The Impact of Climate Vulnerability on Payout Policy. Empirical Evidence for European Firms

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Abstract

The importance of climate risk for business and finance is increasingly recognized in the literature. However, we know little of the impact of climate change on dividend policy. The goal of the paper is to investigate the impact of climate vulnerabilities (CV) on the dividend policy adopted by European listed firms over the period 2010-2021. The results of the panel logit model show that firms are less likely to pay dividends if they are located in countries more exposed to climate vulnerabilities. In the second part of the empirical analysis, the impact of climate vulnerability on the level of dividend payments (measured by dividend payout ratio and dividend yield) is analyzed. The results of the Prais-Winsten regression model with Panel Corrected Standard Errors (PCSE) show that climate vulnerability statistically increases dividend payments. The robustness of these findings is tested by employing different sub-samples of firms. Overall, the empirical results highlight the importance of climate change for the decision-making framework at the firm level.

Keywords: dividend policy; climate change; climate vulnerability; climate risk; dividend yield; financial decisions.

JEL Classifications: G32, G35, Q54.

1. Introduction

The importance of climate risk (CR) for business and finance is increasingly recognized in the literature (Ginglinger, 2020; Kotz et al., 2024; World Economic Forum, 2024). Task Force on Climate Change-related Financial Disclosures (TCFD) argues that climate change (CC) is "one of the most significant, and perhaps most misunderstood, risks that organizations face today" (TCFD, 2017, p.3). Also, according to the Global Risk Report 2024, extreme weather events are ranked as the top risk in the short term and are "anticipated to become even more severe, as the top-ranked risk over the next decade" (World Economic Forum, 2024, p. 38).

Bertrand and Parnaudeau (2019) highlight that around 70% of firms at the global level are exposed to the physical and transition risks of climate change. However, there are important differences across industries. Usually, agriculture, energy, tourism and construction are weather-dependent (Hong et al., 2020; Sautner et al., 2023). On the other hand, knowledge-intensive services without face-to-face contact are not weather-dependent. While the impact of CR at the macroeconomic level has been thoroughly researched, only recently a burgeoning literature has been devoted to how firms adapt and manage the challenges posed by climate risk (Ahmad et al., 2023; Chang et al., 2024; Guizani et al., 2024; Javadi & Masum, 2021; Ongsakul et al., 2023; Ozkan et al., 2023). However, we know little of the impact of climate change on dividend policy despite the importance of this decision.

Understanding the interplay between climate vulnerability (CV) and dividend policy is not only relevant but essential for several reasons. Firstly, dividend policy serves as a crucial signal to investors regarding a firm's financial health and prospects (Bhattacharya, 1979). In the face of climate-related risks, firms may need to reassess their dividend policies to maintain financial flexibility, ensure long-term sustainability, and manage investor expectations. This reassessment can have significant implications for investor confidence, stock prices, and overall market stability.

Secondly, firms exposed to high climate vulnerability may experience greater volatility in earnings and cash flows. This volatility can influence decisions on dividend payouts, as firms may opt to retain earnings to buffer against potential climate-related losses. Understanding this dynamic is vital for investors, policymakers, and stakeholders who seek to assess the resilience of firms and the broader economy to climate change.

Thirdly, European firms are at the forefront of implementing environmental, social, and governance (ESG) criteria in their business practices. The integration of ESG criteria into financial decision-making underscores the importance of studying how climate vulnerability influences dividend policies. Insights from this research can inform corporate governance practices, enhance transparency, and promote sustainable investment strategies.

Lastly, the European context provides a unique setting for this study due to the region's proactive stance on climate action and regulatory frameworks. European firms are subject to stringent environmental regulations and are increasingly adopting measures to mitigate climate risks. Thus, investigating the impact of CV on dividend policy within this context can yield valuable lessons for other regions and contribute to global efforts in addressing climate change.

The aim of the paper is to investigate the impact of CV on the dividend policy adopted by European listed firms over the period 2010-2021. The results of the panel logit model show that firms are less likely to pay dividends if they are located in countries more exposed to climate vulnerabilities. In the second section of the empirical analysis, the effect of CV on the level of dividend payments (measured by dividend payout ratio and dividend yield) is analyzed. The results of the Prais-Winsten regression model with Panel Corrected Standard Errors (PCSE) show that climate vulnerability statistically increases dividend payments. Contrary to previous studies, a positive association between climate vulnerabilities and dividend level has been found. The robustness of these results was tested by using different sub-samples of firms. Overall, the empirical results highlight the importance of climate change for the decision-making framework at the firm level.

From the author's perspective, this paper contributes to the extant literature in several ways. First, this paper contributes to the expanding yet still limited body of literature on how firms respond to climate change. Numerous authors stressed the importance of analyzing and understanding the impact of CV on firm strategies and decisions (Hong et al., 2020). Second, this paper adds to the dividend policy literature. Contrary to the previous papers that measure only the potential exposure to climate risk, our measure takes into consideration the adaptive capacity at the country level by employing the Notre Dame Global Adaptation Initiative (ND-GAIN). Third, the sample used in the analysis allows us to capture the latest three years with high temperatures that are not included in previous studies (e.g., Chang et al., 2024). Fourth, contrary to previous empirical studies, the paper uses the Prais Winsten regression model with PCSE as this method accounts for firm-level heteroscedasticity, thereby enhancing the robustness of the results (Beck & Katz, 1995).

The remainder of this study proceeds as follows. The next section presents the theoretical background and formulates the hypotheses. Section 3 exhibits the data and methodology used in the paper. Section 4 presents and discusses the main results. Section 5 highlights the main conclusion, policy implications, and avenues for future research.

2. Literature review

In the last two decades, a growing body of literature has focused on analyzing the macroeconomic impact of climate change. They assessed how climate change is affecting economic growth (Bansal & Ochoa, 2011; Kahn et al., 2021; Klomp & Valckx, 2014; Kompas et al., 2018), economic development (Dell et al., 2012; Hsiang, 2010), exports (Jones & Olken, 2010), cost of sovereign borrowing (Beirne et al., 2021; Kling et al., 2018), and international investments (Li & Gallagher, 2022; Shear et al., 2023).

Other papers have investigated the impact of climate change on assets pricing (Acharya et al., 2022; Apergis, 2023; Baldauf et al., 2019; Bansal et al., 2016; Beatty & Shimshack, 2010; Bernstein et al., 2019; Bouri et al., 2022; Cevik & Jalles, 2022; Choi et al., 2020; Giglio et al., 2021; Gong et al., 2022; He & Zhang, 2022; Hong et al., 2017; Hong et al., 2020; Huynh & Xia, 2021; Murfin & Spiegel, 2019; Ramelli et al., 2021; Reboredo & Ugolini, 2022; Tzouvanas et al., 2019; Xu et al., 2022; Ye, 2022).

Recently, a growing body of literature has focused on the impact of climate vulnerability/climate risk on firm performance and financial decisions. They have assessed the impact of CV risk on firm performance (Addoum et al., 2020; Cevik & Miryugin, 2023; Huang et al., 2018; Ongsakul et al., 2023; Ozkan et al., 2023; Pankratz et al., 2019), environmental decisions (Garel & Petit-Romec, 2022), payout policy (Chang et al., 2024; Huang et al., 2018; Ongsakul et al., 2024), cost of equity (Balvers et al., 2017; Huynh et al., 2020), cost of debt (Javadi & Masum, 2021), capital structure (Elnahas et al., 2018; Ginglinger & Moreau, 2023; Nguyen et al., 2022; Zhou & Wu, 2023), cash holdings (Brahmana & Kontesa, 2023; Guizani et al., 2024; Heo, 2021; Javardi et al., 2023; Lee et al., 2023; Li et. al, 2024; Yu et al., 2022; Zhang et al., 2023), working capital management (Ahmad et al., 2023), and investment decision (Kanagaretnam et al., 2022).

Several effects have been found. First, a positive relationship between CC and cash holdings has been reported (Heo, 2021; Huang et al., 2018; Javardi et al., 2023). Second, several studies (Javadi & Masum, 2021; Kling et al., 2021) show that CV increases the cost of borrowing money. Third, a few studies (Nguyen et al., 2022; Ginglinger & Moreau, 2023) reported a negative association between physical CR and degree of indebtedness. Fourth, Ahmad et al. (2023) found a negative relationship between CR and working capital.

However, to the best of the author's knowledge, relatively little is known about the impact of climate vulnerabilities on dividend policy. Concerning physical risk, Huang et al. (2018) observed that firms located in countries with higher exposure to physical risk tend to hold larger cash reserves and reduce dividend payouts. Chang et al. (2024) employed the Climate Risk Index to study the impact of CV on dividend flexibility in a sample of listed firms from 45 countries during the period from 2004 to 2018. Their results show that climate risk is negatively associated with total payouts (cash dividends + share repurchases). However, they find that CR is positively associated with the probability and magnitude of share repurchases, suggesting that shareholders prefer to substitute cash dividends with share repurchases when CV is high. Ongsakul et al. (2024) employed a measure of climate risk exposure at the firm level (using textual analysis) on a sample of US firms over the period 2001 and 2019 and found a negative relationship between climate risk and the probability of paying dividends/the level of dividends.

Given all the above considerations, the following research hypotheses will be tested:
H1: Climate vulnerability is negatively associated with the probability of dividend payments.
H2: Climate vulnerability is negatively associated with the level of (cash) dividend payments.

3. Data and research design

3.1. Sample and data

The paper covers publicly listed European firms during the period 2010–2021. Firm-level data were obtained from the Orbis database. Data on climate vulnerabilities was sourced from the Notre Dame Global Adaptation Initiative (ND-GAIN), while macroeconomic data has been retrieved from World Bank, World Development Indicators.

We excluded firms operating in the financial industry (SIC codes between 6000 and 6999) from the initial sample of listed companies across 35 European countries due to the unique characteristics of this industry. Consistent with standard practices in the existing literature, firm-year observations with missing data for the regression variables were excluded from the analysis. Additionally, the sample was restricted to firms with at least five consecutive years of available data. After applying these filtering criteria, the final sample consists of unbalanced panel data of 17,069 firm-year observations covering the period from 2010 to 2021.

3.2. Dependent variable

In line with extant literature (e.g., Barros et al., 2022; Chang et al., 2024; Ongsakul et al., 2024), several indicators for dividend policy have been employed. Firstly, a dummy variable is assigned a value of one if the firm distributes dividends of any amount, and zero otherwise. Secondly, two more variables that highlight the level of dividend policy have been used, namely dividend yield and dividend payout ratio (see Table 1 for formula and source of data).

3.3.Indepedent variable

In the extant literature, several approaches to measure climate vulnerability/climate risk faced by firms have been developed and used, namely:

- annual country-level climate risk index - Notre Dame Global Adaptation Initiative (ND-GAIN) climate vulnerability index (Beirne et al., 2021; Cevik & Jalles, 2022; Cevik & Miryugin, 2023; Cheema-Fox et al., 2022; Jia & Li, 2020; Kling et al., 2018; Kling et al., 2021; Ramelli et al., 2021; Shear et al., 2023; Wen et al., 2023) or Global Climate Risk Index (CRI) created by Germanwatch (Chang et al., 2024; Guizani et al., 2024; Huang et al., 2018; Liu et al., 2023; Song et al., 2023);
- local temperature (Yu et al., 2022);
- climate risk exposure at the firm level using textual analysis developed by Sautner et al. (2023) and employed in several papers (Ahmad et al., 2023; Ongsakul et al., 2024; Zhang et al., 2023).

Table 1. Variables description and sources

Variable	Abbr.	Expected Sign	Measurement	Source
Dependent variables				
DIV_DUM	DIV_DUM		„Dummy: 1 if firms pay (cash) dividends in year *t*, 0 otherwise" (Barros et al., 2022, p. 3)	Orbis
Dividend Yield	DY		„Ratio between dividend per share in year *t* and firms' stock price at the end of year *t*" (Barros et al., 2022, p. 3)	Orbis
Dividend Payout Ratio	DPR		„Ratio between dividend per share and earnings per share in year *t*" (Barros et al., 2022, p. 3)	Orbis
Independent variable				
VUL	VUL	-	ND-GAIN climate vulnerability index for country *i* at time *t*	Notre Dame Global Adaptation Index
Control variables				
Firm level				
Firm size	SIZE	+	The natural logarithm of total assets in year *t*	Orbis

Leverage	LEV	-	Total debt over total assets	Orbis
Return on Assets	ROA	+	Net profit over total assets	Orbis
Net Profit Margin	NPM	+	Net profit over total sales	Orbis
Cash and Cash Equivalents to Total Assets	CCE	+	Ratio between Cash and Cash Equivalents and Total Assets	Orbis
Price-to-earnings ratio	PER	+/-	„Stock price at the end of year *t* divided by earnings per share in year *t*” (Barros et al., 2022, p. 3)	Orbis
Country level				
Economic development	GDP	+	The natural logarithm of GDP per capita in year *t*	World Bank, World Development Indicators
Economic growth	GDP_GR	+	GDP per capita growth (annual %)	World Bank, World Development Indicators
COVID-19	COVID-19	-	Dummy: 1 for years 2020 and 2021, 0 otherwise	-

ND-GAIN climate vulnerability index has been employed for two important reasons. First, it measures not only the vulnerability to climate hazards but also sensitivity and adaptive capacity[1]. It covers 182 countries over the period 1995-2021 and assesses a nation's vulnerability by evaluating six critical sectors: food, water, health, ecosystem services, human habitat, and infrastructure (Chen et al., 2015). Second, it was extensively employed by prior recent studies (Beirne et al., 2021; Cevik & Miryugin, 2023; Cevik & Jalles, 2022; Jia & Li, 2020; Shear et al., 2023; Wen et al., 2023) and international organizations (e.g., World Bank).

3.4. Control variables

Concerning firm-level control variables, firm size was accounted for following prior literature (Ahmad et al., 2018; Barros et al., 2022; Chang et al., 2016). Larger firms are more likely to pay higher dividends. Firm performance (measured as ROA), net profit margin, price-to-earnings ratio, leverage (measured as total debt over total assets), and liquidity (Cash and Cash Echivalents to Total Assets) were also included in the model, an approach consistent with extant literature (Ahmad et al., 2018; Barros et al., 2022; Boțoc & Pîrtea, 2014).

Given the international scope of this paper, it is also essential to incorporate country-specific macroeconomic variables into the model. Thus, in line with Bilyay-Erdogan et al. (2023), this study employs economic development and economic growth to account for the impact of economic activity on dividend policy.

To assess the relationship between CV and the probability of a firm’s dividend payment, the following panel logit model is employed:

[1] Refer to Chen et al. (2015) for an extensive explanation regarding the designing of the ND-GAIN index.

$$DIV\_DUM_{i,j,t} = \alpha_{i,j} + \beta_1 VUL_{j,t} + \beta_2 CON\_FIRM_{i,t} + \beta_2 \mathrm{CON}\_COUNTRY_{j,t} + \varepsilon_{i,t} \quad (1)$$

where: $DIV\_DUM_{i,j,t}$ captures the probability of dividend payments for firm *i* located in country *j* in year *t*; $VUL_{j,t}$ reflects the ND-GAIN climate vulnerability index for country *j* at time *t*; $CON\_FIRM_{i,t}$ is a vector for firm-level control variables in line with previous studies (Ahmad et al., 2018; Barros et al., 2022; Boțoc & Pîrtea, 2014). Specifically, the model controls for profitability, leverage, liquidity, size, and growth opportunities; $CON\_COUNTRY_{j,t}$ denotes country-specific variables employed in the models (e.g., economic development, economic growth, and a COVID-19 dummy for years 2020 and 2021); $\varepsilon_{i,t}$ represents the idiosyncratic component. The data analysis incorporates industry and year-fixed effects to account for potential heterogeneity across industries[2] and periods.

In the second part of the empirical analysis, the impact of climate vulnerability on the level of dividend payments (measured by dividend yield and dividend payout ratio) is investigated. The baseline model is performed using panel regressions with a fixed-effects specification.

To determine the most suitable estimation technique, a series of tests were performed (details are available upon request to conserve space). The results from the Breusch-Pagan Lagrange multiplier (LM) test indicate that a simple OLS regression is not appropriate. Subsequently, the Hausman test was applied, and its results led to the selection of a fixed effects model. Finally, tests for cross-sectional dependence or contemporaneous correlation were conducted using the Pesaran CD test. As the test shows that there is cross-sectional dependence, the paper employs the Prais Winsten regression model with PCSE as this method controls for firm-level heteroscedasticity and provides more robust results (Beck and Katz, 1995).

4. Findings and discussion

4.1.Summary of statistics

Descriptive statistics for all the variables employed in the models are presented in Table 3. To reduce the effect of outliers, extreme values were winsorized to fall within the upper and lower 1% thresholds before presenting the summary statistics.

Table 3. Descriptive statistics of the final sample (17,069 firm-year observations)

	Mean	Std. Dev.	p25	p50	p75
DIV_DUM	0.5450	0.4980	0.0000	1.0000	1.0000
DY	3.8322	3.8574	1.8140	2.9000	4.5840
DPR	77.5743	143.7602	28.8120	45.3700	72.6600
VUL	0.2989	0.0261	0.2869	0.2944	0.3073
SIZE	13.7031	2.0699	12.1511	13.6641	15.2201
LEV	23.2340	15.5111	11.2459	21.8132	32.8176
ROA	5.5282	5.9616	2.5350	4.7420	7.7890
NPM	10.6533	14.7150	3.5410	7.4690	13.7440
CCE	0.0977	0.0911	0.0344	0.0719	0.1317

[2] The Fama and French's classification into 12 industries has been employed to identify the firm's industry

PER	21.5339	31.4430	9.1920	14.9020	22.9240
GDP	10.5870	0.4809	10.5017	10.6605	10.7683
GDP_GR	1.1346	2.9935	0.3340	1.1402	2.1736
COVID-19	0.1704	0.3760	0.0000	0.0000	0.0000

Notes: The variables are defined in Table 1.

Throughout the analysis period (2010-2021), approximately 54.50% of the firms distributed dividends. It is worth mentioning that this value is lower than those reported by studies focused on U.S. firms (Barros et al., 2022). The mean and median values for dividend yield (DY) are 3.83% and 2.9%, respectively. The mean dividend payout ratio stands at 77.57%, which is much higher than the mean of 43.60% that Bilyay-Erdogan et al. (2023) reported for non-financial listed firms in Europe over the period 2002-2019. Profitability shows an average (median) ROA of 5.52% (4.74%), albeit with relevant variability. The mean VUL value is 0.2989, which is lower than the mean of 0.37 that Kling et al. (2021) reported. However, this conceals significant differences within the sample, as evidenced by the minimum and maximum values. The lowest level (0.24) was reported in Switzerland in 2020, while the highest level (0.42) was recorded in Moldova in 2010.

4.2. Correlation

Table 3 presents the Spearman correlation among our variables. A negative correlation between climate vulnerability (VUL) and dividend dummy can be noticed. On the other hand, a positive correlation between VUL and dividend payout ratio and dividend yield can be noticed. The results can be preliminary support for the research hypothesis. With one exception, the correlation coefficients are quite low, indicating that multicollinearity is unlikely to be an issue in the estimations[3].

[3] The variance inflation factors (VIFs) were also computed but not reported to save space. All VIFs values in our sample are below the threshold of 10, indicating that our sample does not suffer from multicolliniarity problems.

Table 3. Spearman correlation

	DIV_DUM	DPR	DY	VUL	SIZE	LEV	ROA	NPM	CCE	PER	GDP	GDP_GR	COVID-19
DIV_DUM	1.0000												
DPR	-0.0250**	1.0000											
DY	-0.0633***	0.298***	1.0000										
VUL	-0.130***	0.0074	0.104***	1.0000									
SIZE	0.161***	-0.0124	-0.0434***	-0.0951***	1.0000								
LEV	-0.0267**	0.0466***	0.0627***	0.0584***	0.220***	1.0000							
ROA	0.0623***	-0.160***	-0.0005	-0.0563***	-0.120***	-0.270***	1.0000						
NPM	0.0450***	-0.0902***	0.0019	0.0002	0.0339***	0.0839***	0.409***	1.0000					
CCE	-0.0101	-0.0047	-0.0373***	-0.113***	-0.181***	-0.299***	0.220***	-0.0056	1.0000				
PER	-0.0170*	0.424***	-0.152***	-0.0333***	-0.0253**	0.0145	-0.0902***	-0.0372***	0.0461***	1.0000			
GDP	0.150***	0.0050	-0.116***	-0.664***	0.196***	0.0122	0.0584***	0.0458***	0.0684***	0.0476***	1.0000		
GDP_GR	0.0652***	-0.0450***	0.0032	0.0797***	-0.0707***	-0.0715***	0.103***	0.0488***	-0.0297***	-0.0381***	-0.106***	1.0000	
COVID-19	0.0012	0.0213**	-0.0249**	-0.0394***	0.0463***	0.0379***	0.0089	0.0115	0.0866***	0.0750***	0.0447***	-0.149***	1.0000

Notes: Stars (***/ **/*) indicate significance at the 1%/5%/10% level. See Table 1 for the variables' definitions.

4.3. Baseline results

The results of the panel logit model (see table 4, column 1) show that companies are less likely to pay dividends if they are located in countries more exposed to climate vulnerabilities. In other words, CV has a negative impact on the probability of firms paying cash dividends. These results confirm previous findings reported by Chang et al. (2024) or by Ongsakul et al. (2024) on US firms for the period 2001-2019.

In the second model (table 4, column 2), a dummy variable for COVID-19 is included in the model to investigate the effect of the coronavirus pandemic on the probability of paying dividends[4]. The statistical significance and the magnitude of the relation remain unchanged in the augmented model. Overall, these empirical results provide support for research hypothesis H1. The consistency of these findings across both models further reinforces the robustness of the negative impact of CV on the likelihood of dividend payments.

Table 4. Determinants of dividend payments - panel logit model

	Model 1 (1)	Model 2 (2)
VUL	-36.4792***	-36.4792***
	(9.1209)	(9.1209)
SIZE	0.9692***	0.9692***
	(0.0577)	(0.0577)
LEV	-0.0279***	-0.0279***
	(0.0023)	(0.0023)
ROA	0.0203***	0.0203***
	(0.0034)	(0.0034)
NPM	0.0107***	0.0107***
	(0.0017)	(0.0017)
CCE	0.2846	0.2846
	(0.3084)	(0.3084)
PER	-0.0001	-0.0001
	(0.0005)	(0.0005)
GDP	1.3623***	1.3623***
	(0.4325)	(0.4325)
GDP_GR	0.0031	0.0031
	(0.0102)	(0.0102)
COVID-19		0.0212
		(0.1211)
Year FEs	YES	YES
Obs.	17,069	17,069
Log-likelihood	-6117.9806	-6117.9806

Notes: Stars (***/ **/*) indicate significance at the 1%/5%/10% level. See Table 1 for the variables' definitions.

The negative relationship between climate risk and the probability of paying dividends can be interpreted as a strategic response by firms to the growing challenges posed by climate

[4] This can be also considered a robustness test.

change. Specifically, firms seem to recognize that higher climate risk exposes them to potential financial strains, including increased costs associated with adapting to or mitigating climate-related impacts, such as physical damage to assets, regulatory changes, or shifts in market dynamics (often referred to as transition risks).

In light of these risks, firms may prioritize conserving cash rather than distributing it as dividends. This is because maintaining a higher cash reserve provides a financial buffer or safety cushion that allows firms to navigate the uncertain and potentially costly environment created by climate risks. Holding more cash can help firms avoid reliance on external financing, which may become more expensive or difficult to obtain in a high-risk scenario. Additionally, it protects against adverse cash flow shocks, which can arise from sudden disruptions caused by climate events, and mitigates the risk of having stranded assets - assets that lose value or become obsolete due to climate-related changes.

The control variables are consistent with the existing literature in terms of their expected sign. The degree of indebtedness hurts the probability of paying dividends (Barros et al., 2022; Ahmad et al., 2018; Chang et al., 2016; Ongsakul et al., 2024). The effect of size is significant and has the expected positive sign for all specifications, suggesting that larger firms pay higher dividends (Boțoc & Pîrtea, 2014; Barros et al., 2022; Ongsakul et al., 2024). More profitable firms are paying higher dividends (Ongsakul et al., 2024). The positive association between GDP and the probability of paying dividends suggests that firms located in more economically developed countries are more likely to distribute dividends to their shareholders. Contrary to the initial expectations, the COVID-19 pandemic has no impact on the probability of paying dividends.

In the second section of the empirical analysis, the impact of CV on the level of dividend payments (measured by dividend yield and dividend payout ratio) is analyzed. The results of the Prais-Winsten regression model with PCSE and dividend yield as the dependent variable are presented in Table 5. The coefficient of VUL is positive and statistically significant, which implies that CV increases dividend payments in both models (A1 and A2, the first two columns). In terms of economic significance, the estimated coefficients indicate that a one-standard deviation increase in VUL corresponds to a 0.19% increase in dividend yield (model A1).

In contrast to the previous studies (Chang et al., 2024; Ongsakul et al., 2024), the current findings suggest a positive association between CV and the level of dividend yields, suggesting that firms aim to balance shareholder expectations with the challenges posed by climate risk. While climate risk generally leads to a lower probability of paying dividends, those firms that do choose to pay dividends may increase the level of those payments as a signal of financial strength and stability to investors.

Firms may increase dividend levels to satisfy short-term shareholder demands, even as they navigate long-term climate risks. This approach might be used to sustain investor confidence during periods of transition or uncertainty. Also, firms with sufficient cash reserves might choose to distribute a higher portion of their earnings as dividends, especially if they anticipate that climate-related challenges will not immediately impact their cash flow or if they believe that withholding too much cash could signal pessimism.

Regarding the control variables, the empirical results show that the dividend yield in the case of EU-listed firms is positively associated with leverage and firm profitability. On the other hand, dividend yield is negatively associated with size, price-earnings ratio, and economic development (GDP).

Table 5. Level of dividends (Dividend Yield)

	Full sample		EU countries	
	Model A1	**Model A2**	**Model A3**	**Model A4**
VUL	7.4820***	7.4820***	10.5244***	10.5244***
	(2.7268)	(2.7268)	(3.3929)	(3.3929)
SIZE	-0.0777***	-0.0777***	-0.1177***	-0.1177***
	(0.0254)	(0.0254)	(0.0306)	(0.0306)
LEV	0.0109***	0.0109***	0.0073*	0.0073*
	(0.0035)	(0.0035)	(0.0044)	(0.0044)
ROA	0.0193***	0.0193***	0.0363***	0.0363***
	(0.0073)	(0.0073)	(0.0103)	(0.0103)
NPM	-0.0027	-0.0027	-0.0012	-0.0012
	(0.0026)	(0.0026)	(0.0031)	(0.0031)
CCE	0.3540	0.3540	0.3858	0.3858
	(0.4462)	(0.4462)	(0.5551)	(0.5551)
PER	-0.0082***	-0.0082***	-0.0088***	-0.0088***
	(0.0008)	(0.0008)	(0.0010)	(0.0010)
GDP	-0.6247***	-0.6247***	-0.6158***	-0.6158***
	(0.1585)	(0.1585)	(0.1750)	(0.1750)
GDP_GR	-0.0012	-0.0012	-0.0118	-0.0118
	(0.0135)	(0.0135)	(0.0182)	(0.0182)
COVID-19		-0.0634		-0.0462
		(0.1559)		(0.2319)
Constant	8.8874***	8.8874***	8.1066***	8.1066***
	(2.2301)	(2.2301)	(2.3591)	(2.3591)
Year FEs	YES	YES	YES	YES
Industry FEs	YES	YES	YES	YES
R-squared	0.0962	0.0962	0.1028	0.1028
Obs.	14,914	14,914	10,858	10,858

Notes: Robust standard errors (SEs) are in parentheses and account for clustering at the firm level. Stars (***/ **/*) indicate significance at the 1%/5%/10% level. See Table 1 for the variables' definitions.

The robustness of these findings is assessed by analyzing various sub-samples of firms. Thus, the model is rerun only in the case of firms located in EU countries. The results are reported in columns A3 and A4, Table 5. A positive relationship between CV and dividend yield has been found for our full sample of firms located in EU countries. Results are consistent with the base model but the magnitude of the impact is higher. The estimated coefficients show that a one-standard-deviation increase in VUL leads to a 0.19% increase in dividend yield.

Table 6. Level of dividends (Dividend Payout Ratio)

	Full sample		EU countries	
	Model A1	**Model A2**	**Model A3**	**Model A4**

VUL	117.3861	117.3861	181.5704*	181.5704*
	(84.5411)	(84.5411)	(100.4204)	-100.4204
SIZE	-1.5317*	-1.5317*	-2.7132***	-2.7132***
	(0.9078)	(0.9078)	(1.0449)	-1.0449
LEV	0.2050	0.2050	0.0374	0.0374
	(0.1328)	(0.1328)	(0.1574)	-0.1574
ROA	-2.6125***	-2.6125***	-2.6932***	-2.6932***
	(0.2547)	(0.2547)	(0.3141)	-0.3141
NPM	-0.4606***	-0.4606***	-0.4383***	-0.4383***
	(0.0996)	(0.0996)	(0.1092)	-0.1092
CCE	11.5850	11.5850	10.9648	10.9648
	(17.4534)	(17.4534)	(20.6165)	-20.6165
PER	1.9806***	1.9806***	2.0016***	2.0016***
	(0.0603)	(0.0603)	(0.0656)	-0.0656
GDP	3.1797	3.1797	2.6269	2.6269
	(4.3242)	(4.3242)	(4.8712)	-4.8712
GDP_GR	0.0046	0.0046	-0.5848	-0.5848
	(0.6128)	(0.6128)	(0.7464)	-0.7464
COVID-19		5.6360		-2.2288
		(7.5274)		-6.9436
Constant	-2.1481	-2.1481	-4.2080	-4.208
	(62.8715)	(62.8715)	(68.1897)	-68.1897
Year FEs	YES	YES	YES	YES
Industry FEs	YES	YES	YES	YES
R-squared	0.2211	0.2211	0.2411	0.2411
Obs.	14,945	14,945	10,885	10,885

Notes: Robust SEs are in parentheses and account for clustering at the firm level. Stars (***/ **/*) indicate significance at the 1%/5%/10% level. See Table 1 for the variables' definitions.

In the second model, the impact of CV on the dividend payout ratio is tested using both samples of firms. Climate vulnerability is positively associated with the dividend payout ratio. However, the results are statistically significant only at 10%. To compensate investors for the higher perceived risk associated with climate exposure, firms may offer higher dividend payments. This can be a way to maintain investor loyalty and attract capital despite the underlying risks.

These findings highlight the importance of incorporating climate risk into investment decisions, not just as a risk factor, but also as a determinant of dividend strategies and potential investment returns. Investors should adopt a nuanced approach, considering both the risks and opportunities presented by climate-exposed firms.

5. Conclusions and implications

Examining the impact of CV on payout policy is crucial for understanding how firms manage the financial challenges arising from climate change. This study aims to provide empirical evidence on European firms, thereby contributing to the broader discourse on corporate resilience and sustainability in the face of environmental risks. The effect of climate risk on dividend policy is investigated using a large sample of listed European firms over the period 2010-2021.

The results of the panel logit model show that firms are less likely to pay dividends if they are located in countries more exposed to climate vulnerabilities. In essence, firms are likely cutting back on dividend payments as a precautionary measure to ensure they have sufficient resources to manage the challenges and uncertainties associated with climate risk. This behaviour reflects an awareness of the long-term financial implications of climate change and a strategic shift toward resilience and sustainability.

Contrary to previous studies, a robust positive relation between climate vulnerability and the level of dividend payments (dividend yield and dividend payout ratio) has been found irrespective of model specification. This positive relationship can be interpreted as a strategic response by firms that may be aiming to balance shareholder expectations with the challenges posed by climate risk. While climate risk generally leads to a lower probability of paying dividends, those firms that do choose to pay dividends may increase the level of those payments as a signal of financial strength and stability to investors.

The findings of this research will not only enhance academic understanding but also bring practical insights for investors, policymakers, and corporate leaders striving to build a more resilient and sustainable economic future. Investors should be aware that firms exposed to higher climate risks may be less likely to consistently pay dividends. This suggests that climate risk should be a key factor in their risk assessment processes. Investors need to carefully evaluate the potential for reduced dividend payments when investing in firms operating in high-risk environments. For income-focused investors, the positive relationship between climate risk and the level of dividend payments (measured by dividend yield and payout ratio) indicates that some firms might increase dividends as a compensatory strategy. However, this could be a double-edged sword. While higher dividend yields may appear attractive, they might also signal underlying risks that the firm is attempting to offset by offering higher immediate returns. Also, these findings suggest that investors should consider diversifying their portfolios to include firms with varying levels of climate risk exposure. While firms with high climate risk might offer higher dividend yields, they could also present greater long-term risks. Balancing investments between firms with different risk profiles can help mitigate potential volatility.

The current study is not without limitations given by data availability. First, the conclusions drawn from this study are constrained by the data upon which the results are based. Further research could rely on a firm-level climate risk measure and consider other factors that mediate the relationship between CV and payout policy (e.g., institutional factors, corporate governance practices, or behavioural aspects of corporate decision-making). Also, Future research could explore how the relationship between climate risk vulnerability and dividend policy varies across different sectors. Given that some industries are more exposed to climate risks (e.g., energy, agriculture, manufacturing), it would be valuable to investigate whether the observed effects differ by sector and the mechanisms driving these differences.

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