corporate debt maturity structure.

As shown in Model 2 of Table 6, we specify E*EPU as the interaction term of the Governance dimension of ESG and policy uncertainty. The coefficient of the interaction term is 0.025, significant at the 1% level. In comparison, the coefficient of S*EPU and G*EPU in Models 4 and 6 are 0.023 and 0.031, respectively, also statistically significant. These results indicate that all three dimensions of ESG contribute to reducing the shortening effect of policy uncertainty on corporate debt maturity structure.

Economically, moving from the lowest to the highest observed scores for each dimension: Environmental (-8 to 6), Social (-6 to 12), and Governance (-3 to 3)—could reduce the negative effect of policy uncertainty on the percentage of debt maturing in more than three years by approximately 0.35, 0.414, and 0.186 percentage points, respectively.

While at first glance the economic significance of the Governance dimension may appear smaller due to its narrower score range, the impact per unit change is the largest among the three dimensions. This emphasises the critical role of good governance practices in mitigating policy uncertainty effects on corporate debt maturity structure.

Table 6: 2SLS regressions for ESG sub-dimensions

Dependent Variable	=D3					
	(1)	(2)	(3)	(4)	(5)	(6)
EPU	−0.054***	−0.054***	−0.055***	−0.053***	−0.051***	−0.051***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.003)	(0.003)
E dimension	1.393***	1.376***				
	(0.001)	(0.001)				
E*EPU		0.025***				
		(0.001)				
S dimension			0.776***	0.786***		
			(0.009)	(0.008)		
S*EPU				0.023***		
				(0.000)		
G dimension					0.582	0.547
					(0.262)	(0.293)
G*EPU						0.031**
						(0.017)
Intercept	9.741*	9.469*	9.513*	8.749	7.648	7.505
	(0.062)	(0.072)	(0.071)	(0.102)	(0.160)	(0.169)
Controls	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Adjusted R-square	0.287	0.288	0.279	0.278	0.279	0.279
N	27,019	27,019	27,019	27,019	27,019	27,019

Notes: The table shows the second-stage results from a 2SLS regression model, in which the dependent variable is D3 (percentage of debt maturing in more than three years). ESG's sub-indices are test variables. Predicted leverage, $\hat{\text{l}}$everage, is from the first-stage regression where dependent variable is Lev. Independent variables in the first regression are EPU, MTB, Size, Size2, CAPEX, FA, AM, SAI, REG, RET_STD, TLCF. See Appendix 1 for variable definitions. * denotes statistical significance at the 10% level. ** denotes statistical significance at the 5% level. *** denotes statistical significance at the 1% level.

5.4 The Moderating Effect of ESG on Policy Uncertainty's Sub-indices

Table 7 presents the empirical findings on the impact of alternative policy uncertainty measures on corporate debt maturity structure, specifically CPI, FED, TAX, and NEWS, and how ESG performance moderates these relationships.

Our findings provide robust evidence for the moderating role of ESG performance across difference contexts of policy uncertainty. When policy uncertainty intensifies, firms tend to prefer a shorter debt maturity structure. This behaviour is consistent across various types of policy uncertainty, which relate to monetary, fiscal, tax, and newspaper-covered sub-indices of EPU. However, the analysis also reveals the important role of ESG performance in moderating these relationships. In particular, the ESG*CPI interaction term stands out with a positive coefficient of 0.021, suggesting that strong ESG performance significantly weakens the negative influence of monetary policy uncertainty on corporate debt maturity structure. In terms of economic significance, an increase in a

Table 7: 2SLS regressions for EPU sub-indices

Dependent Variable	=D3			
	(1)	(2)	(3)	(4)
CPI	−0.040**			
	(0.012)			
ESG*CPI	0.021***			
	(0.000)			
FED		−0.018**		
		(0.011)		
ESG*FED		0.009***		
		(0.001)		
TAX			−0.023***	
			(0.002)	
ESG*TAX			0.009***	
			(0.001)	
NEWS				−0.037**
				(0.044)
ESG*NEWS				0.005
				(0.271)
ESG	0.574***	0.754***	0.769***	0.886***
	(0.001)	(0.000)	(0.000)	(0.000)
Intercept	9.766*	6.697	6.936	8.581
	(0.063)	(0.237)	(0.219)	(0.103)
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Adjusted R-square	0.288	0.280	0.279	0.274
N	27,019	27,019	27,019	27,019

Notes: The table shows the second-stage results from a 2SLS regression model, in which the dependent variable is D3 (percentage of debt maturing in more than three years). EPU's sub-indices are test variables. Predicted leverage, $\hat{\text{l}}$everage, is from the first-stage regression where dependent variable is Lev. Independent variables in the first regression are EPU, MTB, Size, Size2, CAPEX, FA, AM, SAI, REG, RET_STD, TLCF. See Appendix 1 for variable definitions. * denotes statistical significance at the 10% level. ** denotes statistical significance at the 5% level. *** denotes statistical significance at the 1% level.

firm's ESG performance from the lowest to the highest observed score in our sample could reduce the impact of monetary policy uncertainty on the percentage of debt maturing in more than three years by 0.504 points.

Similarly, ESG performance demonstrates a significant moderating effect on the relationships between corporate debt maturity structure and FED and TAX-related policy uncertainties. However, we did not find evidence to suggest a significant moderating effect of ESG performance on the relationship between NEWS-based policy uncertainty and corporate debt maturity structure.

5.5 Results with Alternative Debt Maturity Structure Measure

In an extension of our study and conduct a robustness check, we decided to further explore the impact of policy uncertainty and ESG performance on the corporate debt maturity structure. We altered our focus from D3, the percentage of debt maturing in more than three years, to D1, which represents the percentage of debt maturing in more than one year.

As per our regression results as Table 8, we found a negative and significant coefficient of -0.065 for EPU, suggesting that an increase in policy uncertainty is associated with a decrease in the proportion of long-term debt with shorter maturities in a firm's debt structure. The results are consistent with our baseline regression.

Table 8: Alternative measure of the percentage of debt maturing in more than one year.

Dependent Variable	=D1			
	(1)	(2)	(3)	(4)
EPU	−0.065***	−0.064***	−0.064***	−0.063***
	(0.000)	(0.000)	(0.000)	(0.000)
ESG	1.093***	1.079***	1.071***	1.051***
	(0.000)	(0.000)	(0.000)	(0.000)
ESG*EPU			0.017***	0.017***
			(0.000)	(0.000)
Intercept	24.337***	23.117***	23.453***	22.209***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Adjusted R-square	0.325	0.321	0.324	0.320
N	27,019	25,566	27,019	25,566

Notes: The table shows the second-stage results from a 2SLS regression model, in which the dependent variable is D3 (percentage of debt maturing in more than three years). Predicted leverage, $\hat{\text{l}}$everage, is from the first-stage regression where dependent variable is Lev. Independent variables in the first regression are EPU, MTB, Size, Size2, CAPEX, FA, AM, SAI, REG, RET_STD, TLCF. See Appendix 1 for variable definitions. *** denotes statistical significance at the 1% level.

5.6 Results with Considering the 2007-2009 Financial Crisis

We take into account the heightened economic policy uncertainty (EPU) and systematic risk imposed on firms during 2007-2009 financial crisis. To ensure the robustness and reliability of our findings, we include a control variable, 'Crisis', which is a dummy variable assigned a value of 1 for data from the years 2007-2009 and 0 otherwise. As per the results in Table 9, our findings remain consistent even after controlling for the financial crisis, substantiating the robustness and reliability of our research.

Table 9: Second-stage regression of 2SLS regression explaining debt maturing in more than three years, with controlling the Crisis during 2007–2009.

Dependent Variable	=D3		=D1	
	(1)	(2)	(3)	(4)
EPU	−0.053***	−0.049***	−0.065***	−0.065***
	(0.001)	(0.004)	(0.000)	(0.000)
ESG	0.737***	0.767***	1.055***	1.031***
	(0.001)	(0.001)	(0.000)	(0.000)
ESG*EPU	0.019***	0.018***	0.017***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)
Crisis	0.482	0.329	−1.333	−1.657*
	(0.675)	(0.764)	(0.193)	(0.099)
Intercept	9.095*	7.264	23.861***	22.709***
	(0.093)	(0.217)	(0.000)	(0.000)
Controlled for Crisis	YES	YES	YES	YES
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Adjusted R-square	0.282	0.280	0.324	0.320
N	27,019	25,566	27,019	25,566

Notes: The table shows the second-stage results from a 2SLS regression model, in which the dependent variable are D1 and D3 (percentage of debt maturing in more than one and three years, respectively). Regressions control for the 2007–2009 financial crisis with the variable, Crisis, taking 1 if year is 2007, 2008, and 2009. Predicted leverage, $\hat{\text{l}}$everage, is from the first-stage regression where dependent variable is Lev. Independent variables in the first regression are EPU, MTB, Size, Size2, CAPEX, FA, AM, SAI, REG, RET_STD, TLCF. See Appendix 1 for variable definitions. * denotes statistical significance at the 10% level. *** denotes statistical significance at the 1% level.

Our findings contrast with the conclusions drawn by Buchanan et al. (2018), who suggest that firms demonstrating superior ESG performance may be perceived as suffering from ESG overinvestment issues and consequently may experience extreme loss in firm value amid heightened policy uncertainty during crisis periods, resulting in shortened corporate debt maturity structure. However, our results from both Models 3 and 4 indicate an interaction term coefficient of 0.019 and 0.018 for ESG and EPU. Given that the level of policy uncertainty can surge significantly during crisis periods, our analysis suggests an alternative interpretation: firms with robust ESG performance could have distinct advantages during crises, as opposed to suffering from ESG overinvestment detriments.

5.7 Placebo Test for Multivariate Regressions

We conducted a placebo test as a robustness check to ensure that the relationship between policy uncertainty and debt maturity structure decisions, as well as the moderating effects of ESG, are not driven by chance or confounding factors. Following previous literature, we randomly assigned EPU to different years, expecting that the relationship between the policy uncertainty proxy and debt maturity structure would become statistically insignificant (Acharya & Xu, 2017; Datta et al., 2019).

Table 10: Placebo test of relationship between policy uncertainty and debt maturity, with testing the moderation effects of ESG. This table uses a placebo analysis to assess the validity of causal claims

	D3			
Independent Variables	(1)	(2)	(3)	(4)
EPU	0.003	0.002	0.004	0.003
	(0.672)	(0.817)	(0.639)	(0.755)
ESG	−0.252**	−0.222**	−0.254**	−0.227**
	(0.012)	(0.023)	(0.011)	(0.020)
ESG*EPU			0.001	0.002
			(0.702)	(0.486)
Intercept	4.086	2.534	4.038	2.443
	(0.491)	(0.702)	(0.495)	(0.711)
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Adjusted R-square	0.279	0.277	0.279	0.277
N	27,019	25,566	27,019	25,566

Notes: The table shows the second-stage results from a 2SLS regression model, in which the dependent variable is D3 (percentage of debt maturing in more than three years), while randomly assign the EPU index. Predicted leverage, $\hat{\text{l}}$everage, is from the first-stage regression where dependent variable is Lev. Independent variables in the first regression are EPU, MTB, Size, Size2, CAPEX, FA, AM, SAI, REG, RET_STD, TLCF. See Appendix 1 for variable definitions. ** denotes statistical significance at the 5% level.

As seen in Table 10, EPU no longer exhibits a statistically significant influence on corporate debt maturity structures. Furthermore, the moderating variable ESG also transforms into a statistically insignificant relationship concerning the association between EPU and corporate debt maturity structure. This indicates that our results are not due to happenstance.

6 Conclusion

This study investigates the impact of policy uncertainty on corporate debt maturity structure decisions and scrutinises whether and to what extent firms' ESG performance moderates the relationship between policy uncertainty and corporate debt maturity structure. We also examine if firm characteristics influence ESG's moderating effect. Prior

literature has examined the relationship between policy uncertainty and debt maturity structure (Buchanan et al., 2018; Datta et al., 2019). In making debt maturity structure decisions, firms primarily consider the trade-offs between refinancing risks associated with short-term debt and mispricing risks related to long-term debt (Diamond, 1993; Mayer et al., 2013).

Our empirical findings support Datta et al.'s (2019) conclusion that firms tend to shorten their debt maturity structure during times of heightened policy uncertainty. In contrast, we contest Buchanan et al.'s (2018) findings, which argued that policy uncertainty would extend corporate debt maturity structure. The implication is that elevated policy uncertainty levels intensify both refinancing and mispricing risks; however, the exacerbating effect of policy uncertainty on long-term debt mispricing risks outweighs the refinancing and liquidity risks of short-term debt. Consequently, firms are more inclined to finance with short-term debt rather than long-term debt.

The interaction term of EPU and ESG consistently weakens the moderating effect on the relationship between EPU and corporate debt maturity structure. Notably, existing literature has documented that policy uncertainty aggrevates both refinancing/liquidity risks (Brunnermeier & Yogo, 2009; Diamond, 1993; Mayer et al., 2013) and mispricing risks (Broggard & Detzel, 2015; Favara et al., 2021). We discover ESG reduces refinancing risks by lowering perceived risks (Edmans, 2011) and mispricing risks by mitigating information asymmetry problems (Cheng et al., 2014). Although policy uncertainty arises from evolving government regulations and policies, a systematic risk exposure that firms cannot control, they can manage their ESG performance as a non-financial strategy.

In our sample, firms increasing their ESG performance from the lowest to the highest observed score could mitigate the effect of EPU by approximately 0.475 percentage points. The finding underscores the positive role of sustainable practices in highly uncertainty periods. In this context, firms may use ESG investment as a strategic tool to control their debt maturity structure and achieve optimal debt maturity structure (Dangl & Zechner, 2021).

While we do not find evidence that firm's growth opportunity influences ESG's moderating effect on the relationship between policy uncertainty and corporate debt maturity structure, larger firms typically have more significant cash flows to cover financing needs and tend to enjoy lower flotation costs. During periods of heightened policy uncertainty, refinancing risk increases, and firms with higher ESG performance experience lower refinancing risks and more frequent external monitoring, which lead to lower perceived risks (Ge & Liu, 2015). Compared to small firms, larger firms possess greater resources to improve their ESG performance and prefer more short-term debt (Udayasankar, 2008). Besides, our findings provide evidence that ESG's moderating effect is more pronounced in financial constrained firms and make them to have longer debt maturity structures. While policy uncertainty exacerbates financial constraints, firms with higher ESG performance may exhibit lower information asymmetry and less perceived mispricing risks (Cheng et al., 2014), leading to a more pronounced ESG moderating effect.

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A Appendix

Table 11: Variable list for selected variable in multivariate regressions, and illustrations of abbreviation, definition, and mathematics presentation or explanation for selected variables.

Variables	Abbreviation	Definition	Mathematics Presentation or explanation
Dependent Variable			
Debt maturing in over one year	D1	Ratio of total long-term debt to total debt	$\frac{Debt\ maturing\ in\ more\ than\ one\ year}{Total\ debt} \times 100$
Debt maturing in over two years	D2	Ratio of the difference between total long-term debt and debt maturing in two years to total debt	$\frac{Debt\ maturing\ in\ more\ than\ two\ year}{Total\ debt} \times 100$
Debt maturing in over three years	D3	Ratio of the difference between total long-term debt and debt maturing in two and three years to total debt	$\frac{Debt\ maturing\ in\ more\ than\ three\ year}{Total\ debt} \times 100$
Debt maturing in over four years	D4	Ratio of the difference between total long-term debt and debt maturing in two, three, and four years to total debt	$\frac{Debt\ maturing\ in\ more\ than\ four\ year}{Total\ debt} \times 100$
Debt maturing in over five years	D5	Ratio of the difference between total long-term debt and debt maturing in two, three, four, and five years to total debt	$\frac{Debt\ maturing\ in\ more\ than\ five\ year}{Total\ debt} \times 100$
Test Variables			
Economic policy uncertainty	EPU	The overall index of EPU proposed by Baker et al. (2016). http://www.policyuncertainty.com/.	Measurement of policy uncertainty
NEWS	NEWS	Index from top 10 U.S. newspapers measuring economic policy uncertainty	Measurement of NEWS measuring of EPU
TAX	TAX	Index from Congressional Budget Office (CBO), measuring uncertainty associated with the number of expiring temporary federal tax code provisions	Measurement of TAX measuring of EPU
CPI	CPI	Expected consumer price index from Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters	Measurement of CPI measuring of EPU
FED	FED	Expected national purchase of goods and services from Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters	Measurement of FED measuring of EPU
Environmental, Social, and Governance performance	ESG	MSCI KLD ESG scores	The calculation process of the ESG scores is shown in Appendix 2
E dimension of ESG	E	The sum score of Environment and Product perspectives of KLD	E = Environment + Product
S dimension of ESG	S	The sum score of Community, Diversity, and Employ relations perspectives of KLD	S = Community + Diversity + Employ relations
G dimension of ESG	G	The score of Governance perspective of KLD	G = Governance
Independent Variables			
Firm size	Size	A firm's market value	Size = Stock price * common shares outstanding + Book value of total assets – Book value of equity
SA index	SAI	Financial condition measurement proposed by Hadlock and Pierce (2010)	$SAIndex_{it} = -0.737 * \log(Size_{it}) + 0.04 * \log(Size_{it}^2) - 0.040 * FirmAge_{it}$
Market-to-book ratio	MTB	The ratio between firm size and book value of total assets	$\frac{Size}{Book\ value\ of\ total\ assets}$

Table 11: Continued

Variables	Abbreviation	Definition	Mathematics Presentation or explanation
Control Variables			
Asset maturity	AM	Maturity of assets	$\frac{Gross\ PPE}{Total\ assets} \times \frac{Gross\ PPE}{Depreciation\ expense} + \frac{Current\ Assets}{Total\ assets} \times \frac{Current\ assets}{Cost\ of\ goods\ sold}$
Capital expenditure ratio	CAPEX(%)	Capital expenditure divided by book value of total assets*100	$\frac{Capitalexpenditure}{Bookvalueoftotalassets} \times 100$
Fixed asset ratio	FA(%)	Ratio of net PPE to total assets	$\frac{NetPPE}{Totalassets}$
Net operating loss carryforwards	TLCF	A dummy measurement of loss carryforwards	TLCF = 0 if no loss carryforwards TLCF = 1 if loss carryforwards exist
Regulated industry	REG	A dummy measurement of whether the firm is in the regulated industry	REG = 0 if the firm is not in the regulated industry REG = 1 if SIC = 4011, 4210, 4213, 4512, 4812, 4813, and 4900 – 4939
Stock return volatility	RET_STD	The product of standard deviation of the natural logarithm of yearly stock return and market equity to asset ratio	$SD\ of\ Log\ (annual\ stock\ return) \times \frac{Market\ value\ of\ equity}{Market\ value\ of\ assets}$
Term structure	TS	Difference in yield between 10-year and 6-month government bonds	Month-end yield on 10-year government bonds – month-end yield on 6-month government bonds
Abnormal earnings	AE	Earnings in year t+1 less earnings in year t divided by market value of equity	$\frac{Earnings\ in\ year\ t+1 - Earnings\ in\ year\ t}{share\ price\ in\ year\ t \times\ outstanding\ shares\ in\ year\ t}$
Leverage	Lev. (%)	Long-term debt to market value of total assets * 100	$\frac{Long\ term\ debt}{Market\ value\ of\ total\ assets} \times 100$
Financial Crisis	Crisis	Denotes the 2007–2009 financial crisis	Crisis = 1 if sample year = 2007, 2008, and 2009; Crisis = 0 if sample year apart from 2007, 2008, and 2009
Profitability	Prof.	The ratio of operating income before depreciation to total assets	$\frac{Operating\ income\ before\ depreciation}{Total\ asets}$

Table 12: MSCI ESG database statistics six qualitative dimensions of ESG strengths and concerns. We calculate each firm's idiosyncratic overall ESG scores by adding 1 score on each strength while deduct 1 score on each concern.

Dimension	Strengths	Concerns
Community	Charitable giving	Investment controversies
	Innovative giving	Negative economic impact
	Non-US charitable giving	Indigenous people's relations
	Support for housing	Tax disputes
	Support for education	Other concern
	Indigenous people's relations	
	Volunteer programs	
	Other strength	
Diversity	CEO's identity—promotion	Controversies
	Board of Directors	Non-representation
	Women and minority contracting	Other concern
	Employment of the disabled	
	Gay and lesbian policies	
	Other strength	
Employee relations	Union relations	Union relations
	No-layoff policy	Health and safety concern
	Cash profit sharing	Workforce reductions
	Employee involvement	Retirement benefits concern
	Retirement benefits strength	Other concern
	Health and safety strength	
	Other strength	
Environment	Beneficial products and services	Hazardous waste
	Pollution prevention	Regulatory problems
	Recycling	Ozone depleting chemicals
	Clean energy	Substantial emissions
	Communications	Agricultural chemicals
	Property, plant, and equipment	Climate change
	Management systems	Other concern
	Other strength	
Product	Quality	Product safety
	R&D/innovation	Marketing/contracting concern
	Benefits to economically disadvantage	Antitrust
	Other strength	Other concern
Corporate governance	Limited compensation	High compensation
	Ownership strength	Ownership concern
	Transparency strength	Accounting concern
	Political accountability strength	Political accountability concern
	Other strength	Transparency concern
		Other concern