Environment, Development and Sustainability (2024) 26:4293–4333
https://doi.org/10.1007/s10668-022-02884-5

Environmental, social, and governance disclosure in response to climate policy uncertainty: Evidence from US firms

Huy Viet Hoang[1]

Received: 13 July 2022 / Accepted: 23 December 2022 / Published online: 14 January 2023

Abstract
Increasingly drastic governmental efforts in reducing environmental footprints in face of rising abnormal climate events have urged firms to redirect their strategy to withstand climate-induced policy uncertainty. Despite the incomplete regulatory framework for environment, social, and governance (ESG) reporting, many US firms have voluntarily incorporated ESG content into their public reports. Motivated by this sprouting ESG disclosure pattern of US firms, this study examines whether US firms adjust their ESG disclosure practices in face of changing climate policy. By employing fixed-effect estimations using firm-level and country-level data from various sources, we show that US firms disclose more ESG information following periods of heightened climate policy uncertainty (CPU), consistent with our prediction that firms employ ESG reporting to shelter themselves from CPU risks. Further analyses reveal that firms with more attentive audit committees, more severe financial constraints and earnings management problems, greater emissions and renewable energy consumption, and better comprehension of climate risks experience a stronger positive effect of CPU. Uncertain events and states' ESG heterogeneity also strengthen the effect. Our results suggest investors analyze firms' ESG reporting with care during heightened CPU periods and advise policymakers to accelerate their mandate of corporate ESG disclosure.

Keywords Climate policy uncertainty · Earnings management · Emissions · ESG disclosure · Financial constraint

1 Introduction

Climate change is a boiling topic in recent years since numerous abnormal climate disasters, such as extreme temperatures, drought and rising sea levels, have been witnessed. To monitor corporate productions, considered the major source of exhalation to the environment, many governments are endorsing sustainable policies that force firms to cut down

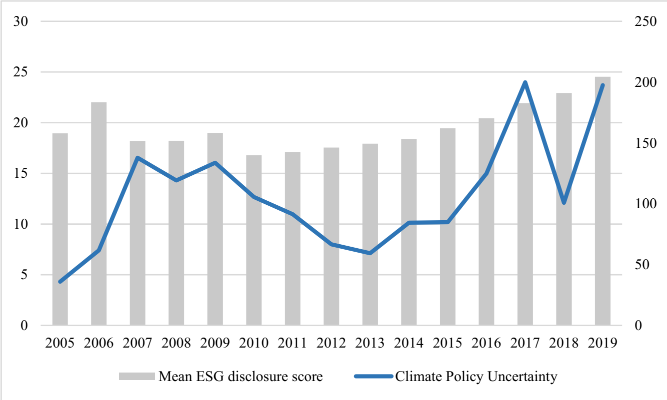
✉ Huy Viet Hoang
huyhv@neu.edu.vn

[1] National Economics University, Hanoi, Vietnam

emissions and switch to renewable energy (Fox & Alldred, 2020). The Paris Agreement 2015 marks a milestone where all participating nations reach a consensus on mutual efforts to encounter the growing climate unpredictability. The collective efforts of all the signatories have been manifested through stringent climate policies aiming at climate change mitigation. The implementation of new climate policies, on the other hand, imposes pressure on businesses because these policies mostly aim at mitigating emissions, especially emissions from firms' productions (Bartram et al., 2022). That said, although climate policies generally are antagonistic to emitting firms, their rigidity may be relaxed sometimes since climate policies must show synergies with other dimensions of development (e.g., social and economic) (Cohen et al., 2019). On the flip side, the effort to achieve policy synergy may escalate overall policy uncertainty when conflicts of climate resolutions, originating from divergent attitudes toward climate changes, exist among political forces. President Trump, as a former US leader, contested that the adoption of climate policies undermines the US economy and decided to roll back President Obama's climate change mitigation policies (Popovich et al., 2021). President Trump even took it further by officially withdrawing the USA from the Paris Agreement in November 2020, only for the current President Biden to rejoin the Agreement four and a half months later with a huge ambition of curbing greenhouse gas emissions (U.S. Department of State, 2021). This complexity of climate policy attitudes and implementations, hence, introduces a new variable to the economic system and intensifies the current level of policy-related uncertainty.

Sustainability is undoubtedly the future of businesses, requiring firms' commitment to reducing their emissions below an acceptable threshold. However, changing the emission scheme requires a major change in the firms' strategy as most corporate resources are contrived to serve the current strategy (Kump, 2021). Shutting down factories or immediate cuts in energy usage will adversely affect firms' production rhythm and potentially terminate contractual relationships with their clients (Wang et al., 2021). Besides, the market does not wait to hammer environment-unfriendly firms, especially during highly sensitive times (Cooper et al., 2018; Jung et al., 2018; Qian et al., 2020). Another way that possibly helps firms to temporarily ward off the risk of climate policy uncertainty (CPU) is to improve their reporting transparency using their available source of ESG information. ESG information, according to previous literature, is value-relevant (Alessi et al., 2021; Pedron et al., 2021); thus, pursuing sustainability disclosure enables firms to protect their market value (Ahsan & Qureshi, 2021; Attig et al., 2020; Yuan et al., 2022). The value relevance of ESG disclosure should be more pronounced during heightened CPU periods since the commitment to sustainability information transparency directly tackles corporate social responsibility (CSR) scrutiny from market participants.

The literature notes two prominent motivations for firms disclosing ESG information during bad times. First, as market surveillance intensifies when (climate) policy uncertainty rises, investors tend to rigidly scrutinize firms' activities that may signal their attitude to the changing climate. Disclosing sustainability information, as a means to announce corporate commitment to transparency and climate issues, can help firms to improve their reputation and shelter policy uncertainty (Ahsan & Qureshi, 2021). This view is strongly relevant to sustainability-proactive firms, who dedicate their resources to pursuing sustainable development. Second, firms may pursue ESG disclosure for defensive purposes without making real efforts to improve sustainability performance (e.g., Dang et al., 2021; Matsumura et al., 2017). These opportunistic demeanors stem from the market's favoritism toward sustainability reporting firms, especially during uncertainties (Du et al., 2017). Jia and Li (2020) document that although uncertainties adversely affect firms' sustainability investments, those who have been engaging in



Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Mean ESG disclosure score	18.95	22.02	18.21	18.21	18.99	16.79	17.11	17.55	17.92	18.40	19.46	20.44	21.93	22.93	24.53
CPU index	35.91	61.74	137.83	119.22	133.69	105.53	91.42	66.65	59.34	84.43	84.81	124.86	199.92	100.86	197.50

Fig. 1 US firms' ESG disclosure and CPU during the 2005–2019 period

good sustainability practices reap more optimistic market valuations during these times. Comparing sustainability and other indices, depending on regions, sustainability indices perform better than other indices thanks to their ability to offset local and global uncertainty risks (de Oliveira et al., 2020). Given the benefit of sustainability reporting to disclosers, investigating corporate ESG disclosure behaviors contingent on CPU, hence, is an intriguing but under-researched topic.

Another motivation for this study is the fact that climate change is inciting greater troubles in human lives. The delivery of many climate accords, such as the 1992 United Nations Framework Convention on Climate Change, the 1997 Kyoto Protocol and the 2015 Paris Agreement, has raised the alarm on the environmental consequences of business activities in recent decades. The commitment to these climate accords requires participating nations to reconsider their approaches to economic development toward climate footprint mitigation, thus leading to a greater level of climate policy-induced uncertainty. Correspondingly, our observation of US firms during the 2005–2019 period shows an increasing pattern of ESG disclosure scores throughout the years (see Fig. 1). Noticeably, after hitting the trough in 2010, US firms' ESG disclosure started to rise again and has taken off since 2015, which matches the timing when CPU intensifies. This poses a compelling question: Is the similar movement of ESG disclosure and CPU coincident? This question, besides the literature gape, motivates us to address this question.

Figure 1 shows the mean value of US firms' ESG disclosure score and the value of CPU during the period from 2005 to 2019. The columns and the left vertical axis present the mean value of ESG disclosure scores, while the blue line and the right vertical axis present the value of the CPU index. The value of the mean ESG disclosure score and CPU index is reported in the table underneath the graph.

This study examines how CPU influences US firms' ESG disclosure behaviors and attempts to bring to light plausible explanations for this potential effect. Our measure of CPU is based on the study of Gavriilidis (2021), who quantifies CPU by employing Baker et al.'s (2016) seminal textual analysis approach to capture information on major events related to climate policy. This study uses fixed-effect models with a range of control variables on a sample of non-financial US firms from 2005 to 2019 to uncover the potential impact of CPU on US firms' ESG disclosure behaviors. The endorsement of fixed-effect models helps mitigate the omitted variable bias, through that reinforcing the validity of our inferences (Mustard, 2003). Our estimates show that US firms disclose more ESG information when CPU rises. This effect is more pronounced among firms whose audit committee meets more frequently, firms with financial constraints, more manipulated earnings, greater emissions and renewable energy consumption, and firms that are aware of climate change risks. In addition, the impact of CPU is strengthened in presidential election years and among Republican-leaning states. These results lend support to our inference that firms are motivated to increase ESG disclosure during heightened CPU periods.

Our study contributes in several ways. Firstly, the literature on CPU is quite limited given the recent introduction of this metric. Current empirical firm-level studies of CPU have addressed its relationship with ESG performance, (non-)renewable energy demand, investment, firm value, corporate financialization, and firm-level total factor productivity (Azimli, 2022; Gavriilidis, 2021; Hoang, 2022; Ren et al., 2022a, b; Shang et al., 2022). The closest study to ours is Gavriilidis (2021), who initiates the CPU index and examines firms' emission behavior in response to changing CPU without considering firms' ESG communication. We tackle this current gap by investigating the effect of CPU on ESG disclosure and documenting some captivating results that enlighten the current literature on ESG during uncertainty. We reveal that firms' ESG behaviors in straining CPU situations are similar to other types of uncertainty, thus highlighting the necessity of ESG communication to market participants in dubious times. Secondly, we show that some firms are more motivated to deliver ESG information than others to make use of the market's ESG preference in these periods. Interestingly, the impact of CPU is strengthened not only among firms that are directly exposed to stringent climate policies but also among firms that are considered risky (e.g., firms with financial constraints and serious earnings management problems). It is feasible that CPU factors an additional layer of risk into the economy, which affects all US firms as a whole rather than only climate-sensitive firms. Third, any CPU-sensitive event could prompt firms' reactions in form of ESG communication. This inference is supported by our examination of the US presidential election, which is a CPU-generated source because of the different viewpoints toward climate change risk among the political parties. Fourth, our examination from the institutional perspective indicates that CPU affects firms differently across states. The heterogeneous corporate responses to CPU may root in the regulations and attitude toward climate change in each state as we take into account uncertain events and state-level political preferences.

The remainder of the paper is structured as follows. Section 2 summarizes related literature and formulates our hypothesis. Section 3 presents the methodology and sample. Section 4 discusses the results. Section 5 concludes and provides some implications from our findings.

2 Related literature and hypothesis development

Rising policy uncertainty troubles firms' decision-making and represses their activities, causing reduced investments, increased cost of capital, and discouraging innovations (Gulen & Ion, 2016; Xu, 2020). Firms' decisions to shrink their operation to avoid unpredicted policy outcomes possibly are disadvantageous for their business. CPU, a dimension of uncertainties focusing on climate policy, also likely triggers dramatic corporate reactions. Ye (2022) shows that the climate news risk, proxied by the Wall Street Journal climate news index, affects uncertainties in short, medium, and long run, in which the effect is most noticeable in the short run and gradually fades afterward.

The adoption of stringent climate policies is largely influenced by the increasing frequency of extreme climate disasters recently. As the climate turns erratic, brown firms are penalized by the market, such as experiencing negative short-term abnormal returns or investment losses to green firms (Choi et al., 2020; Jin et al., 2020). Rising CPU can stimulate investors' sentiment toward environmental issues and trigger greater scrutiny, as well as drastic reactions, to corporate sustainability practices. According to the *risk mitigation hypothesis*, ESG activities serve as insurance-like protection amid adversity events (Jiraporn et al., 2014; Ongsakul et al., 2019). Intuitively, because many governments are seeking an effective economic growth strategy without leaving significant social and environmental consequences (Batruch, 2017), committing to ESG helps firms to reduce their vulnerability to climate-induced policy uncertainty. However, given that emission diminution takes time and the market cannot wait, a timely countermeasure to CPU firms can take is through ESG disclosure to enhance corporate transparency and inform the market about firms' accountability (Dellaportas et al., 2012). The convenience of utilizing ESG disclosure is reflected in the voluntary nature of ESG disclosure, which allows firms to timely manage their preferred ESG disclosure level (Delmas & Toffle, 2008; Sharma, 2000). This, combined with the market's soaring favoritism of ESG transparency during heightened CPU times, makes ESG disclosure an appealing temporary resolution to mitigate firms' exposure to changing climate policies.

The ESG disclosure behavior can also be explained via the lens of the *stakeholder theory*. The stakeholder theory refers to the interconnection between firms and their stakeholders and defines firms' success through the values they deliver to their stakeholders (Freeman, 2010). The undertaking of ESG reporting reflects firms' inclination to tie their benefits with stakeholders through firms' accountability to improving firms' transparency and expressing firms' pro-environment attitude (Weber, 2013). Relationship management via ESG disclosure lifts firms' reputation, resulting in reduced risks associated with stakeholders (Cho & Patten, 2007). A rise in CPU systematically affects all business entities in the economy, which may cause them to re-assess the risk profile of their current partners. In this context, ESG disclosure is expected to be more prominent since it is an effective device to reassure stakeholders about firms' responsibility. The stakeholder theory, hence, shows agreement with the risk mitigation theory about increasing corporate engagement in ESG disclosure during heightened CPU periods.

Empirical evidence provides support for this proposition. Attig et al. (2020) reveal that when (economic) policy uncertainty is high, firms counter the risks of uncertainty by disclosing more substantive information regarding their environmental performance. Huang et al. (2022) examine ESG behaviors of firms located next to the disaster areas and reveal their increasing disclosure of ESG activities in the period following the disaster. Such disclosure increases are a countermeasure to the rising corporate vulnerability to uncertainties since ESG disclosure is value-relevant and can nullify information asymmetry (Al-Tuwaijri et al., 2004; Egginton & McBrayer, 2019). Specifically, policy-induced uncertainty can be attenuated by increasing engagement in environmental and social disclosures (Ahsan & Qureshi, 2021). Besides, the pursuit of ESG reporting enables firms to enjoy the market's rewards. In the US setting, the cost of equity is lower if firms disclose their climate change risk in their 10-K filings, and the cost is further reduced as reporting firms treat climate change risks as a material (Matsumura et al., 2017). According to Arif (2020), ESG disclosure is a device to mitigate future earnings risk as sensitive industry firms report more non-financial information and have lower earnings risk than non-sensitive industry firms. Marketwise, the value relevance of ESG disclosure can enhance firm value (Jain et al., 2016; Mervelskemper & Streit, 2017).

To sum up, the extant literature converges on a consensus that when climate policy risk escalates, firms are more prudent in their decision-making and are inclined to make use of the market's favoritism for ESG to earn investors' trust. Our discussion of ESG disclosure and CPU leads to the following research hypothesis:

Hypothesis 1 ESG disclosure is positively correlated with climate policy uncertainty.

Although CEOs are directly involved in ESG reporting, their role is overseen by the firms' governance bodies and the decision of ESG reporting should be approved by the board and relevant committees. Prior studies pinpoint various characteristics of the board of directors and audit committee that influence corporate reporting in general and ESG reporting in specific (e.g., Chen & Jaggi, 2000; Khlif & Samaha, 2014; Lagasio & Cucari, 2019; Samaha et al., 2015). The board of directors and committees are established as a representative of the shareholders to safeguard shareholders' interests. Considering the shareholder theory (Mansell, 2013), the board and committees tend to opt for value-increasing decisions in order to accumulate shareholders' wealth. Given the insurance effect of ESG disclosure, incorporating ESG into corporate strategy and directing firms' ESG activities should be one of the board's priorities to shield the impact of CPU on their firm value. The stakeholder theory also favors the board's inclination toward ESG disclosure (Weber, 2013). The boards' decision-making must ensure firms' long-term profitability, thus highlighting the need of nourishing stakeholder relationships. ESG engagement, as previously discussed, signifies firms' willingness to commit to a benefit-sharing scheme with their related parties. These theories substantiate the idea that ESG reporting during intense CPU times is highly beneficial for not only firms' owners but also other stakeholders. Since business strategy, including ESG, is formulated and supervised by the board, corporate governance bodies play an important role in shielding the impact of CPU on the firm through ESG reporting.

In this vein, we expect the examined relationship is affected in the presence of some corporate governance mechanisms.

Hypothesis 2 Corporate governance practices moderate the effect of climate policy uncertainty on ESG disclosure.

Empirical evidence finds consensus on the jeopardizing effect of uncertainty on firms' ability to access external capital, which in turn aggravates financial constraints (e.g., Gilchrist et al., 2014; Pástor & Veronesi, 2013). Viewing from the information asymmetry perspective, firms' unwillingness to improve corporate reporting transparency is the root of financial constraints (Ascioglu et al, 2008; Hoberg & Maksimovic, 2015). If corporate reporting decades ago mostly related to firms' financial performance, the growing climate awareness recently has gradually lifted the market attention to firms' communication of their sustainability achievement. Yet ESG disclosure is not mandatory, ignoring such activities may undermine firms' prospects during high CPU periods because of the soaring sensitivity to corporate sustainability integrity from both the market and the government. García-Sánchez et al. (2019) document that financially constrained firms have better access to external capital if they offer a greater range of information in terms of CSR initiatives to the market. Dhaliwal et al. (2011) point out that firms with high costs of capital are inclined to initiate their CSR disclosure in the current year to enjoy lower capital costs in the subsequent periods. The coverage of sustainability content in annual reports signifies financially constrained firms' efforts to relieve the information asymmetry and agency problems (Martínez-Ferrero et al., 2016a, 2016b). The elevation of CPU likely complicates capital access of firms with financial constraints as a result of an increasing aggregated uncertainty level. Given that ESG disclosure is a device for financially constrained firms to reduce the cost of capital, financially constrained firms should be more proactive in their ESG disclosure during intensified CPU periods. Therefore, we predict that firms with financial constraints show a greater engagement in ESG disclosure during intensified CPU times.

Hypothesis 3 Firms with more severe financial constraints disclose more ESG information during heightened CPU periods.

Conceptually, ESG firms tend to highly value business ethics in their course of action, aiming at harmonizing both economic and social goals while creating values for revolving stakeholders (Hoi et al., 2013; Jackman & Moore, 2021). By this concept, ESG firms should not be associated with earnings manipulation since this behavior is prone to investors' trust loss and firm value degradation. However, previous research is unable to point out a clear directional association between ESG disclosure and earnings management. Overall, empirical evidence proposes two competing streams of opinion. The first opinion posits that sustainability disclosure positively correlates with innate earnings quality and is negatively associated with opportunistic earnings manipulation (Hong & Andersen, 2011; Rezaee & Tuo, 2019). This indicates that ESG commitment enhances reporting transparency and earnings quality by negating managerial reporting opportunism, hence corroborating the conventional viewpoint of ESG.

The second school of thought, though does not refuse the ethical aspect of ESG, argues that ESG can be exploited in a way that serves private purposes for its users (e.g., Dang et al., 2021; Martínez-Ferrero et al., 2016a, 2016b; Prior et al., 2008). Since ESG is highly appreciated during this climate-sensitive era and corporate reporting materials are moving toward balancing financial and non-financial/sustainability information, ESG is emerging as a risk-reward factor in corporate disclosure besides financial numbers. Given managerial discretion in picking up preferable pieces of data favored by the readers, ESG content is likely administered to satisfy market participants. Consequently, market participants shift part of their attention to ESG information communicated in annual reports, thus both cultivating firms' credibility in sustainability and reducing the risk of earnings management detection. Prior et al. (2008) find that because earnings management brings private benefits to managers at the expense of shareholders' benefits, managers consider CSR a compensation scheme for their earnings management wrongdoings. In sum, this competing viewpoint accentuates the utilization of sustainability reporting to mask their earnings management behaviors instead of improving corporate transparency, through that raising doubt on the conceptual and actual implementation of ESG disclosure.

The opposite views on the interaction between ESG disclosure and earnings management pose an interesting question and compel us to delve into the effect of CPU on firms' ESG disclosure, taking into account their earnings management practice. We do not provide a specific prediction for this potential effect.

Hypothesis 4 Earnings-managed firms adjust ESG disclosure practices during heightened CPU periods.

Although businesses are regarded as the main contributors to environmental degradation, the level of emissions varies not only among firms but also among industries since some industries are more polluted in nature (Nguyen & Phan, 2020). Heavy-emitting industry firms, with their intolerance of the environment, are highly vulnerable in climate-sensitive times due to the market's scrutiny of sustainability-lacking firms. Despite that emission-intensive firms can immediately reduce emissions to please the market, a sudden emission cut probably generates an unfavorable effect on firms' production plans and leads to disappointing firm performance in the subsequent periods. Otherwise, according to the risk mitigation theory, firms may try to fence the CPU risk through ESG disclosure. Hoang (2022) presents evidence of heterogeneous corporate reactions to heightened CPU conditional on their emission level. Hoang (2022) reveals that heavy-emitting firms with technology and infrastructure concerns invest less in R&D when CPU is rising, in opposition to the general rise in R&D investments of US firms when considering the whole study sample of US firms. In that light, we hypothesize that heavy-emitting industry firms will disclose more ESG information since they are liable to a greater degree of climate policy risks than light-emitting firms.

Hypothesis 5 Firms operating in heavy-emitting industries disclose more ESG information during heightened CPU periods.

Figure 2 shows the simplified research framework applied in this study. Besides focusing on the relationship between CPU and ESG disclosure, we also consider the moderating effect of corporate governance, financial constraints, earnings management, and emission level variables on this relationship.

3 Methodology

3.1 Key variable measurement

We adopt the natural logarithm of the ESG disclosure score computed by the Bloomberg financial database as a proxy for ESG disclosure in this study. Bloomberg's ESG disclosure score ranges from 0 to 100, in which 0 means the firm does not disclose any ESG information, while 100 indicates that the firm discloses every detail of its ESG in accordance with Bloomberg's criteria.

The measure of CPU in this study stems from the study of Gavriilidis (2021). Gavriilidis (2021) applies the textual analysis technique to count the number of articles containing keywords related to uncertainty in climate policy from eight leading US newspapers and then scales the number of relevant articles in a month by the total number of articles in that month. Afterward, Gavriilidis (2021) derives standard deviation by standardizing the series and averages those monthly. At last, the averaged series are normalized to have a mean value of 100 for the study period.

The textual analysis technique to construct an index has been elaborated in Baker et al.'s (2016) seminal research paper on the economic policy uncertainty (EPU) index. Gavriilidis' (2021) follows Baker et al.'s (2016) infamous methodology to archive climate policy

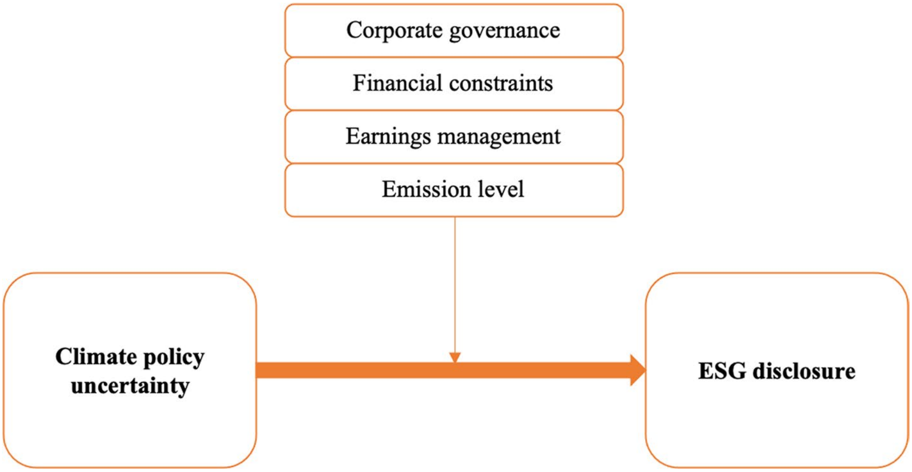


Fig. 2 Simplified research framework

news, that may engender uncertainties, in a CPU index. The approach of Gavriilidis (2021) allows the author to capture the policy impact of climate change, which Engle et al.'s (2020) climate change news does not delve into. The CPU index of Gavriilidis (2021) has widely been adopted in recent papers such as Bouri et al. (2022), Hoang (2022), and Zeng et al. (2022). It is noted that the data of CPU provided by Gavriilidis (2021) are originally monthly data. Since this study aims at investigating the effect of CPU on an annual basis, we take the average of CPU indices in a year as our proxy for CPU. The greater value of the CPU index, the higher degree of uncertainty induced by climate policy.

3.2 Model specifications

Our baseline model to examine the effect of CPU on firms' ESG disclosure (Hypothesis 1) is as follows:

$$\mathrm{ESGDIS}_{i,t} = \beta_1 + \beta_2\mathrm{CPU}_t + \beta_3\mathrm{CONTROLS}_{i,t} + f_i + f_y + \varepsilon_{i,t} \quad (1)$$

We follow prior studies to control for firms' characteristics, including firm size, leverage, profitability, growth opportunities, capital expenditure, board size, board independence, board gender diversity, and CEO duality (see Martínez-Ferrero et al., 2016a, 2016b; Huang et al., 2022; Yuan et al., 2022). Since some industries are more sensitive to climate policy, industry fixed effect is incorporated into the model to capture the heterogeneous effect of CPU. We also include time fixed effect to control for time-variant factors that may influence our estimates of CPU.

Additional to the baseline model, we scrutinize how some firms' attributes moderate the impact of CPU on ESG disclosure via a range of cross-sectional tests. Model (2) below is employed to examine our Hypotheses 2–5:

$$\mathrm{ESGDIS}_{i,t} = \beta_1 + \beta_2\mathrm{CPU}_t + \beta_3 X_{i,t} + \beta_4\mathrm{CPU}_{i,t} \times X_{i,t} + \beta_3\mathrm{CONTROLS}_{i,t} + f_i + f_y + \varepsilon_{i,t} \quad (2)$$

where X represents variables in our cross-sectional tests with regard to corporate governance, financial constraint, earnings management, industry-level emissions, and institutions. The results of these cross-sectional tests will broaden our understanding of CPU-induced ESG disclosure conditionally on some prominent firms' and institutional peculiarities.

One may concern about the estimation bias caused by the non-stationarity of our panel data. Scrutiny of our data reveals that although our study stretches across a 15-year period, the average number of period for each firm is only 8.05 periods as a result of missing data. According to Baltagi (2005), unit root tests for such short time series do not generate reliable inferences. We, therefore, employ fixed-effect estimations to encounter the non-stationarity issue on the ground of Wooldridge (2012) that non-stationarity is more of an issue for fixed-effect estimations with panel data of large T and small N. Because our panel data are characterized by large N and relatively small T, our estimates are unlikely to be influenced by the spurious effect.

Discussing fixed-effect estimations, Wooldridge (2012) emphasizes the need to address potential misspecifications of non-normality, heteroskedasticity, and autocorrelation. In light of the central limit theorem, we can relax the normality assumption in our model as we estimate a large sample size of 18,116 observations. To correct for potential heteroskedasticity and autocorrelation issues, we cluster robust standard errors to firm and year across all tests. Moreover, all continuous variables are winsorized at 1% and 99% to reduce the outlier effect.

3.3 Sample and data selection

The initial sample of this study consists of all US-listed non-financial firms from 2005 to 2019. We exclude the financial industry from our sample due to its strict regulations and distinguished operation nature. Observations with missing values of ESG disclosure and CPU are also eliminated from the sample. The refinement leaves our final sample an unbalanced panel with 18,116 observations from 3806 firms.

Our data are collected from various sources. Firm-level data are retrieved from Bloomberg financial database. Data of CPU and EPU are obtained from the website https://www.policyuncertainty.com. Firm-level climate change exposure, risk, and sentiment data are from Sautner et al. (2021). Board co-option data are requested from Coles et al. (2014). To merge the firm-level data from different sources, we perform three steps. First, we match Sautner et al.'s (2021) climate change exposure, risk, and sentiment data and Coles et al.'s (2014) board co-option data using *gvkey*. Second, we search and match each *gvkey* with *tic* as both identifiers are available on Compustats. Third, we modify Compustats' *tic* to be in the same form as Bloomberg's *Ticker* and then match the two identifiers to make an aggregate dataset. Monthly data of CPU and EPU are annualized using the equally weighted method before being inserted into the aggregate dataset.

In summary, an average firm in our sample has a firm size of $1.235 billion, a debt-to-assets ratio of roughly 50%, a negative return on assets of − 10.5%, and is highly valuated with Tobin's Q of 2.326. A firm's board is expected to be highly independent (78% of the board are independent directors), but only 13.3% of the board members are females. About 43.5% of firms have CEOs concurrently holding the board chair position. In respect of CPU, we notice that the CPU index started picking up in 2014 and sharply rose in 2016 and 2017 following the Paris Agreement, which was signed in the first half of 2016. Variable definition and summary statistics are presented in Panel A in Table 1, and Pearson pairwise correlation coefficient matrix is shown in Panel B, Table 1.

4 Results and discussion

4.1 The effect of climate policy uncertainty on ESG disclosure

At first, we examine the effect of CPU on ESG disclosure by estimating Model (1). The estimates are reported in Column 1 in Table 2. The coefficient of *CPU* is positive at 1% significance level, indicating that ESG disclosure and CPU are positively correlated. The economic meaning of this relationship is that for every one standard deviation increase in the natural logarithm of CPU, our ESG disclosure measure rises by 0.109 standard deviation (see Column 2, Table 2). This result corroborates our Hypothesis 1 that ESG disclosure increases with uncertainty arising from climate policy.

To ensure the reliability of our estimates, a rich set of sensitivity tests are conducted (see Table 2). First, we estimate the standalone effect of CPU on ESGDIS without and with fixed effects (Columns 3 and 4) and Model (1) without fixed effects (Column 5). Second, we estimate Model (1) with industry × year and year fixed effects, and with firm and year fixed effects (Columns 6 and 7). Third, we exclude some highly uncertain periods to filter the climate-unrelated uncertainties which may cause biasedness in our estimation. Particularly, we regress Model (1) after excluding the 2008–2009 global financial crisis (Column 8), the Presidential election years (Column 9), and the pre-Presidential election years (Column 10). Fourth, we add several variables to control for corporate environment-related policies relating to environmental quality management (*EQMANAGE*), energy efficiency (*ENERGYEFF*), waste reduction (*WASTE*), and water (*WATER*) (Column 11). In all the tests, CPU coefficients are positive and highly significant at 1% level, thus strengthening our results.

We conduct some additional tests in Table 3, using alternative measures of *CPU* and *ESGDIS*. Since the data of CPU are monthly based, it is possible to acquire the increasing and decreasing weighted measures of CPU. To derive the increasing weighted measure, we assign the weight of 1 for January, 2 for February, and up to 12 for December. We reverse the weight for the decreasing weighted measure. The estimations of Model (1) with increasing/decreasing weighted CPU are reported in Columns (1) and (2) in Table 3. Next, a change in climate policy may influence both climate and economic policy uncertainties because the new climate policy possibly entails sustainability requirements that interrupt firms' production plans. We attempt to separate CPU from the economic policy risk by taking the residual of the regression of *CPU* on *EPU* (see Baker et al., 2016). The residual is then used as a replacement for *CPU* in Model (1). The result of this test is shown in Column 3. Besides, because the ESG disclosure decision of this year may be influenced by the uncertainty in climate policy of the precedent year, we replace CPU_t with CPU_{t-1} and regress Model (1) (see Column 4). Regarding dependent variable measurement, since the ESG disclosure score is aggregated from the scores of environmental, social, and governance disclosure, we replace ESG disclosure in Model (1) with the disclosure of each pillar to observe whether the effect of CPU remains unchanged (see Columns 5–7). Overall, after replacing *ESGDIS* and *CPU* with some alternative measures, our results still hold.

To further investigate whether this effect persists in smaller samples, we carry out some subsample tests. Table 4 reports the estimates from the regression of Model (1)

Table 1 Summary statistics

Panel A. Descriptive statistics

Variable	Description	*N*	Mean	SD	Min	Max	Median
ESG disclosure							
ESGDIS	Bloomberg's ESG disclosure score	18,116	2.881	0.481	2.061	4.079	2.727
ENVDIS	Bloomberg's Environment disclosure score	8140	2.345	1.248	0.439	4.164	2.579
SOCDIS	Bloomberg's Social disclosure score	13,927	2.676	0.780	1.255	4.088	2.642
GOVDIS	Bloomberg's Governance disclosure score	18,116	3.958	0.113	3.47	4.269	3.947
Climate policy uncertainty							
CPU	Natural logarithm of Gavriilidis' (2021) climate policy uncertainty index	18,116	4.664	0.383	3.581	5.298	4.614
CPU_I	Increasing weighted CPU	18,116	4.719	0.370	3.643	5.383	4.662
CPU_D	Decreasing weighted CPU	18,116	4.594	0.424	3.515	5.407	4.543
CPU_RES	Residual from the regression of CPU on EPU	18,116	0.045	0.403	−0.732	0.738	0.013
Control variables							
SIZE	The natural logarithm of total assets	18,116	7.119	2.107	−1.604	11.269	7.207
LEV	Debt this year divided by the previous year's total assets	18,116	49.869	103.976	0.000	804.416	22.547
ROA	Returns this year divided by the previous year's total assets	18,116	−0.105	1.147	−12.125	1.135	0.044
Q	Tobin's *Q*	18,116	2.326	2.406	0.493	31.185	1.647
CAPX	Capital expenditure scaled by the previous year's total assets	18,116	−0.089	0.180	−1.311	0.000	−0.036
BS	The number of directors on board	18,116	2.129	0.275	1.386	2.639	2.197
BI	The proportion of independent directors on board	18,116	0.780	0.125	0.333	0.933	0.818
BGD	The proportion of female directors on board	18,116	0.133	0.112	0.000	0.455	0.125
DUAL	CEO duality	18,116	0.435	0.496	0.000	1.000	0.000
Additional control variables—robustness							
EQMANAGE	Equals 1 if a firm has introduced environmental quality management effort and 0 otherwise	13,480	0.235	0.424	0.000	1.000	0.000
ENERGYEFF	Equals 1 if a firm has any policy relating to efficient use of energy and 0 otherwise	13,475	0.354	0.478	0.000	1.000	0.000
WASTE	Equals 1 if a firm has any policy relating to waste reduction and 0 otherwise	13,475	0.334	0.472	0.000	1.000	0.000

Table 1 (continued)

Variable	Description	*N*	Mean	SD	Min	Max	Median
Panel A. Descriptive statistics							
WATER	Equals 1 if a has any policy relating to reducing water used in operations and efficient use of water in their production, and 0 otherwise	13,357	0.252	0.434	0.000	1.000	0.000
Channel variables							
BMF	The number of board meetings per year	17,737	1.960	0.404	1.099	3.045	1.946
ACMF	The number of audit committee meetings per year	17,662	1.900	0.363	1.099	2.708	1.946
HIGHCOD	Equals 1 if the proportion of co-opted directors on board exceeds the median value and 0 otherwise	7315	0.510	0.500	0.000	1.000	1.000
HIGHTWCOD	Equals 1 if the tenure-weighted measure of board co-option exceeds the median value and 0 otherwise	7315	0.500	0.500	0.000	1.000	0.000
ZSCORE	Altman Z-score	17,997	−4.260	17.971	−677.846	675.461	−3.961
HIGHDEFSCORE	Bloomberg's default risk score in the next year	17,987	0.563	0.496	0.000	1.000	1.000
HIGHDEFPROB	Bloomberg's Probability of default of a firm in the next year	17,987	0.500	0.500	0.000	1.000	0.000
RQDD02	Dechow and Dichev's (2002) earnings quality	16,109	−0.189	0.723	−6.670	−0.001	−0.040
RQF05	Francis et al.'s (2005) earnings quality	16,093	−0.186	0.682	−6.232	−0.001	−0.040
HEAVYEMIT	Equals 1 if firms belong to one of nine heavy-emitting industries and 0 otherwise	18,116	0.134	0.340	0.000	1.000	0.000
HIGHGHGEMIT	Equals 1 if a firm has its GHG emission exceeds the median value of the sample and 0 otherwise	3272	0.500	0.500	0.000	1.000	0.500
HIGHGHGCO2EMIT	Equals 1 if a firm has its GHG-CO_2 emission exceeds the median value of the sample and 0 otherwise	3453	0.500	0.500	0.000	1.000	1.000
CLIMATERISKS	Equals 1 if a firm discusses climate change risks in it annual reports and 0 otherwise	13,468	0.231	0.421	0.000	1.000	0.000
EMISSIONREDUCE	Equals 1 if a firm has an emission reduction policy and 0 otherwise	13,477	0.331	0.471	0.000	1.000	0.000
HIGHRENEWENERGY	Equals 1 if a firms' consumption of renewable energy exceeds the median value of the sample and 0 otherwise	1144	0.500	0.500	0.000	1.000	0.500
ELECT	Equals 1 if the current year holds a presidential election and 0 otherwise	18,116	0.217	0.412	0.000	1.000	0.000
PREELECT	Equals 1 if the next year holds a presidential election and 0 otherwise	18,116	0.289	0.453	0.000	1.000	0.000
POLPREF	Equals 1 if a firm's headquarter is located in a Republican-leaning state and 0 if the firm's headquarter is located in a Democratic-leaning state	18,116	0.314	0.464	0.000	1.000	0.000

Table 1 (continued)

Panel B. Pearson pairwise correlation coefficient matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) ESGDIS	**1.000**										
(2) CPU	**0.177**	**1.000**									
(3) SIZE	**0.647**	**0.042**	**1.000**								
(4) LEV	**0.070**	**0.105**	**0.126**	**1.000**							
(5) ROA	**0.111**	**−0.033**	**0.235**	**−0.225**	**1.000**						
(6) *Q*	**−0.082**	**0.014**	**−0.280**	0.003	**−0.209**	**1.000**					
(7) CAPX	**−0.031**	**−0.024**	**−0.060**	**−0.531**	**0.209**	**−0.028**	**1.000**				
(8) BS	**0.513**	**0.024**	**0.682**	**0.060**	**0.140**	**−0.127**	0.011	**1.000**			
(9) BI	**0.309**	**0.047**	**0.277**	**0.017**	**0.048**	**−0.044**	**0.028**	**0.274**	**1.000**		
(10) BGD	**0.408**	**0.162**	**0.351**	**0.056**	**0.069**	**−0.027**	−0.001	**0.335**	**0.247**	**1.000**	
(11) DUAL	**0.067**	**−0.055**	**0.106**	−0.008	**0.033**	**−0.021**	**−0.017**	0.010	**0.040**	**0.038**	**1.000**

All coefficients that are significant at 10% level are in bold

Table 2 Baseline and robustness

Variable	Dependent variable: *ESGDIS*										
	Baseline	Standardized coefficients	Reduced-form—no FE	Reduced-form—with FEs	Baseline—no FE	Baseline—industry × year and year FEs	Baseline—firm and year FEs	Baseline—exclude 2008 GFC	Baseline—exclude election years	Baseline—exclude Pre-election years	Additional controls for environmental policies
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CPU	0.137***	0.109***	0.222***	0.123***	0.157***	0.472***	0.366***	0.137***	0.136***	0.192***	0.046***
	(6.193)		(24.354)	(4.852)	(23.490)	(6.832)	(18.893)	(6.154)	(6.177)	(5.283)	(3.470)
SIZE	0.122***	0.535***			0.122***	0.123***	0.038***	0.124***	0.121***	0.122***	0.040***
	(68.099)				(67.395)	(68.214)	(9.605)	(66.211)	(60.085)	(56.894)	(27.287)
LEV	−0.000***	−0.058***			−0.000***	−0.000***	0.000	−0.000***	−0.000***	−0.000***	−0.000***
	(−9.840)				(−6.386)	(−9.870)	(0.895)	(−9.749)	(−8.500)	(−8.927)	(−4.692)
ROA	−0.013***	−0.032***			−0.012***	−0.015***	0.003*	−0.014***	−0.012***	−0.016***	−0.005***
	(−6.675)				(−6.191)	(−7.278)	(1.919)	(−6.620)	(−5.297)	(−6.529)	(−3.501)
Q	0.016***	0.080***			0.016***	0.016***	0.002**	0.016***	0.015***	0.017***	0.003***
	(14.885)				(15.062)	(14.881)	(2.350)	(14.017)	(13.020)	(12.714)	(3.484)
CAPX	0.010	0.004			−0.030*	0.005	0.000	0.006	0.004	0.024	−0.018
	(0.669)				(−1.850)	(0.292)	(0.028)	(0.382)	(0.247)	(1.289)	(−1.601)
BS	0.195***	0.111***			0.143***	0.194***	0.057***	0.186***	0.193***	0.185***	0.099***
	(15.994)				(11.120)	(15.864)	(4.364)	(14.635)	(14.013)	(12.810)	(10.201)
BI	0.307***	0.080***			0.383***	0.309***	0.008	0.313***	0.297***	0.314***	0.165***
	(14.132)				(17.000)	(14.151)	(0.330)	(13.733)	(12.003)	(12.211)	(9.818)
BGD	0.448***	0.105***			0.656***	0.446***	0.159***	0.441***	0.449***	0.447***	0.150***
	(18.248)				(26.663)	(18.120)	(6.056)	(17.362)	(16.284)	(15.212)	(8.154)
DUAL	0.029***	0.030***			0.009*	0.030***	−0.007	0.027***	0.029***	0.030***	0.018***
	(5.828)				(1.663)	(6.109)	(−1.384)	(5.127)	(5.208)	(5.028)	(4.647)

Table 2 (continued)

Variable	Dependent variable: *ESGDIS*										
	Baseline	Standardized coefficients	Reduced-form—no FE	Reduced-form—with FEs	Baseline—no FE	Baseline—industry × year and year FEs	Baseline—firm and year FEs	Baseline—exclude 2008 GFC	Baseline—exclude election years	Baseline—exclude Pre-election years	Additional controls for environmental policies
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
EQMANAGE											0.206***
											(30.277)
ENERGYEFF											0.267***
											(27.483)
WASTE											0.178***
											(17.979)
WATER											0.165***
											(19.610)
Industry FE	Y	Y	N	Y	N	N	N	Y	Y	Y	Y
Year FE	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y
Industry × year FE	N	N	N	N	N	Y	N	N	N	N	N
Firm FE	N	N	N	N	N	N	Y	N	N	N	N
Observations	18,116	18,116	18,116	18,116	18,116	18,116	17,905	16,518	14,186	12,881	13,347
R-squared	0.551	0.551	0.031	0.146	0.492	0.552	0.863	0.560	0.558	0.537	0.790

Table 2 reports the estimates of Model (1) (Column 1) and robustness tests (Columns 2–10). Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels

Table 3 Further robustness tests—alternative measures of CPU and ESG disclosure

Variable	Dependent variable: *ESGDIS*				*ENVDIS*	*SOCDIS*	*GOVDIS*
	Increasing weighted CPU	Decreasing weighted CPU	Residual of regression of CPU on EPU	CPU_{t-1}			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CPU					0.317***	0.361***	0.021***
					(4.370)	(7.795)	(3.503)
CPU_I	0.134***						
	(6.193)						
CPU_D		0.141***					
		(6.193)					
CPU_RES			0.176***				
			(6.193)				
L1.CPU				0.261***			
				(8.689)			
SIZE	0.122***	0.122***	0.122***	0.123***	0.391***	0.144***	0.021***
	(68.099)	(68.099)	(68.099)	(68.448)	(45.358)	(37.395)	(39.909)
LEV	−0.000***	−0.000***	−0.000***	−0.000***	−0.001***	−0.000***	−0.000***
	(−9.840)	(−9.840)	(−9.840)	(−9.900)	(−6.104)	(−4.216)	(−6.879)
ROA	−0.013***	−0.013***	−0.013***	−0.014***	−0.011	−0.014***	−0.002***
	(−6.675)	(−6.675)	(−6.675)	(−6.790)	(−0.676)	(−2.806)	(−3.582)
Q	0.016***	0.016***	0.016***	0.016***	0.055***	0.014***	0.001**
	(14.885)	(14.885)	(14.885)	(14.966)	(7.481)	(5.761)	(2.137)
CAPX	0.010	0.010	0.010	0.011	0.035	0.020	0.009*
	(0.669)	(0.669)	(0.669)	(0.710)	(0.460)	(0.582)	(1.862)
BS	0.195***	0.195***	0.195***	0.194***	0.566***	0.325***	0.048***
	(15.994)	(15.994)	(15.994)	(15.913)	(9.304)	(11.687)	(12.616)
BI	0.307***	0.307***	0.307***	0.311***	0.336***	0.434***	0.150***
	(14.132)	(14.132)	(14.132)	(14.275)	(3.265)	(8.715)	(20.380)
BGD	0.448***	0.448***	0.448***	0.446***	1.502***	0.593***	0.065***
	(18.248)	(18.248)	(18.248)	(18.121)	(13.035)	(10.870)	(8.936)
DUAL	0.029***	0.029***	0.029***	0.029***	0.040*	0.060***	0.006***
	(5.828)	(5.828)	(5.828)	(5.774)	(1.873)	(5.444)	(4.798)
Industry FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Observations	18,116	18,116	18,116	18,018	8,140	13,927	18,116
R-squared	0.551	0.551	0.551	0.552	0.464	0.362	0.395

Table 3 reports the estimates of Model (1) with alternative measures of CPU (Columns 1–3) and ESG disclosure (Columns 4–6). Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels

Table 4 Subsample tests

Variable	Dependent variable: *ESGDIS*					
	Smaller size	Larger size	Less debt	More debt	Lower investment opportunities	Higher investment opportunities
	(1)	(2)	(3)	(4)	(5)	(6)
CPU	0.085***	0.306***	0.085***	0.212***	0.127***	0.147***
	(7.961)	(10.685)	(3.525)	(4.968)	(4.406)	(4.763)
SIZE	0.021***	0.221***	0.106***	0.143***	0.122***	0.125***
	(11.650)	(57.984)	(42.843)	(51.071)	(48.296)	(48.861)
LEV	−0.000	−0.000***	0.002***	−0.000***	−0.000***	−0.000***
	(−0.641)	(−9.693)	(3.303)	(−8.828)	(−7.530)	(−5.513)
ROA	0.002	−0.010	−0.011***	−0.021***	−0.008*	−0.016***
	(1.518)	(−1.046)	(−4.648)	(−6.709)	(−1.960)	(−7.173)
Q	0.001	0.047***	0.009***	0.030***	−0.011	0.012***
	(0.879)	(14.119)	(8.052)	(13.841)	(−0.801)	(10.312)
CAPX	−0.004	−0.074***	0.066***	−0.033	−0.019	0.040*
	(−0.276)	(−2.737)	(2.739)	(−1.606)	(−0.796)	(1.911)
BS	0.055***	0.323***	0.126***	0.252***	0.181***	0.191***
	(5.793)	(15.143)	(8.422)	(13.170)	(10.776)	(10.902)
BI	0.104***	0.446***	0.198***	0.366***	0.356***	0.228***
	(5.490)	(12.321)	(7.191)	(11.074)	(11.793)	(7.304)
BGD	0.162***	0.714***	0.368***	0.513***	0.457***	0.433***
	(7.759)	(17.131)	(11.928)	(13.495)	(13.443)	(12.278)
DUAL	0.010**	−0.010	0.024***	0.029***	0.016**	0.044***
	(2.265)	(−1.274)	(3.591)	(4.013)	(2.326)	(6.226)
Industry FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Observations	9058	9058	9058	9058	9060	9056
R-squared	0.308	0.536	0.465	0.579	0.553	0.558

Table 4 reports the estimates of subsample tests conditional on firm size (Columns 1–2), debt (Columns 3–4), and investment opportunities (Columns 5–6). Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels

after splitting our sample by the median values of firm size (*SIZE*), leverage (*LEV*), and investment opportunity (*Q*). The subsample tests are conducted based on the premise that sustainability disclosure varies with the three proposed characteristics (e.g., Andrikopoulos & Kriklani, 2013; Drempetic et al., 2020; Malone et al., 1993). In all subsample tests, *CPU*'s coefficients are significantly positive at 1% level. Complementary tests on subsamples based on Sautner et al.'s (2021) climate change exposure, risk, and sentiment are conducted and presented in Table 5. Sautner et al. (2021) construct these measures by implementing a keyword discovery algorithm to identify the frequency that predetermined bigrams relating to climate change appear in earnings calls' transcripts. Like the previous subsample tests, we divide our sample into low and high subsamples of climate change exposure, risk, and sentiment scores using the median values of these variables. Our

Table 5 Heterogeneity tests (cont.)—climate change exposure

Variable	Dependent variable: *ESGDIS*					
	Low CC exposure	High CC exposure	Low CC risk	High CC risk	Low CC sentiment	High CC sentiment
	(1)	(2)	(3)	(4)	(5)	(6)
CPU	0.135***	0.137***	0.158***	0.121***	0.138***	0.137***
	(2.682)	(5.589)	(4.255)	(4.473)	(3.437)	(5.199)
SIZE	0.128***	0.120***	0.127***	0.119***	0.129***	0.119***
	(34.526)	(58.461)	(45.164)	(50.818)	(41.272)	(54.024)
LEV	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***
	(−4.225)	(−8.957)	(−5.875)	(−7.846)	(−5.993)	(−7.759)
ROA	−0.020***	−0.011***	−0.017***	−0.011***	−0.016***	−0.013***
	(−4.432)	(−5.087)	(−4.921)	(−4.554)	(−3.839)	(−5.531)
Q	0.015***	0.016***	0.013***	0.018***	0.014***	0.017***
	(7.374)	(12.881)	(6.996)	(13.793)	(7.359)	(12.762)
CAPX	0.036	0.003	0.008	0.012	−0.026	0.028
	(1.135)	(0.192)	(0.329)	(0.568)	(−0.935)	(1.468)
BS	0.163***	0.205***	0.172***	0.211***	0.172***	0.205***
	(6.578)	(14.608)	(9.207)	(13.125)	(8.200)	(13.619)
BI	0.333***	0.299***	0.318***	0.307***	0.334***	0.298***
	(7.839)	(11.815)	(9.959)	(10.374)	(9.190)	(10.993)
BGD	0.340***	0.486***	0.367***	0.510***	0.341***	0.507***
	(7.120)	(16.904)	(9.958)	(15.390)	(8.433)	(16.402)
DUAL	0.016	0.033***	0.031***	0.028***	0.018**	0.034***
	(1.568)	(5.813)	(4.140)	(4.167)	(2.100)	(5.584)
Industry FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Observations	4504	13,612	7934	10,182	6327	11,789
R-squared	0.531	0.557	0.536	0.563	0.534	0.561

Table 5 reports the estimates of subsample tests conditional on climate change exposure (Columns 1–2), risk (Columns 3–4), and sentiment (Columns 5–6). Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels estimates corroborate the previous subsample test results, suggesting that CPU has an umbrella effect on not only the whole sample but also subsamples in our study.

Although CPU strongly influences corporate ESG disclosure, we are unsure whether this effect persists with different levels of disclosure. Growing CPU entails stricter sustainability requirements for firms, which is apparently more pernicious to firms that do not previously follow a sustainability route. Therefore, less active ESG disclosers likely react stronger to rising CPU. Furthermore, our regression of Model (1) shows that the residuals' distribution is asymptotically normal, hinting at a possible variation in the impact of CPU on ESG disclosure across our sample. To address this, the quantile regression method is applied at the 10th, 25th, 50th, 75th, and 90th percentiles of the ESG disclosure score. The estimates reported in Table 6 show that *ESGDIS* and *CPU* are strongly correlated in all percentiles. Interestingly, the magnitude of the impact is inversely related to firms' contemporary ESG disclosure practice, confirming our conjecture that ESG-inactive firms tend to raise their disclosure level more substantially when CPU inflates. This result sweeps our doubt about the consistency of the CPU effect.

The Paris Agreement, an international treaty on climate change, marks a milestone when 195 countries and territories join forces to tackle the climate change issue. The Agreement requires a collaborative effort of all signatories to minimize greenhouse gas emissions as well as to adapt to the changing climate. The birth of this multilateral agreement motivates governments to implement more rigorous policies to achieve the common goal. As industrial activities are deemed the predominant source of emissions, new climate policies mostly aim at forcing businesses to behave more responsibly for the common good. The Paris Agreement, hence, probably induces greater corporate reactions in respect of sustainability. To compare ESG disclosure practices before and after the Paris Agreement, we split our sample into pre-2016 and post-2016 periods because the Paris Agreement was opened for signature in April 2016. For each period, we estimate the coefficient of *CPU* in both the bivariate regression model (consists of only *ESGDIS* and *CPU*) and the full Model (1). Our results, as shown in Table 7, specify that the coefficients of CPU in pre-2016 tests are statistically insignificant. Differently, we document consistent significant and positive coefficients of *CPU* in the post-2016 years. Consequently, we draw that CPU is positively associated with ESG disclosure in the post-2016 period, whereas does not affect ESG disclosure in the pre-2016 period. This emphasizes the vital role of the international treaty in improving ESG disclosure among US firms.

4.2 Two-stage least-squares regressions

Although CPU is generated from government interventions to climate policies, there exists a possibility that corporate ESG disclosure could influence climate policy decision-making. As climate instability is posing a growing concern across the globe, the shortage of sustainability information supplied by firms could urge the government to push forward the mandatory disclosure of firms' sustainability activities. Our research design, therefore, may be susceptible to reverse causality misspecification. To investigate this possible issue of our research design, we employ the two-stage least-squares estimation method which uses instrumental variable(s) (IV) to estimate the predicted value of *CPU* (the potential endogenous variable) in the first stage. The predicted value of *CPU* is then used in the estimation of Model (1) in the second stage.

A key step of the two-stage least-squares approach is to select legitimate IVs. In this study, we perform two tests using different IVs. In the first test, we select the first lag of

Table 6 Quantile regression

Variable	Dependent variable: *ESGDIS*				
	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile
	(1)	(2)	(3)	(4)	(5)
CPU	0.172***	0.184***	0.181***	0.156***	0.119***
	(44.605)	(60.911)	(27.955)	(14.802)	(10.219)
SIZE	0.045***	0.068***	0.107***	0.142***	0.147***
	(48.140)	(67.613)	(63.944)	(50.492)	(46.070)
LEV	0.000	−0.000***	−0.000***	−0.000***	−0.000**
	(0.766)	(−8.134)	(−8.954)	(−3.070)	(−2.003)
ROA	−0.001	−0.006***	−0.012***	−0.013***	−0.005
	(−0.676)	(−6.564)	(−10.961)	(−4.445)	(−1.056)
Q	0.006***	0.009***	0.014***	0.020***	0.020***
	(8.053)	(24.035)	(18.389)	(11.321)	(16.573)
CAPX	−0.022*	−0.046***	−0.028***	0.001	0.065**
	(−1.692)	(−12.485)	(−2.766)	(0.054)	(2.498)
BS	0.033***	0.049***	0.113***	0.174***	0.213***
	(5.554)	(10.553)	(9.871)	(8.509)	(9.562)
BI	0.224***	0.303***	0.381***	0.381***	0.278***
	(18.800)	(28.844)	(20.230)	(10.636)	(7.329)
BGD	0.305***	0.484***	0.646***	0.730***	0.648***
	(19.264)	(28.941)	(23.506)	(18.331)	(15.458)
DUAL	−0.006**	0.002	0.010*	0.025***	0.021**
	(−2.143)	(0.649)	(1.862)	(3.035)	(2.240)
Observations	18,116	18,116	18,116	18,116	18,116

Table 6 reports the estimates from quantile regressions at the 10th, 25th, 50th, 75th, and 90th percentiles. Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels

CPU (CPU_{t-1}) as the IV because corporate ESG disclosure of this year cannot affect CPU of the preceding year. Subsequently, we follow Ren et al., (2022a, 2022b) to utilize the global temperature anomalies as the second IV for CPU.[1] To ensure the validity of our IVs, we conduct specification tests to see whether our IVs are liable to the underidentification and weak identification problems.

Table 8 reports the estimates of our endogeneity tests. Overall, the IV regression results are consistent with our previous finding on the relationship between ESG disclosure and CPU. In particular, in both tests, we document a strong positive association at 1% significance level (i) between the IVs and *CPU* in the first stage and (ii) between the predicted values of *CPU* and *ESGDIS* in the second stage. Turning to the IV specification tests, both IVs are fairly identified, i.e., not underidentified and weakly identified, as their test statistics reject the null hypotheses. On the basis of these results, we can safely conclude that our model is not seriously influenced by the endogeneity issue.

[1] The data of global temperature are obtained from the US's National Centers for Environmental Information. Website:https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series

4.3 Cross-sectional tests on corporate governance

This subsection investigates the moderating effect of some corporate governance characteristics on the relationship between ESG disclosure and CPU. Corporate strategy, including ESG, is more likely to be on track if directors spend more effort on their monitoring role (Shahbaz et al., 2020). This study employs the meeting frequency per year of the board of directors and audit committee as a proxy for director diligence to see if more attentive boards and audit committees affect the *ESGDIS-CPU* relationship. The estimation results, as reported in Columns 1 and 2 in Table 9, demonstrate that the impact of *CPU* on *ESGDIS* is stronger if the audit committee meets more frequently. As the duty of the audit committee is to watch over the firms' non-financial reporting function, it is logical that a higher meeting frequency of the audit committee can facilitate swift corporate reactions to CPU. Differently, the board takes care of more general issues; thus, more frequent board meetings do not necessarily alter CPU's impact, especially when ESG reporting is not either the main duty of the firms or mandatory by the government.

Co-opted directors may be another source influencing the ESG disclosure decision. As documented in Coles et al. (2014) and subsequently studies, board co-option impairs the board function by furnishing CEOs with more discretion in decision-making. In terms of ESG, Hoang et al. (2021) unveil that the presence of co-opted directors on board discourages the ESG disclosure practice among listed US firms. However, we cast doubt on this effect in our context since moving away from market expectations during sensitive times could severely harm the job security of CEOs, who co-opted directors pay allegiance. We hence test the *ESGDIS-CPU* relationship conditional on firms' level of board co-option (see Columns 3 and 4, Table 9). Using two measures of board co-option and tenure-weighted board co-option in Coles et al. (2014), we find no moderating effect of board co-option on the investigated relationship. This result denotes that co-opted boards seem not wanting to obstruct ESG decisions to avert harmful CPU consequences.

Preparing for potential economic hardship, firms may tighten their policies to direct the management to act in the interest of shareholders. For example, firms may initiate compensation recoupment provisions to dampen managers' self-serving intentions (e.g., Chen et al., 2015; Kubick et al., 2020). By regressing Model (1), replacing *ESGDIS* with *CLAWBACK* (a dummy variable that takes the value of 1 if a firm has a CEO compensation clawback policy and 0 otherwise), we find a positive correlation between *CPU* and *CLAWBACK*, suggesting that heightened CPU leads to a higher likelihood that firms adopt compensation clawback policy (see Column 5, Table 9). Since sustainability disclosure can mitigate future earnings risk (Arif, 2020), engaging in ESG reporting, to some extent, lessens CEOs' exposure to recoupment prospects.

Although our results in this subsection substantiate the moderating effect of the audit committee meeting frequency, other corporate governance practices do not alter the relationship between ESG disclosure and CPU. We further test the moderating effect of our corporate governance control variables, i.e., board size, board independence, board gender diversity, and CEO duality (see Columns 6–9, Table 9). We find none of these factors affects the examined relationship. Thus, Hypothesis 2 is not strongly supported.

Table 7 The effect of climate policy uncertainty pre-2016 and post-2016

Variables	Dependent variable: *ESGDIS*			
	Pre-2016		Post-2016	
	Bivariate	Controls included	Bivariate	Controls included
	(1)	(2)	(3)	(4)
CPU	0.012	0.051	0.077***	0.347***
	(0.838)	(1.164)	(4.883)	(14.580)
SIZE		0.118***		0.130***
		(50.933)		(46.735)
LEV		−0.000***		−0.000***
		(−7.028)		(−7.149)
ROA		−0.016***		−0.013***
		(−4.987)		(−5.307)
Q		0.019***		0.012***
		(14.613)		(6.408)
CAPX		0.007		−0.002
		(0.325)		(−0.087)
BS		0.215***		0.158***
		(13.867)		(8.113)
BI		0.300***		0.324***
		(10.878)		(9.278)
BGD		0.482***		0.387***
		(14.596)		(10.550)
DUAL		0.033***		0.026***
		(5.199)		(3.251)
Industry FE	N	Y	N	Y
Year FE	N	Y	N	Y
Observations	13,939	11,396	9,234	6,720
R-squared	0.000	0.496	0.002	0.577

Table 7 reports the estimates of Model (1) pre- and post-2016. Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels

4.4 Financial constraints and earnings management channels

In this subsection, we look at the examined relationship through the lenses of firms' financial capacity and reporting honesty. Three measures, namely Altman Z-score, Bloomberg default score, and Bloomberg 1-year default probability, are used as proxies for firms' financial constraints. As shown in Columns 1, 2, and 3 in Table 10, the coefficients of the interaction between *CPU* and our constraint variables are all significantly positive, thus signifying that the effect of CPU is more profound among constrained firms. Since slashing information asymmetry is essential for firms to get better access to external capital, it is logical that financially constrained firms work up their ESG disclosure to underline their efforts in improving transparency. Besides, since the market highly appreciates ESG

Table 8 Two-stage least-squares estimations

VARIABLES	IV: CPU_{t-1}		IV: Global temperature anomalies	
	Dependent variable: *CPU*	Dependent variable: *ESGDIS*	Dependent variable: *CPU*	Dependent variable: *ESGDIS*
	First stage	Second stage	First stage	Second stage
	(1)	(2)	(3)	(4)
CPU_{t-1}	0.388***			
	(58.815)			
GTA			1.312***	
			(74.080)	
CPU		0.310***		0.464***
		(15.455)		(31.945)
SIZE	0.005***	0.123***	0.005***	0.122***
	(2.834)	(66.569)	(3.099)	(63.179)
LEV	0.000***	−0.000***	0.000***	−0.000***
	(10.307)	(−8.219)	(3.866)	(−10.237)
ROA	−0.007***	−0.011***	−0.006***	−0.010***
	(−2.797)	(−5.472)	(−2.739)	(−4.500)
Q	0.004***	0.016***	−0.000	0.015***
	(3.454)	(14.390)	(−0.385)	(13.279)
CAPX	0.079***	−0.043***	0.053***	−0.056***
	(4.504)	(−2.649)	(3.254)	(−3.291)
BS	−0.051***	0.151***	0.016	0.163***
	(−3.957)	(11.593)	(1.306)	(12.070)
BI	0.034	0.379***	−0.027	0.367***
	(1.593)	(16.717)	(−1.309)	(15.637)
BGD	0.446***	0.573***	0.186***	0.482***
	(17.320)	(21.302)	(7.731)	(17.935)
DUAL	−0.034***	0.014***	−0.006	0.023***
	(−6.551)	(2.619)	(−1.144)	(4.150)
Underidentification test		3257.303***		4345.090***
Weak identification test		3459.229***		5487.777***
Observations	18,018	18,018	18,116	18,116
R-squared		0.482		0.435

Table 8 reports the estimates of Model (1) using the two-stage least-squares method. Columns 1 and 2 report the first and second stages when the first lag of *CPU* is employed as an IV. Columns 3 and 4 report the first and second stages when the global temperature anomalies are employed as an IV. Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels

practices during increasing CPU periods, a commitment to ESG disclosure may generate a magnifying effect.

Next, the impact of CPU on ESG disclosure among US firms, in consideration of their earnings management, is studied. We use two proxies of earnings quality from Dechow and

Table 9 Corporate governance

Variable	Dependent variable: *ESGDIS*				*CLAWBACK*	Dependent variable: *ESGDIS*			
	Board meeting frequency	AC meeting frequency	Board co-option	Tenure-weighted board co-option		Board size	Board independence	Board gender diversity	CEO duality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CPU	0.127***	0.091***	0.454***	0.444***	0.340***	0.070	0.116**	0.142***	0.137***
	(3.528)	(3.649)	(8.390)	(8.251)	(15.320)	(1.290)	(2.487)	(6.030)	(5.837)
BMF	−0.005								
	(−0.075)								
CPU × BMF	0.004								
	(0.303)								
ACMF		−0.073***							
		(−2.753)							
CPU × ACMF		0.026***							
		(4.321)							
HIGHCOD			0.118						
			(1.171)						
CPU × HIGHCOD			−0.032						
			(−1.470)						
HIGHTWCOD				0.042					
				(0.417)					
CPU × HIGHTWCOD				−0.013					
				(−0.592)					
CPU × BS						0.031			
						(1.348)			
CPU × BI							0.027		
							(0.520)		

Table 9 (continued)

Variable	Dependent variable: *ESGDIS*				*CLAWBACK*	Dependent variable: *ESGDIS*			
	Board meeting frequency	AC meeting frequency	Board co-option	Tenure-weighted board co-option		Board size	Board independence	Board gender diversity	CEO duality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CPU × BGD								−0.034	
								(−0.609)	
CPU × DUAL									0.001
									(0.062)
SIZE	0.124***	0.121***	0.198***	0.198***	0.066***	0.122***	0.122***	0.122***	0.122***
	(69.375)	(65.343)	(60.781)	(60.846)	(30.545)	(68.143)	(68.097)	(68.093)	(68.098)
LEV	−0.000***	−0.000***	−0.001***	−0.001***	−0.000	−0.000***	−0.000***	−0.000***	−0.000***
	(−10.606)	(−10.580)	(−9.746)	(−9.770)	(−1.446)	(−9.849)	(−9.846)	(−9.840)	(−9.840)
ROA	−0.014***	−0.015***	−0.017	−0.016	0.000	−0.013***	−0.013***	−0.013***	−0.013***
	(−7.090)	(−7.252)	(−0.988)	(−0.966)	(0.158)	(−6.718)	(−6.688)	(−6.660)	(−6.675)
Q	0.018***	0.017***	0.037***	0.037***	0.003**	0.016***	0.016***	0.016***	0.016***
	(16.517)	(15.554)	(11.735)	(11.612)	(2.436)	(14.902)	(14.888)	(14.874)	(14.878)
CAPX	0.006	0.004	−0.093***	−0.091***	0.069***	0.010	0.010	0.010	0.010
	(0.421)	(0.246)	(−3.139)	(−3.076)	(3.238)	(0.670)	(0.664)	(0.663)	(0.670)
BS	0.172***	0.173***	0.209***	0.210***	0.203***	0.050	0.195***	0.195***	0.195***
	(14.184)	(14.198)	(9.690)	(9.736)	(13.160)	(0.456)	(15.989)	(15.979)	(15.992)
BI	0.266***	0.267***	0.430***	0.434***	0.700***	0.307***	0.180	0.307***	0.307***
	(12.004)	(12.077)	(10.756)	(10.853)	(26.316)	(14.149)	(0.733)	(14.134)	(14.133)
BGD	0.474***	0.459***	0.600***	0.598***	0.390***	0.448***	0.448***	0.610**	0.448***
	(19.457)	(18.684)	(13.980)	(13.931)	(12.452)	(18.219)	(18.223)	(2.276)	(18.246)

Table 9 (continued)

Variable	Dependent variable: *ESGDIS*				*CLAWBACK*	Dependent variable: *ESGDIS*			
	Board meeting frequency	AC meeting frequency	Board co-option	Tenure-weighted board co-option		Board size	Board independence	Board gender diversity	CEO duality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DUAL	0.032***	0.034***	0.023***	0.020**	−0.034***	0.029***	0.029***	0.029***	0.025
	(6.286)	(6.764)	(2.758)	(2.387)	(−5.514)	(5.825)	(5.828)	(5.813)	(0.419)
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	17,737	17,662	7,315	7,315	18,046	18,116	18,116	18,116	18,116
R-squared	0.555	0.555	0.606	0.606	0.326	0.551	0.551	0.551	0.551

Table 9 reports the estimates of Model (1) under the moderating effect of board meeting frequency, audit committee meeting frequency, and board co-option (Columns 1–4). The effect of CPU on clawback provision policy is reported in Column 5. The moderating effects of board size, board independence, board gender diversity, and CEO duality are reported from Columns 6–9. Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels

Dichev (2002) and Francis et al. (2005), namely *RQDD02* and *RQF05*, to measure firms' earnings management. Our results in Columns 4 and 5 in Table 10 validate our conjecture, indicating a stronger impact of CPU on ESG disclosure among firms that manage earnings more aggressively. This result adds to prior studies' findings by pointing out that firms exploit ESG reporting to offset earnings management detection risk during climate-sensitive times.

Based on the results presented in this subsection, we validate our Hypotheses 3 and 4. These results illuminate our thought that financially risky firms seem to act in accordance with the market to cushion the increasing risk associated with climate policy.

4.5 Environment channel

We next examine whether firms' ESG disclosure decisions are motivated by their real sustainability achievement. Following Hoang (2022), we pay attention to the ESG disclosure behaviors of heavy-emitting and light-emitting firms. We use two different methods to categorize firms into heavy and light emitters. The first method is to classify firms operating in nine heaviest emitting GICS industries as heavy emitters, and others are light emitters[2] (see Carbon Disclosure Project, 2012; Nguyen & Phan, 2020). In the second method, we assign firms to the heavy emitter group if their GHG emissions (GHG/CO_2 emissions) are higher than the median value, and vice versa. We report the regression results in Columns 1, 2, and 3 in Table 11. We find that the coefficients of the interactions between *CPU* and the three measures of firms' emission levels are significantly positive. These results lend support to our conjecture that the effect of CPU is stronger if a firm is a heavy emitter.

We further test how perceived climate risk (*CLIMATERISKS*), equals one (zero) if firms (do not) discuss business risks related to climate change in annual reports, modifies the impact of CPU (see Column 4, Table 11). Moreover, firms that emit a huge deal of pollutants should set out an emission reduction policy to reduce environmental consequences (Lin & Zhu, 2019; Zhang & Vigne, 2021). We hence test the moderating effect of the emission reduction policy (*EMISSIONREDUCE*) on the relationship between ESG disclosure and CPU. The results of both tests, which are displayed in Columns 4 and 5 in Table 11, further reinforce our ground by denoting that climate change risk awareness and emission reduction policy bolster the effect of CPU.

We then revisit Syed et al. (2022), who identify that firms cut renewable consumption when CPU intensifies, to probe the firms' resolution of ESG disclosure with regard to renewable energy. Based on this finding, we speculate that heavy consumers of renewable energy consider themselves highly vulnerable to rising CPU; hence, they may increase their ESG disclosure practice to mitigate the risk. Using the median value of renewable energy consumption, we witness a stronger effect of CPU if firms are heavy consumers of renewable energy. Because renewable energy is highly encouraged due to its low carbon footprint and inconsiderable requirement of natural resources, it is justifiable why renewable energy users send more detailed ESG messages to the public.

The findings from the subsection emphasize that environment-damaging firms disclose more ESG information, likely because of their higher exposure to risks induced by changing climate policy. Additionally, firms with an appropriate awareness of climate

[2] Nine heaviest emitting industries consist of Oil, Gas and Consumable Fuels; Electric Utilities; Gas Utilities; Independent Power Producers & Energy Traders; Multi-Utilities; Chemicals; Construction Materials; Metals and Mining; and Paper and Forest Products.

Table 10 Financial constraint and earnings management

Variable	Dependent variable: *ESGDIS*				
	Z-score	BB default score	BB 1-year default prob	DD02	F05
	(1)	(2)	(3)	(4)	(5)
CPU	0.150***	0.130***	0.132***	0.494***	0.501***
	(6.604)	(5.603)	(5.747)	(7.619)	(7.705)
ZSCORE	−0.003				
	(−1.098)				
CPU × ZSCORE	0.001**				
	(2.410)				
HIGHDEFSCORE		−0.117**			
		(−1.965)			
CPU × HIGHDEF-SCORE		0.023*			
		(1.810)			
HIGHDEFPROB			−0.105*		
			(−1.770)		
CPU × HIGHDEF-PROB			0.021*		
			(1.691)		
RQDD02				−0.225*	
				(−1.649)	
CPU × RQDD02				0.048*	
				(1.692)	
RQF05					−0.234*
					(−1.780)
CPU × RQF05					0.049*
					(1.806)
SIZE	0.126***	0.123***	0.123***	0.123***	0.123***
	(68.796)	(65.660)	(65.734)	(63.852)	(63.897)
LEV	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***
	(−11.888)	(−9.598)	(−9.699)	(−9.685)	(−9.724)
ROA	−0.010***	−0.014***	−0.014***	−0.016***	−0.016***
	(−5.185)	(−6.909)	(−6.798)	(−6.990)	(−7.007)
Q	0.018***	0.016***	0.016***	0.017***	0.017***
	(16.736)	(13.909)	(14.096)	(14.507)	(14.528)
CAPX	−0.018	0.011	0.010	0.022	0.021
	(−1.173)	(0.681)	(0.635)	(1.302)	(1.258)
BS	0.186***	0.192***	0.192***	0.195***	0.195***
	(15.101)	(15.589)	(15.571)	(14.920)	(14.912)
BI	0.301***	0.306***	0.307***	0.311***	0.311***
	(13.786)	(14.022)	(14.072)	(13.461)	(13.430)
BGD	0.439***	0.451***	0.451***	0.438***	0.438***
	(17.794)	(18.175)	(18.179)	(16.592)	(16.567)
DUAL	0.030***	0.029***	0.029***	0.029***	0.029***
	(5.946)	(5.797)	(5.815)	(5.483)	(5.485)
Industry FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Table 10 (continued)

Variable	Dependent variable: *ESGDIS*				
	Z-score	BB default score	BB 1-year default prob	DD02	F05
	(1)	(2)	(3)	(4)	(5)
Observations	17,997	17,987	17,987	16,109	16,093
R-squared	0.556	0.552	0.552	0.537	0.537

Table 10 reports the estimates of Model (1) under the moderating effect of financial constraint (Columns 1–3) and earnings quality measures (Columns 4–5). Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels

risks, reflected via climate change risk discussion and emission reduction policy, have more responsive ESG reporting than their peers.

4.6 Additional tests

The US presidential election is a unique event that may add another layer to the current CPU level because each presidential candidate enters the election with different climate approaches. CPU is likely even more eminent when the succeeding president comes from a different party from the current president. For example, two of the recent US presidents, Obama and Trump, had completely contrasting opinions about the climate issue. While Obama—a representative of the Democratic party—strived to establish a solid regulatory framework to stimulate corporate environmental and social responsibility, Trump—Obama's successor from the Republican party—demolished these endeavors by rolling back numerous initiatives enacted under Obama's legacy and attempting to gut environmental fundings (Popovich et al., 2021). Such discrepancy in climate attitude may introduce an extra source of uncertainty on top of the contemporaneous effect of CPU, especially around the year of election.

We use dummy variables *ELECT* and *PREELECT*, in which *ELEC* (*PREELECT*) takes the value of one if the current year is an election (pre-election) year and zero otherwise, to study the influence of election uncertainty. Columns 1 and 2 in Table 12 report the results. We find evidence that firms tend to disclose ESG more during the election year, but not one year ahead of the election.

Since each state has their own climate-related regulations, the risk associated with climate policy should impact firms across states differently. The current literature suggests that firms located in Democratic-leaning states seem to be more socially responsible than their counterparts in Republican-leaning states through their strong support of green energy policies and greater CSR spending (Coley & Hess, 2012; Di Giuli & Kostovetsky, 2014). The carelessness toward CSR of Republican-leaning states' firms may trigger a comparably stronger reaction when they encounter a foggy climate policy direction. We disentangle this suspicion by observing how state-level political preference moderates the impact of CPU on ESG disclosure. We create variable *POLPREF*, which equals one if a firm's headquarter is located in a Republican-leaning state in the most recent presidential election and zero otherwise, to proxy for state-level political preference. From Column 3 of Table 12, we see that the coefficient of $CPU \times POLPREF$ is positive and significant, thus advocating our thought on the political preference viewpoint. The results from this

Table 11 Environment

Variable	Dependent variable: *ESGDIS*					
	Light versus heavy-emitting industries	Low versus High GHG emitters	Low versus High GHG/CO_2 emitters	Climate risks	Emission reduction policy	Low versus High renewable energy used
	(1)	(2)	(3)	(4)	(5)	(6)
CPU	0.130***	0.193***	0.209***	0.097***	0.077***	−0.025
	(5.804)	(5.481)	(6.194)	(4.736)	(4.954)	(−0.504)
HEAVYEMIT	−0.226**					
	(−2.371)					
CPU × HEAVYEMIT	0.058***					
	(2.860)					
HIGHGHGEMIT		−0.183*				
		(−1.936)				
CPU × HIGHGHGEMIT		0.044**				
		(2.256)				
HIGHGHGCO2EMIT			−0.203**			
			(−2.174)			
CPU × HIGHGHGCO2EMIT			0.049**			
			(2.530)			
CLIMATERISKS				−0.022		
				(−0.273)		
CPU × CLIMATERISKS				0.044***		
				(2.625)		
EMISSIONREDUCE					0.467***	
					(7.927)	
CPU × EMISSIONREDUCE					0.027**	
					(2.167)	

Table 11 (continued)

Variable	Dependent variable: *ESGDIS*					
	Light versus heavy-emitting industries	Low versus High GHG emitters	Low versus High GHG/CO_2 emitters	Climate risks	Emission reduction policy	Low versus High renewable energy used
	(1)	(2)	(3)	(4)	(5)	(6)
HIGHRENEWENERGY						−0.410***
						(−3.063)
CPU × HIGHRENEWENERGY						0.087***
						(3.152)
SIZE	0.122***	0.058***	0.062***	0.106***	0.052***	0.072***
	(67.673)	(10.413)	(11.498)	(52.163)	(32.290)	(10.210)
LEV	−0.000***	−0.000*	−0.000**	−0.000***	−0.000***	−0.000**
	(−9.721)	(−1.735)	(−1.969)	(−8.405)	(−5.323)	(−2.128)
ROA	−0.013***	−0.009	−0.008	−0.013***	−0.005***	−0.002
	(−6.698)	(−0.535)	(−0.515)	(−5.986)	(−2.962)	(−0.116)
Q	0.016***	0.007*	0.009**	0.010***	0.004***	0.015***
	(14.813)	(1.857)	(2.100)	(7.944)	(3.859)	(3.136)
CAPX	0.014	0.010	0.008	0.023	0.016	−0.013
	(0.899)	(0.242)	(0.191)	(1.364)	(1.164)	(−0.233)
BS	0.196***	0.251***	0.251***	0.218***	0.110***	0.204***
	(16.079)	(8.890)	(9.041)	(15.336)	(10.258)	(4.946)
BI	0.308***	0.068	0.076	0.258***	0.203***	0.244***
	(14.137)	(1.395)	(1.570)	(10.347)	(10.886)	(3.439)
BGD	0.450***	0.294***	0.274***	0.438***	0.215***	0.188***
	(18.330)	(5.907)	(5.490)	(15.989)	(10.531)	(2.731)

Table 11 (continued)

Variable	Dependent variable: *ESGDIS*					
	Light versus heavy-emitting industries	Low versus High GHG emitters	Low versus High GHG/CO_2 emitters	Climate risks	Emission reduction policy	Low versus High renewable energy used
	(1)	(2)	(3)	(4)	(5)	(6)
DUAL	0.029***	0.029***	0.029***	0.040***	0.027***	−0.029**
	(5.737)	(3.162)	(3.244)	(6.960)	(6.179)	(−2.434)
Industry FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	18,116	3,272	3,453	13,468	13,477	1,144
R-squared	0.551	0.304	0.304	0.531	0.731	0.316

Table 11 reports the estimates of Model (1) under the moderating effect of firms' emissions (Columns 1–3), climate risks (Column 4), emission reduction policy (Column 5), and renewable energy consumption (Column 6). Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels

Table 12 Additional tests

Variable	Dependent variable: *ESGDIS*		
	Election years	Pre-election years	Political preference
	(1)	(2)	(3)
CPU	0.137***	0.191***	0.126***
	(6.193)	(5.239)	(5.504)
ELEC	−0.382***		
	(−2.664)		
CPU × ELEC	0.059**		
	(2.057)		
PREELECT		−0.287	
		(−1.602)	
CPU × PREELECT		0.037	
		(0.950)	
POLPREF			−0.165***
			(−2.667)
CPU × POLPREF			0.030**
			(2.283)
SIZE	0.122***	0.122***	0.122***
	(68.099)	(68.099)	(68.194)
LEV	−0.000***	−0.000***	−0.000***
	(−9.840)	(−9.840)	(−9.940)
ROA	−0.013***	−0.013***	−0.013***
	(−6.675)	(−6.675)	(−6.662)
Q	0.016***	0.016***	0.016***
	(14.885)	(14.885)	(14.679)
CAPX	0.010	0.010	0.009
	(0.669)	(0.669)	(0.561)
BS	0.195***	0.195***	0.195***
	(15.994)	(15.994)	(15.974)
BI	0.307***	0.307***	0.308***
	(14.132)	(14.132)	(14.201)
BGD	0.448***	0.448***	0.441***
	(18.248)	(18.248)	(17.887)
DUAL	0.029***	0.029***	0.029***
	(5.828)	(5.828)	(5.822)
Industry FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	18,116	18,116	18,116
R-squared	0.551	0.551	0.551

Table 12 reports the estimates of Model (1) under the moderating effect of presidential election events (Columns 1–2) and state-level political preference (Column 3). Robust standard errors are clustered to firm and year. Robust *t*-statistics are in parentheses. The 1%, 5%, and 10% levels of significance are denoted as ***, **, and *, respectively. All continuous variables are winsorized at 1% and 99% levels subsection suggest that firms' ESG disclosure inclination is driven by not only firm factors but also surrounding contexts.

In sum, we bring to light a robust, positive impact of CPU on corporate ESG disclosure among US-listed firms, manifesting that the climate efforts of the US government seem to start showing desired effects. However, climate actions cannot progress without corporate cooperation since ESG reporting is not mandatory. It is worth noting that a business's ultimate goal is to maximize its owners' wealth; thus, with the presence of the government's climate interventions, the ESG strategy should be redirected to supplement that ultimate goal. In light of this conjecture, we conduct additional tests to see whether firms pursue ESG disclosure for private benefit. Mentioning ESG strategy, it is necessary to distinguish between active and defensive responses to ESG. According to Siltaloppi et al. (2021), active navigation of ESG refers to the integration of ESG into the strategy while ensuring the long-term balance of the business. Conversely, defensive navigation of ESG is regarded as the compromise of some ESG measures to resolve a few emerging issues in the short term. The results of most additional tests (e.g., financial constraints, earnings management, emissions, consumption of renewable energy, climate change risks) indicate that firms communicate ESG information when they are highly exposed to heightened CPU or financially weaknesses. In other words, many US firms report ESG for defensive purposes. Our test on the impact of CPU before and after 2016 substantiates this proposition as corporate ESG disclosure only becomes more prevalent post-2016, which matches the time the Paris Agreement turns effective.

5 Conclusions

Investors are unwilling to compromise when it comes to the climate and the environment. Since corporate activities are deemed the main contributor to global emissions, the market immediately shows its discontent and is ready to penalize any firms with mischievous environmental attitudes. We find that US firms increase their ESG disclosure in heightened CPU periods, consistent with the proposition that firms show stronger commitment to ESG practices when uncertainty elevates. Further analyses reveal that the effect of CPU is more profound among firms with more frequent audit committee meetings, financial constraints, more manipulated earnings, greater emissions and renewable energy consumption, and better awareness of climate change risks. This effect is also more salient in presidential election years and in Republican-leaning states. Our results suggest that although the impact of CPU clouds all US firms, the ESG disclosure decision among US firms varies with different firms' internal and surrounding settings.

Our findings deliver some implications for investors and regulators. Because ESG reporting is voluntary in the USA, US firms have full discretion in selecting advantageous ESG information, favorable to the market, to materialize in non-financial reports. Investors, hence, should not fixate on firms' reports but closely observe their environmental performance and other components of the financial reports to have a bigger picture of the firms' overall health. Besides, as indicated in our findings, some firms employ ESG disclosure more aggressively in times of heightened CPU, such as firms with financial hardship and with greater exposure to CPU risks. Investors are advised to pay closer attention to those specific corporate aspects.

From the regulation viewpoint, firms should show greater commitment to sustainability on a regular basis, starting with being more responsive to public demand for ESG transparency.

Although the Securities and Exchange Commission (SEC) is working toward forming a complete regulatory framework for ESG disclosure, such as providing guidance for specific ESG metrics in public filings and revising several regulations of ESG reporting, SEC should push forward the mandate of ESG reporting among US publicly listed firms. Such enforcement would make ESG reporting a regular activity rather than a situational reconciliation for urgent occasions.

The findings from this study consolidate the empirical consensus on firms' increasing engagement in sustainability in response to climate-related risks induced by rigid climate policies in recent years. This study's results, however, may not hold in less developed markets where the government has to concentrate their resources to boost economic activities. These markets must, to some extent, compromise between the environment and short-term economic benefits, thus offering an interesting setting for future studies.

Another limitation of this study is that we have not dissected the truthfulness of sustainability reporting when CPU rises. It is naïve to assume firms' honesty in sustainability reporting. As discussed above, while some firms disclose their ESG activities to communicate their sustainability progress, some others beseech market tolerance by manipulating sustainability information to mislead investors and authorities. For example, Volkswagen's scandal of manipulating emission specifications of their cars' engines during the laboratory testing process (Ewing, 2018). Some observable problems of ESG reporting such as a lack of mandates and auditing, and bewildering information can facilitate firms' sustainability reporting misconduct (Pucker, 2021). Future research may find it fascinating to delve into this research direction.

Despite figuring out that US firms manage their ESG disclosure to shield their exposure to CPU, our results are likely driven by a large proportion of defensive firms in our sample due to the voluntary nature of ESG reporting. This study is short in a way that we are unable to delve into the responses of firms which are active navigators of ESG due to data constraints. Because active navigators of ESG incorporate ESG into their long-term strategy to foster their sustainable development and have established their ESG image (Siltaloppi et al., 2021), they may not necessarily manage ESG disclosure in the same way as highly CPU-exposed firms. This perspective offers a promising research avenue relating to ESG reporting.

Acknowledgements This research is funded by National Economics University, Vietnam.

Data availability Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Declarations

Conflict of interest The author has no relevant financial or non-financial interests to disclose.

References

Ahsan, T., & Qureshi, M. A. (2021). The nexus between policy uncertainty, sustainability disclosure and firm performance. *Applied Economics, 53*(4), 441–453. https://doi.org/10.1080/00036846.2020.1808178

Alessi, L., Ossola, E., & Panzica, R. (2021). What greenium matters in the stock market? The role of greenhouse gas emissions and environmental disclosures. *Journal of Financial Stability, 54*, 100869. https://doi.org/10.1016/j.jfs.2021.100869

Al-Tuwaijri, S. A., Christensen, T. E., & Hughes, K. E., II. (2004). The relations among environmental disclosure, environmental performance, and economic performance: A simultaneous equations approach. *Accounting, Organizations and Society, 29*(5–6), 447–471. https://doi.org/10.1016/S0361-3682(03)00032-1

Andrikopoulos, A., & Kriklani, N. (2013). Environmental disclosure and financial characteristics of the firm: The case of Denmark. *Corporate Social Responsibility and Environmental Management, 20*(1), 55–64. https://doi.org/10.1002/csr.1281

Arif, M. (2020). *Non-financial information disclosures and firm risk* (Doctoral Thesis, Lincoln University). Lincoln University Research Repository. Available at https://researcharchive.lincoln.ac.nz/handle/10182/13964

Ascioglu, A., Hegde, S. P., & McDermott, J. B. (2008). Information asymmetry and investment–cash flow sensitivity. *Journal of Banking and Finance, 32*(6), 1036–1048. https://doi.org/10.1016/j.jbankfin.2007.09.018

Attig, N., Brockman, P., & Trabelsi, S. (2020). *Greenwashing during uncertain times*. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3786452

Azimli, A. (2022). *The impact of climate policy uncertainty on firm value: Does corporate social responsibility engagement matter?* Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4186267

Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring economic policy uncertainty. *The Quarterly Journal of Economics, 131*(4), 1593–1636. https://doi.org/10.1093/qje/qjw024

Baltagi, B. H. (2005). *Econometric analysis of panel data* (4th ed.). Wiley.

Bartram, S. M., Hou, K., & Kim, S. (2022). Real effects of climate policy: Financial constraints and spillovers. *Journal of Financial Economics, 143*(2), 668–696. https://doi.org/10.1016/j.jfineco.2021.06.015

Batruch, C. (2017). Climate change and sustainability in the energy sector. *The Journal of World Energy Law and Business, 10*(5), 444–463. https://doi.org/10.1093/jwelb/jwx024

Bouri, E., Iqbal, N., & Klein, T. (2022). Climate policy uncertainty and the price dynamics of green and brown energy stocks. *Finance Research Letters, Forthcoming*. https://doi.org/10.1016/j.frl.2022.102740

Carbon Disclosure Project (2012). *Carbon reductions generate positive ROI*. Retrieved from https://www.yumpu.com/en/document/read/8691735/carbon-reductions-generate-positive-roi-carbon-disclosure-project

Chen, C. J., & Jaggi, B. (2000). Association between independent non-executive directors, family control and financial disclosures in Hong Kong. *Journal of Accounting and Public Policy, 19*(4–5), 285–310. https://doi.org/10.1016/S0278-4254(00)00015-6

Chen, M. A., Greene, D. T., & Owers, J. E. (2015). The costs and benefits of clawback provisions in CEO compensation. *Review of Corporate Finance Studies, 4*(1), 108–154. https://doi.org/10.1093/rcfs/cfu012

Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. *Accounting, Organizations and Society, 32*(7–8), 639–647. https://doi.org/10.1016/j.aos.2006.09.009

Choi, D., Gao, Z., & Jiang, W. (2020). Attention to global warming. *Review of Financial Studies, 33*(3), 1112–1145. https://doi.org/10.1093/rfs/hhz086

Cohen, B., Blanco, H., Dubash, N. K., Dukkipati, S., Khosla, R., Scrieciu, S., Stewart, T., & Torres-Gunfaus, M. (2019). Multi-criteria decision analysis in policy-making for climate mitigation and development. *Climate and Development, 11*(3), 212–222. https://doi.org/10.1080/17565529.2018.1445612

Coles, J. L., Daniel, N. D., & Naveen, L. (2014). Co-opted boards. *Review of Financial Studies, 27*, 1751–1796. https://doi.org/10.1093/rfs/hhu011

Coley, J. S., & Hess, D. J. (2012). Green energy laws and Republican legislators in the United States. *Energy Policy, 48*, 576–583. https://doi.org/10.1016/j.enpol.2012.05.062

Cooper, S. A., Raman, K. K., & Yin, J. (2018). Halo effect or fallen angel effect? Firm value consequences of greenhouse gas emissions and reputation for corporate social responsibility. *Journal of Accounting and Public Policy, 37*(3), 226–240. https://doi.org/10.1016/j.jaccpubpol.2018.04.003

Dang, H. N., Hoang, K., Vu, T. V., & Nguyen, L. V. (2021). Do socially responsible firms always disclose high-quality earnings? Evidence from an emerging socialist economy. *Asian Review of Accounting, 29*(3), 291–306. https://doi.org/10.1108/ARA-11-2020-0174

Dechow, P. M., & Dichev, I. D. (2002). The quality of accruals and earnings: The role of accrual estimation errors. *The Accounting Review, 77*(s-1), 35–59. https://doi.org/10.2308/accr.2002.77.s-1.35

Dellaportas, S., Langton, J., & West, B. (2012). Governance and accountability in Australian charitable organisations: Perceptions from CFOs. *International Journal of Accounting and Information Management, 20*(3), 238–254. https://doi.org/10.1108/18347641211245128

Delmas, M. A., & Toffel, M. W. (2008). Organizational responses to environmental demands: Opening the black box. *Strategic Management Journal, 29*(10), 1027–1055. https://doi.org/10.1002/smj.701
Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *The Accounting Review, 86*(1), 59–100. https://doi.org/10.2308/accr.00000005
Drempetic, S., Klein, C., & Zwergel, B. (2020). The influence of firm size on the ESG score: Corporate sustainability ratings under review. *Journal of Business Ethics, 167*(2), 333–360. https://doi.org/10.1007/s10551-019-04164-1
Du, S., Yu, K., Bhattacharya, C. B., & Sen, S. (2017). The business case for sustainability reporting: Evidence from stock market reactions. *Journal of Public Policy and Marketing, 36*(2), 313–330. https://doi.org/10.1509/jppm.16.112
Egginton, J. F., & McBrayer, G. A. (2019). Does it pay to be forthcoming? Evidence from CSR disclosure and equity market liquidity. *Corporate Social Responsibility and Environmental Management, 26*(2), 396–407. https://doi.org/10.1002/csr.1691
Engle, R. F., Giglio, S., Kelly, B., Lee, H., & Stroebel, J. (2020). Hedging climate change news. *Review of Financial Studies, 33*(3), 1184–1216. https://doi.org/10.1093/rfs/hhz072
Ewing, J. (2018). *10 monkeys and a beetle: Inside VW's campaign for 'clean diesel'. The New York Times.* Retrieved from https://www.nytimes.com/2018/01/25/world/europe/volkswagen-diesel-emissions-monkeys.html
Fox, N. J., & Alldred, P. (2020). Re-assembling climate change policy: Materialism, posthumanism, and the policy assemblage. *The British Journal of Sociology, 71*(2), 269–283. https://doi.org/10.1111/1468-4446.12734
Francis, J., LaFond, R., Olsson, P., & Schipper, K. (2005). The market pricing of accruals quality. *Journal of Accounting and Economics, 39*(2), 295–327. https://doi.org/10.1016/j.jacceco.2004.06.003
Freeman, R. E. (2010). *Strategic management: A stakeholder approach*. Cambridge University Press.
García-Sánchez, I. M., Hussain, N., Martínez-Ferrero, J., & Ruiz-Barbadillo, E. (2019). Impact of disclosure and assurance quality of corporate sustainability reports on access to finance. *Corporate Social Responsibility and Environmental Management, 26*(4), 832–848. https://doi.org/10.1002/csr.1724
Gavriilidis, K. (2021). *Measuring climate policy uncertainty*. Available at https://ssrn.com/abstract=3847388
Gilchrist, S., Sim, J. W., & Zakrajšek, E. (2014). *Uncertainty, financial frictions, and investment dynamics*. National Bureau of Economic Research Working paper 20038. Available at https://www.nber.org/papers/w20038
Di Giuli, A., & Kostovetsky, L. (2014). Are red or blue companies more likely to go green? Politics and corporate social responsibility. *Journal of Financial Economics, 111*, 158–180. https://doi.org/10.1016/j.jfineco.2013.10.002
Gulen, H., & Ion, M. (2016). Policy uncertainty and corporate investment. *Review of Financial Studies, 29*(3), 523–564. https://doi.org/10.1093/rfs/hhv050
Hoang, K. (2022). How does corporate R&D investment respond to climate policy uncertainty? Evidence from heavy emitter firms in the United States. *Corporate Social Responsibility and Environmental Management, Forthcoming*. https://doi.org/10.1002/csr.2246
Hoang, H. V., Nguyen, C., Hoang, K., & Gan, C. (2021). *Are co-opted boards socially responsible?* New Zealand Finance Colloquium 2022. Available at https://nzfc.ac.nz/papers/updated/20.pdf
Hoberg, G., & Maksimovic, V. (2015). Redefining financial constraints: A text-based analysis. *The Review of Financial Studies, 28*(5), 1312–1352. https://doi.org/10.1093/rfs/hhu089
Hoi, C. K., Wu, Q., & Zhang, H. (2013). Is corporate social responsibility (CSR) associated with tax avoidance? Evidence from irresponsible CSR activities. *The Accounting Review, 88*(6), 2025–2059. https://doi.org/10.2308/accr-50544
Hong, Y., & Andersen, M. L. (2011). The relationship between corporate social responsibility and earnings management: An exploratory study. *Journal of Business Ethics, 104*(4), 461–471. https://doi.org/10.1007/s10551-011-0921-y
Huang, Q., Li, Y., Lin, M., & McBrayer, G. A. (2022). Natural disasters, risk salience, and corporate ESG disclosure. *Journal of Corporate Finance, 72*, 102152. https://doi.org/10.1016/j.jcorpfin.2021.102152
Jackman, M., & Moore, W. (2021). Does it pay to be green? An exploratory analysis of wage differentials between green and non-green industries. *Journal of Economics and Development, 23*(3), 284–298. https://doi.org/10.1108/JED-08-2020-0099

Jain, A., Jain, P. K., & Rezaee, Z. (2016). Value-relevance of corporate social responsibility: Evidence from short selling. *Journal of Management Accounting Research, 28*(2), 29–52. https://doi.org/10.2308/jmar-51439

Jia, J., & Li, Z. (2020). Does external uncertainty matter in corporate sustainability performance? *Journal of Corporate Finance, 65*, 101743. https://doi.org/10.1016/j.jcorpfin.2020.101743

Jin, Y., Cheng, C., & Zeng, H. (2020). Is evil rewarded with evil? The market penalty effect of corporate environmentally irresponsible events. *Business Strategy and the Environment, 29*(3), 846–871. https://doi.org/10.1002/bse.2403

Jiraporn, P., Jiraporn, N., Boeprasert, A., & Chang, K. (2014). Does corporate social responsibility (CSR) improve credit ratings? *Evidence from Geographic Identification. Financial Management, 43*(3), 505–531. https://doi.org/10.1111/fima.12044

Jung, J., Herbohn, K., & Clarkson, P. (2018). Carbon risk, carbon risk awareness and the cost of debt financing. *Journal of Business Ethics, 150*(4), 1151–1171. https://doi.org/10.1007/s10551-016-3207-6

Khlif, H., & Samaha, K. (2014). Internal control quality, Egyptian standards on auditing and external audit delays: Evidence from the Egyptian stock exchange. *International Journal of Auditing, 18*(2), 139–154. https://doi.org/10.1111/ijau.12018

Kubick, T. R., Omer, T. C., & Wiebe, Z. (2020). The effect of voluntary clawback adoptions on corporate tax policy. *The Accounting Review, 95*(1), 259–285. https://doi.org/10.2308/accr-52484

Kump, B. (2021). When do threats mobilize managers for organizational change toward sustainability? An environmental belief model. *Business Strategy and the Environment, 30*(5), 2713–2726. https://doi.org/10.1002/bse.2773

Lagasio, V., & Cucari, N. (2019). Corporate governance and environmental social governance disclosure: A meta-analytical review. *Corporate Social Responsibility and Environmental Management, 26*(4), 701–711. https://doi.org/10.1002/csr.1716

Lin, B., & Zhu, J. (2019). Is the implementation of energy saving and emission reduction policy really effective in Chinese cities? A policy evaluation perspective. *Journal of Cleaner Production, 220*, 1111–1120. https://doi.org/10.1016/j.jclepro.2019.02.209

Malone, D., Fries, C., & Jones, T. (1993). An empirical investigation of the extent of corporate financial disclosure in the oil and gas industry. *Journal of Accounting, Auditing and Finance, 8*(3), 249–273. https://doi.org/10.1177/0148558X9300800306

Mansell, S. (2013). Shareholder theory and Kant's 'duty of beneficence.' *Journal of Business Ethics, 117*(3), 583–599. https://doi.org/10.1007/s10551-012-1542-9

Martínez-Ferrero, J., Banerjee, S., & García-Sánchez, I. M. (2016a). Corporate social responsibility as a strategic shield against costs of earnings management practices. *Journal of Business Ethics, 133*(2), 305–324. https://doi.org/10.1007/s10551-014-2399-x

Martínez-Ferrero, J., Ruiz-Cano, D., & García-Sánchez, I. M. (2016b). The causal link between sustainable disclosure and information asymmetry: The moderating role of the stakeholder protection context. *Corporate Social Responsibility and Environmental Management, 23*(5), 319–332. https://doi.org/10.1002/csr.1379

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2017). *To disclose or not to disclose climate-change risk in form 10-K: Does materiality lie in the eyes of the beholder?* Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2986290

Mervelskemper, L., & Streit, D. (2017). Enhancing market valuation of ESG performance: Is integrated reporting keeping its promise? *Business Strategy and the Environment, 26*(4), 536–549. https://doi.org/10.1002/bse.1935

Mustard, D. B. (2003). Reexamining criminal behavior: The importance of omitted variable bias. *Review of Economics and Statistics, 85*(1), 205–211. https://doi.org/10.1162/rest.2003.85.1.205

Nguyen, J. H., & Phan, H. V. (2020). Carbon risk and corporate capital structure. *Journal of Corporate Finance, 64*, 101713. https://doi.org/10.1016/j.jcorpfin.2020.101713

de Oliveira, E. M., de Souza Cunha, F. A. F., Palazzi, R. B., Klotzle, M. C., & Maçaira, P. M. (2020). On the effects of uncertainty measures on sustainability indices: An empirical investigation in a nonlinear framework. *International Review of Financial Analysis, 70*, 101505. https://doi.org/10.1016/j.irfa.2020.101505

Ongsakul, V., Jiraporn, P., & Treepongkaruna, S. (2019). Does managerial ownership influence corporate social responsibility (CSR)? The role of economic policy uncertainty. *Accounting and Finance, 61*(1), 763–779. https://doi.org/10.1111/acfi.12592

Pástor, Ľ, & Veronesi, P. (2013). Political uncertainty and risk premia. *Journal of Financial Economics, 110*(3), 520–545. https://doi.org/10.1016/j.jfineco.2013.08.007

Pedron, A. P. B., Macagnan, C. B., Simon, D. S., & Vancin, D. F. (2021). Environmental disclosure effects on returns and market value. *Environment, Development and Sustainability, 23*(3), 4614–4633. https://doi.org/10.1007/s10668-020-00790-2

Popovich, N., Albeck-Ripka, L., & Pierre-Louis, K. (2021). The Trump administration rolled back more than 100 environmental rules. Here's the full list. *The New York Times*. Available at https://www.nytimes.com/interactive/2020/climate/trump-environment-rollbacks-list.html

Prior, D., Surroca, J., & Tribó, J. A. (2008). Are socially responsible managers really ethical? Exploring the relationship between earnings management and corporate social responsibility. *Corporate Governance: An International Review, 16*(3), 160–177. https://doi.org/10.1111/j.1467-8683.2008.00678.x

Pucker, K. P. (2021). *Overselling sustainability reporting*. Available at https:/hbr.org/2021/05/overselling-sustainability-reporting

Qian, W., Suryani, A. W., & Xing, K. (2020). Does carbon performance matter to market returns during climate policy changes? Evidence from Australia. *Journal of Cleaner Production, 259*, 121040. https://doi.org/10.1016/j.jclepro.2020.121040

Ren, X., Li, W., Duan, K., & Zhang, X. (2022a). *Does climate policy uncertainty really affect corporate financialization?* Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4079217

Ren, X., Zhang, X., Yan, C., & Gozgor, G. (2022b). Climate policy uncertainty and firm-level total factor productivity: Evidence from China. *Energy Economics, 113*, 106209. https://doi.org/10.1016/j.eneco.2022b.106209

Rezaee, Z., & Tuo, L. (2019). Are the quantity and quality of sustainability disclosures associated with the innate and discretionary earnings quality? *Journal of Business Ethics, 155*(3), 763–786. https://doi.org/10.1007/s10551-017-3546-y

Samaha, K., Khlif, H., & Hussainey, K. (2015). The impact of board and audit committee characteristics on voluntary disclosure: A meta-analysis. *Journal of International Accounting, Auditing and Taxation, 24*, 13–28. https://doi.org/10.1016/j.intaccaudtax.2014.11.001

Sautner, Z., van Lent, L., Vilkov, G., & Zhang, R. (2021). *Firm-level climate change exposure*. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3642508

Shahbaz, M., Karaman, A. S., Kilic, M., & Uyar, A. (2020). Board attributes, CSR engagement, and corporate performance: What is the nexus in the energy sector? *Energy Policy, 143*, 111582. https://doi.org/10.1016/j.enpol.2020.111582

Shang, Y., Han, D., Gozgor, G., Mahalik, M. K., & Sahoo, B. K. (2022). The impact of climate policy uncertainty on renewable and non-renewable energy demand in the United States. *Renewable Energy, 197*, 654–667. https://doi.org/10.1016/j.renene.2022.07.159

Sharma, S. (2000). Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. *Academy of Management Journal, 43*(4), 681–697. https://doi.org/10.5465/1556361

Siltaloppi, J., Rajala, R., & Hietala, H. (2021). Integrating CSR with business strategy: A tension management perspective. *Journal of Business Ethics, 174*(3), 507–527. https://doi.org/10.1007/s10551-020-04569-3

Syed, Q. R., Apergis, N., & Khoon, G. S. (2022). *Does climate policy uncertainty plunge renewable energy consumption? New insights from novel fourier augmented ARDL approach*. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4017179

U.S. Department of State (2021). *The United States officially rejoins the Paris Agreement* [Press release]. Retrieved from https://www.state.gov/the-united-states-officially-rejoins-the-paris-agreement/

Wang, Q., Xu, X., & Liang, K. (2021). The impact of environmental regulation on firm performance: Evidence from the Chinese cement industry. *Journal of Environmental Management, 299*, 113596. https://doi.org/10.1016/j.jenvman.2021.113596

Weber, O. (2013). Environmental, social and governance reporting in China. *Business Strategy and the Environment, 23*(5), 303–317. https://doi.org/10.1002/bse.1785

Wooldridge, J. M. (2012). *Introductory econometrics: A modern approach* (5th ed.). Cengage Learning.

Xu, Z. (2020). Economic policy uncertainty, cost of capital, and corporate innovation. *Journal of Banking and Finance, 111*, 105698. https://doi.org/10.1016/j.jbankfin.2019.105698

Ye, L. (2022). The effect of climate news risk on uncertainties. *Technological Forecasting and Social Change, 178*, 121586. https://doi.org/10.1016/j.techfore.2022.121586

Yuan, T., Wu, J. G., Qin, N., & Xu, J. (2022). Being nice to stakeholders: The effect of economic policy uncertainty on corporate social responsibility. *Economic Modelling, 108*, 105737. https://doi.org/10.1016/j.econmod.2021.105737

Zeng, Q., Ma, F., Lu, X., & Xu, W. (2022). Policy uncertainty and carbon neutrality: Evidence from China. *Finance Research Letters, Forthcoming*. https://doi.org/10.1016/j.frl.2022.102771

Zhang, D., & Vigne, S. A. (2021). The causal effect on firm performance of China's financing–pollution emission reduction policy: Firm-level evidence. *Journal of Environmental Management, 279*, 111609. https://doi.org/10.1016/j.jenvman.2020.111609