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Climate policy uncertainty and corporate tax avoidance

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Abstract

This study examines the relation between climate policy uncertainty and corporate tax avoidance. Using a novel measure of climate policy uncertainty (CPU), we document that CPU is negatively related to effective taxes rates for both contemporary and future years. During higher levels of CPU, firms tend to undertake more aggressive forms of tax avoidance such as long-term tax planning or tax sheltering. Further analysis suggests that the cash savings from lower tax payments are used to pay dividends and not retained for reinvestments. We tackle the endogenous concern with an instrumental variable approach and the firm fixed effect model. Overall, our findings are consistent with the precautionary hypothesis that firms become more conservative in their long-term investment strategies and are risk-averse when there are uncertainties around climate policies.

Keywords: Tax avoidance; effective tax rate, dividends, capital expenditure, book-tax-difference
JEL Classification: H26; Q54

1. Introduction

Climate change, which results from human activities such as the burning of fossil fuels (coal, oil, and gas) and deforestation, causes long-term shifts in the earth's climate pattern. While burning fossil fuels for electricity generation and transportation, many firms release carbon dioxide into the atmosphere, which contributes to global warming and climate change. The experts on Intergovernmental Panel on Climate Change (IPCC) forecast that in the forthcoming decades, climate change will continue to increase in all regions.[1] IPCC also estimates that the net costs of damage from warming in 2100 for 1.5°C and 2°C are respectively $54 trillion and $69 trillion, whereas current estimates of climate finance needed for residual loss and damage will range between $290 billion to $580 billion by 2030. The gap between the necessary financing to deal with climate-induced risks and impacts is even bigger than projected.[2] United Nations Secretary-General urges societies to find ways to embrace the transformational changes necessary to limit warming as much as possible and says, "There is no time for delay and no room for excuses." World leaders also pledged in the 2015 Paris Climate Agreement to limit warming to well below 2 degrees Celsius, with a goal of not exceeding 1.5°C.[3]

The continued impact of climate change on corporate activities cannot be overemphasized, especially when considering the strategic implications of such an impact on corporate cash flow. Often, policy responses (political, economic, or social) to addressing climate risk and their consequential challenging issues are either unclear, delayed, or non-existent, thus creating uncertainty in the entire socio-political and economic landscape. Therefore, one expects that the

[1] IPCC also estimate that for 1.5°C of global warming, there will be increasing heat waves, longer warm seasons, and shorter cold seasons, which eventually will exceed the critical tolerance thresholds for agriculture and health. See at https://news.un.org/en/story/2021/08/1097362

[2] See the complete report at https://www.germanwatch.org/sites/germanwatch.org/files/20-2-01e%20Global%20Climate%20Risk%20Index%202020_13.pdf

[3] See at https://www.washingtonpost.com/climate-environment/2022/02/28/ipcc-united-nations-climate-change-adaptation/

potential (but real) risks inherent in climate policy uncertainty (CPU) can affect the behaviors of firms that are arguably key agents in the polity because investors are increasingly engaged and willing to value climate risk in security pricing.

Researchers' interests in the impact of CPU on corporate behaviors and initiatives continue to grow. Extant research shows that CPU has immense ramifications for asset pricing (Treepongkaruna et al. 2023), firm value (Azimli, 2023), energy market (Karim et al., 2023), and economic productive capacity (Ren et al., 2022), among others. For example, recent research by Treepongkaruna et al. (2023) documents that investors actively consider CPU when deciding when and how to allocate their investible resources. Such an active CPU stock pricing regime will no doubt influence and shape firms' responses to CPU. Azimli (2023) examines the impact of CPU on firm value. While acknowledging the overall negative of the former on the latter, he advocates for corporate social responsibility engagement as a minimizer of such a negative impact.

Our current research investigates how firms factor in corporate tax avoidance in response to CPU. Recall that investors are alert to CPU risks and tend to reward firms that can maximize their wealth while at the same time minimizing such (CPU) risks. We hypothesize that climate policy uncertainty could be an important factor in corporates' tax planning.

Climate policy uncertainty may have both positive and negative effects on firms' effective tax rates. Prior research indicates that increased uncertainty can lead to reduced and more volatile earnings and cash flows, as well as decreased revenues and operating income (Huang et al., 2018; Addoum et al., 2020; Pankratz et al., 2019). Furthermore, investors' risk aversion may increase in response to heightened uncertainty (Kamstra et al., 2003). Edward et al. (2015) suggest that firms may face difficulties in securing external financing from equity and debt markets during periods of high climate policy uncertainty. In light of these financial constraints, firms may opt to conserve cash by reducing corporate tax payments via a decrease in effective tax rates, which we frame as a cash conservation hypothesis.

On the other hand, climate policy uncertainty may also negatively impact corporate tax avoidance. Engaging in questionable tax avoidance through a decrease in effective tax rates can carry a high reputational cost (Gallemore et al., 2014), and aggressive tax avoidance strategies pose significant risks to a firm's image and reputation (Shulman, 2009). This may lead investors to become less tolerant of excessive tax planning during periods of economic instability caused by climate policy uncertainty. Additionally, tax avoidance may harm a firm's relationship with the government (Siyi et al., 2017), thereby increasing the marginal cost of such behavior. As a result, firms may view paying taxes as a means of contributing to the community during times of heightened climate policy uncertainty. Finally, managers who experience negative shocks during periods of high climate policy uncertainty may prioritize avoiding the negative consequences of corporate tax avoidance, resulting in higher effective tax rates (Xu & Moser, 2021), which we frame as a reputational cost hypothesis. We conjecture that effective corporate tax planning is one channel through which managers achieve both investors' preferences.

Our empirical analyses suggest that firms tend to be aggressive tax avoiders when faced with corporate risks such as risky firm investment choices (Langenmayr & Lester, 2018) and corporate disclosure risks (Glaeser 2018), among others. Our study finds a relation between CPU and firm corporate tax avoidance strategies such as long-term tax planning or tax shelter. Further analysis suggests that the cash savings from lower tax payments are distributed to shareholders as dividends and for reinvestment. We rely on the precautionary hypothesis paradigm to explain the corporate use of tax savings, arguing that firms can become more conservative and risk-averse when faced with climate policy uncertainty. We address the endogeneity concern with an instrumental variable approach and the firm fixed effect model.

This study joins those research streams investigating the impact of climate policy uncertainty on firm-level decision-making (Treepongkaruna et al., 2023, Azimli, 2023, Karim et al., 2023, Ren et al., 2022) and explores another macro variable that acts as an important consideration for corporate tax planning.

2. Data & Empirical Methodology

The empirical analyses consider data from several sources. First, information on the accounting performance data of all publicly traded US firms for the period from 2000 to 2020 is obtained from the Compustat database. Second, we obtained the novel climate policy uncertainty index data from Gavriilidis (2021). After excluding firms from the utility and financial industry and dropping observations with missing variables from the merged dataset, we end up with 22,913 firm-year observations with 4,286 unique firms in the final sample. We winsorize all variables at the top and bottom 1 percent level to address the influence of potential outliers. Table 1 provides the descriptive statistics of all variables used in this study.

[Insert Tables 1, about here]

Following Frank et al. (2009), Chen et al. (2010), and Wen et al. (2020), we use the Ordinary Least Square (OLS) model to estimate the relation. We employ the following baseline empirical model that links firm *i* in year *t* to its tendency toward tax avoidance and a vector of the firm characteristics that have been shown to affect corporate tax avoidance in the year $t\ to\ t + 2$.

$$TaxAvoid_{i,t\ to\ t+2} = a_0 + \beta_1 * CPU_t + \sum_2^q \beta_{2\ to\ q} * X_{2\ to\ q,i,t} + \theta_{Ind} + \delta_t + \varepsilon_{i,t} \quad (1)$$

where i and t indexes firm and year, respectively. The key dependent variable capturing corporate tax avoidance (*TaxAvoid*), is either the effective tax rate, book-tax difference, or tax shelter. The variable of interest in this study is Climate Policy Uncertainty (CPU), measured by the monthly average climate policy uncertainty index (Gavriilidis, 2021) and divided by 100 for normalization. The X is a set of standard controls: ROA, Leverage, NOL, ChNOL, FI, PPE, Intangible, Equity Income, Firm Size, and MTB. θ_{Ind} captures the Fama-French 48 industry classification industry fixed effect, whereas δ_t captures the year-fixed effects to account for time variation in corporate tax avoidance. T-statistics reported in the parenthesis below the coefficients are estimated using heteroskedasticity robust standard errors, which are corrected for the clustering of observations at the firm level.

3. Results and Discussions

3.1. Baseline results

We employ Equation (1) to examine the effect of climate policy uncertainty (*CPU*) on a firm's corporate tax avoidance. Our baseline results, presented in Column (1) of Table 2, indicate a significant negative effect of *CPU* on the effective tax rate (*ETR*) for the current year. When we replace the *ETR* for the current year (t) with 1-year (t+1) and 2-year (t+2) leads as the dependent variable in Columns (2) and (3), we find that an increase in the CPU index in the current year continues to lead to a significant reduction in a firm's ETR in the following two years. This result confirms that current year climate policy uncertainty prompts firms to plan their long-term tax avoidance strategies. The coefficient estimates are economically significant. For instance, Column (1) shows that a one-standard-deviation increase (0.326) in the current year *CPU* index results in a 4.04% decrease (-0.124×0.326) in a firm's *ETR* for that year, corresponding to a 16.3% decrease relative to the sample mean ETR of 0.248. The coefficients of control variables are largely consistent with prior literature (e.g., Atwood et al., 2012; Armstrong et al., 2012). In summary, our results support the hypothesis that a higher CPU index in the current year significantly increases tax avoidance for firms in that year and the following two years.

In Table 3, we present the effect of *CPU* on corporate tax avoidance using its two alternative outcome variables in the same regression model as Equation (1). In Columns (1)-(3), we use the book-tax difference (*BTD*) for the current year (t) and the following two years (t+1), (t+2) as our dependent variables. In Columns (4)-(6), we use the estimated probability that a firm engages in a tax shelter based on Wilson's (2009) model (*Shelter*) for the current year (t) and following two years (t+1), (t+2) as our outcome variables. Our results indicate a significant increase in the firms' *BTD* and *Shelter* in response to higher CPU index for both the current year and the following two years. Interestingly, we observe a decreasing pattern in the magnitude of estimated coefficients for BTD from year t to t+2 in Columns (1)-(3), as well as for Shelter from year t to t+2 in Columns (4)-(6). These results suggest that the effect of current year CPU on corporate tax aggressiveness is strongest in the current year but weakens over time. The ETR (t+2) in Column 3 of Table 2 above similarly signals that over time, the effect of current year CPU on corporate tax avoidance weakens in the long run as firms would have been able to adjust priorities accordingly.

In summary, the baseline results from Table 2 and Table 3 suggest that a higher CPU index in the current year significantly increases tax avoidance for firms in that year and the following two years. In other words, the effect of current year CPU on corporate tax aggressiveness is strongest in the current year but weakens over time.

3.2. CPU, Tax avoidance, dividends payment, and investment.

To maximize shareholder value, firms may engage in tax avoidance in the face of climate policy uncertainty *(CPU*), as climate risk can lead to lower earnings and cash flows (Ni et al., 2021). In this section, we examine the moderating effect of corporate tax avoidance on a firm's dividend payments and investment, proxied by capital expenditure (*Capex*). Our results, presented in Column (1) of Table 4, indicate that the coefficient of the interaction term *CPU*ETRt* is positive and significant at the 1% level, with a positive net effect. This result suggests that during periods of higher CPU, a firm's dividend payments to shareholders increase in response to levels of corporate tax avoidance. In other words, given its level of tax avoidance, when a firm faces a higher CPU, it distributes the resulting cash savings to shareholders as dividends. However, our results in Column (2) of Table 4 do not find any significant association between the interaction term *CPU*ETRt* and Capex, suggesting that cash savings from lower tax payments during periods of CPU are not reinvested. We submit that this is consistent with the opportunity cost of using cash for corporate priorities.

3.3. Endogeneity.

The fluctuation/instability of climate policies due to changes in the natural environment poses a potential endogeneity issue in our baseline results. To address this issue, following Ren et al. (2022), we employ Global Mean Surface Temperature (*GMST*) as an instrumental variable (IV) in a two-stage least squares (2SLS) model. Our results, presented in Panel A of Table 5, show that the coefficient of IV (*GMST*) is significant across three models for years t to t+1, solving the problem of weak instrumental variables (F-statistics is higher than the cut-off 10). In the second stage, the coefficient of estimated *CPU* based on IV is significantly negative across three models for years t to t+1 at the 1% level of significance and consistent with our baseline results. In Panel

B of Table 5, we use firm-fixed effects instead of industry-fixed effects in our OLS model of Equation (1) to address firm-level omitted variable bias. Our results in Columns (1)-(3) indicate that the coefficients of *CPU* are significantly negative across three models for years t to t+1 at the 1% level. In summary, we can conclude that our baseline results are valid, reliable, and robust.

4. Conclusion

Traditionally, firms' characteristics accounted for corporate tax avoidance activities. In this study, we take a different approach by investigating the impact of climate policy uncertainty on tax avoidance. The findings of this study reveal several interesting results. During a higher level of climate policy uncertainty, firms pay lower effective taxes for both contemporary and future years and also undertake more aggressive forms of tax avoidance such as long-term tax planning or tax shelter. Further analysis suggests that firms use the cash savings from lower tax payments to pay dividends but do not retain same for reinvestments. These findings suggest an important policy implication for the relevant governmental policy boards and regulators to formulate and undertake clear environment-friendly policies to ensure that firms operate in corporate environments that are stable and not clouded by policy uncertainties when climate risk increases. Further investigation can add to our understanding of several firm-level channels through which CPU affects firms' tax planning. We leave that to future research.

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Table 1: Descriptive Statistics

This table reports descriptive statistics for measures of tax avoidance proxies, climate policy uncertainty, and other related control variables used in this study. The final sample consists of 22,913 firm-year observations with 4,286 unique firms covering the period from 2000 to 2020. All variables are winsorized at the top and bottom 1% levels. Appendix A provides more details of all variables.

Variable	*N*	*Mean*	*SD*	*P25*	*P50*	*P75*
ETRt	22913	0.248	0.425	0.194	0.328	0.380
ETRt+1	18242	0.253	0.362	0.220	0.327	0.378
ETRt+2	15909	0.275	0.304	0.227	0.327	0.377
BTD	22913	0.272	0.919	-0.048	0.047	0.198
Shelter	22913	1.612	5.888	-0.741	0.470	1.860
CPU	22913	0.990	0.326	0.678	0.937	1.126
ROA	22913	0.123	0.114	0.049	0.093	0.159
Leverage	22913	0.201	0.229	0.001	0.138	0.314
NOL	22913	0.625	0.484	0.000	1.000	1.000
ChNOL	22913	0.001	0.131	-0.006	0.000	0.004
FI	22913	0.018	0.036	0.000	0.000	0.021
PPE	22913	0.244	0.221	0.074	0.172	0.346
Intangible	22913	0.218	0.250	0.015	0.129	0.342
Equity Income	22913	0.001	0.004	0.000	0.000	0.000
Firm Size	22913	6.783	2.051	5.512	6.905	8.143
MTB	22913	0.075	0.158	0.008	0.023	0.066
Dividends	22913	0.015	0.032	0.000	0.000	0.016
Capex	22913	0.058	0.069	0.018	0.035	0.069
GMST	22913	0.786	0.215	0.660	0.690	0.900

Table 2: Baseline results: Climate policy uncertainty and Cash tax

This table presents the results from the OLS regression model (1), where the key outcome variable is the effective tax rate (ETR). ETR is the total tax expense divided by pre-tax income. The variable of interest is climate policy uncertainty. All other independent variables are defined in Appendix A. Standard errors are corrected for clustering at the firm level. T-statistics reported in the parenthesis below the coefficients are estimated using heteroskedasticity robust standard errors, which are corrected for the clustering of observations at the firm level. The statistical significance of the estimates is denoted with asterisks: ***, **, and * correspond to 1%, 5%, and 10% levels of significance, respectively.

	(1)	(2)	(3)
Variable	ETR_t	ETR_{t+1}	ETR_{t+2}
CPU	-0.124***	-0.126***	-0.110***
	(-9.93)	(-9.10)	(-9.79)
ROA	0.004	0.130***	0.121***
	(0.14)	(4.16)	(4.05)
Leverage	-0.058***	-0.073***	-0.031*
	(-3.11)	(-4.03)	(-1.85)
NOL	-0.076***	-0.062***	-0.032***
	(-11.48)	(-9.38)	(-5.26)
ChNOL	0.018	0.008	-0.019
	(0.48)	(0.18)	(-0.49)
FI	0.284***	-0.010	-0.146*
	(3.21)	(-0.11)	(-1.72)
PPE	0.052**	-0.025	-0.057***
	(2.32)	(-1.16)	(-2.78)
Intangible	0.070***	0.052***	0.019
	(3.73)	(3.01)	(1.08)
Equity Income	-1.209*	-1.863***	-2.402***
	(-1.96)	(-2.93)	(-3.89)
Firm Size	0.010***	0.010***	0.002
	(4.57)	(4.11)	(1.09)
MTB	-0.141***	-0.200***	-0.173***
	(-4.77)	(-4.86)	(-4.96)
Constant	0.376***	0.383***	0.401***
	(18.02)	(16.64)	(19.70)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
N	22913	18242	15909
Adj. R2	0.037	0.048	0.043

Table 3: Baseline results: Climate policy uncertainty and tax aggressiveness

This table presents the results from the OLS regression model (1) with alternative outcome variables. The alternative key outcome variable is BTD or Tax shelter. BTD is the book-tax difference, which is measured as the pre-tax income minus estimated taxable income divided by total assets. A tax shelter is the estimated probability that a firm engages in a tax shelter based on Wilson's (2009) model 1, p-998. All other independent variables are defined in Appendix A. Standard errors are corrected for clustering at the firm level. T-statistics reported in the parenthesis below the coefficients are estimated using heteroskedasticity robust standard errors, which are corrected for the clustering of observations at the firm level. The statistical significance of the estimates is denoted with asterisks: ***, **, and * correspond to 1%, 5%, and 10% levels of significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	BTD_t	BTD_{t+1}	BTD_{t+2}	$Shelter_t$	$Shelter_{t+1}$	$Shelter_{t+2}$
CPU	0.224***	0.117***	0.066***	1.362***	0.651***	0.168**
	(8.06)	(6.95)	(5.41)	(7.28)	(5.73)	(1.98)
ROA	1.290***	-0.190***	-0.311***	8.520***	-1.711***	-2.617***
	(8.96)	(-2.63)	(-5.37)	(8.74)	(-3.35)	(-6.30)
Leverage	0.269***	0.100***	0.073***	0.613*	-0.020	-0.048
	(4.87)	(3.52)	(3.13)	(1.65)	(-0.10)	(-0.30)
NOL	0.493***	0.243***	0.182***	3.348***	1.647***	1.267***
	(24.04)	(21.43)	(20.26)	(24.20)	(21.45)	(19.88)
ChNOL	0.457***	0.122	0.227***	2.935***	0.763	1.455***
	(3.38)	(1.49)	(3.54)	(3.25)	(1.41)	(3.28)
FI	0.272	0.883***	0.972***	3.901**	7.711***	7.973***
	(1.01)	(5.80)	(7.73)	(2.14)	(7.38)	(9.02)
PPE	-0.186***	-0.095***	-0.032	-1.241***	-0.673***	-0.307
	(-3.00)	(-2.76)	(-1.16)	(-2.98)	(-2.91)	(-1.58)
Intangible	-0.167***	-0.146***	-0.087***	-1.294***	-1.029***	-0.690***
	(-3.17)	(-5.38)	(-3.82)	(-3.66)	(-5.75)	(-4.46)
Equity Income	-0.766	-0.028	0.612	-1.621	2.212	5.518
	(-0.54)	(-0.03)	(0.78)	(-0.17)	(0.38)	(1.05)
Firm Size	-0.119***	-0.041***	-0.030***	-0.191***	0.336***	0.405***
	(-13.52)	(-8.94)	(-8.77)	(-3.19)	(10.60)	(16.16)
MTB	0.860***	0.570***	0.365***	5.549***	3.868***	2.728***
	(5.76)	(5.73)	(5.14)	(5.48)	(5.69)	(5.21)
Constant	0.268***	0.135***	0.142***	-2.109***	-3.091***	-2.863***
	(4.28)	(3.57)	(4.87)	(-4.99)	(-11.89)	(-13.74)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N	22913	17987	15614	22913	17962	15578
Adj. R2	0.246	0.225	0.228	0.178	0.217	0.289

Table 4: Firm value Tax avoidance outcomes

This table reports the relation between the interaction effect of corporate tax avoidance and climate policy uncertainty on tax avoidance outcomes: dividends payment and investment. All other independent variables are defined in Appendix A. Standard errors are corrected for clustering at the firm level. T-statistics reported in the parenthesis below the coefficients are estimated using heteroskedasticity robust standard errors, which are corrected for the clustering of observations at the firm level. The statistical significance of the estimates is denoted with asterisks: ***, **, and * correspond to 1%, 5%, and 10% levels of significance, respectively.

	(1)	(2)
Variable	*Dividends*	*Capex*
*CPU*ETRt*	0.002**	0.003
	(1.96)	(1.49)
CPU	0.011***	-0.020***
	(8.27)	(-10.47)
ETRt	-0.002	-0.005*
	(-1.46)	(-1.73)
ROA	0.059***	0.126***
	(8.15)	(19.69)
Leverage	0.008***	-0.003
	(3.05)	(-0.82)
NOL	-0.012***	0.005***
	(-10.30)	(4.33)
ChNOL	-0.003	0.023***
	(-1.43)	(5.75)
FI	0.003	0.013
	(0.24)	(0.77)
PPE	0.002	0.198***
	(0.71)	(34.55)
Intangible	-0.010***	0.014***
	(-5.12)	(5.50)
Equity Income	0.543***	-0.648***
	(3.97)	(-4.94)
Firm Size	0.002***	-0.001***
	(7.06)	(-2.70)
MTB	0.008***	-0.007*
	(2.70)	(-1.78)
Constant	-0.014***	0.023***
	(-6.73)	(6.30)
Year FE	Yes	Yes
Industry FE	Yes	Yes
N	22913	22913
Adj. R2	0.149	0.509

Table 5: Endogeneity

This table presents the results of the robustness check with the 2sls estimator and firm fixed-effect models on the relation between climate policy uncertainty (CPU) and effective tax rate. Panel A reports the results from the IV regressions. GMST is the instrument in the 2SLS estimation. Panel B reports the results from the firm fixed model. All other independent variables are defined in Appendix A. Standard errors are corrected for clustering at the firm level. T-statistics reported in the parenthesis below the coefficients are estimated using heteroskedasticity robust standard errors, which are corrected for the clustering of observations at the firm level. The statistical significance of the estimates is denoted with asterisks: ***, **, and * correspond to 1%, 5%, and 10% levels of significance, respectively.

Panel A: IV regression results

	(1)	(2)	(1)	(2)	(1)	(2)
	First-Stage	Second-Stage	First-Stage	Second-Stage	First-Stage	Second-Stage
Variables	*CPU*	*ETRt*	*CPU*	*ETRt+1*	*CPU*	*ETRt+2*
GMST	0.972***		0.936***		0.736***	
	(94.65)		(83.50)		(74.62)	
CPU		-0.111***		-0.159***		-0.208***
		(-6.84)		(-9.42)		(-12.61)
ROA	-0.061***	-0.000	-0.053***	0.130***	-0.047***	0.117***
	(-4.19)	(-0.00)	(-3.10)	(4.19)	(-2.83)	(3.93)
Leverage	0.034***	-0.054***	0.038***	-0.068***	0.004	-0.034**
	(3.74)	(-2.92)	(3.67)	(-3.75)	(0.46)	(-2.05)
NOL	0.034***	-0.085***	0.034***	-0.064***	0.034***	-0.030***
	(9.66)	(-12.95)	(8.74)	(-9.86)	(8.95)	(-4.97)
ChNOL	-0.001	0.014	0.012	0.004	0.034**	-0.013
	(-0.11)	(0.37)	(0.76)	(0.10)	(2.04)	(-0.33)
FI	0.168***	0.303***	0.219***	0.023	0.253***	-0.087
	(3.37)	(3.45)	(4.01)	(0.26)	(4.81)	(-1.03)
PPE	0.015	0.056**	0.001	-0.022	-0.018	-0.059***
	(1.35)	(2.49)	(0.11)	(-1.02)	(-1.52)	(-2.81)
Intangible	0.008	0.066***	0.012	0.051***	0.020**	0.021
	(0.94)	(3.56)	(1.23)	(2.99)	(2.06)	(1.19)
Equity Income	-0.937**	-1.220**	-0.712*	-1.911***	-0.441	-2.429***
	(-2.51)	(-1.97)	(-1.74)	(-3.01)	(-1.14)	(-3.94)
Firm Size	0.007***	0.008***	0.006***	0.009***	0.005***	0.002
	(6.65)	(3.79)	(5.09)	(3.85)	(4.17)	(0.80)
MTB	-0.019	-0.146***	-0.017	-0.204***	-0.028*	-0.184***
	(-1.48)	(-4.97)	(-1.02)	(-4.97)	(-1.78)	(-5.29)
Constant	0.138***	0.322***	0.185***	0.376***	0.331***	0.478***
	(5.83)	(7.47)	(7.07)	(7.70)	(13.88)	(10.10)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,913	22,913	18,242	18,242	15,909	15,909
Adj R2	0.450	0.0333	0.439	0.0425	0.366	0.0284

Panel B: Firm fixed effect model

Variable	(1) *ETRt*	(2) *ETRt+1*	(3) *ETRt+2*
CPU	-0.092***	-0.142***	-0.158***
	(-4.48)	(-6.51)	(-5.88)
ROA	-0.014	0.049	0.054
	(-0.28)	(0.90)	(1.19)
Leverage	-0.030	-0.049	-0.010
	(-0.91)	(-1.47)	(-0.33)
NOL	-0.039***	-0.036***	-0.017*
	(-3.25)	(-3.38)	(-1.78)
ChNOL	0.050	-0.015	-0.121**
	(0.93)	(-0.24)	(-2.51)
FI	-0.190	-0.397*	-0.260
	(-0.93)	(-1.90)	(-1.47)
PPE	0.193***	-0.113*	-0.078
	(3.24)	(-1.92)	(-1.44)
Intangible	-0.005	-0.029	-0.038
	(-0.12)	(-0.88)	(-1.14)
Equity Income	0.280	-1.527	-0.711
	(0.26)	(-1.37)	(-0.92)
Firm Size	0.007	0.048***	0.015*
	(0.76)	(4.45)	(1.79)
MTB	-0.160***	-0.222***	-0.233***
	(-2.77)	(-2.60)	(-3.60)
Constant	0.322***	0.184***	0.362***
	(5.67)	(2.95)	(7.12)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
N	22913	18242	15909
Adj. R2	0.165	0.221	0.245

Appendix A: Variable definition

Variable	Definition
ETR	Total tax expense divided by pre-tax income
BTD	The pre-tax income minus estimated taxable income divided by total assets
Shelter	Estimated probability that a firm engages in a tax shelter based on Wilson's (2009) model 1, p-998
CPU	The climate policy uncertainty, measured by the monthly average climate policy uncertainty index (Gavriilidis, 2021) and divided by 100 to normalize.
ROA	Return on assets, measured as operating income scaled by lagged assets
Leverage	Leverage for a firm, measured as long-term debt scaled by lagged assets
NOL	An indicator variable coded as one if loss carry forward is positive as of the beginning of the year t
ChNOL	Change in loss carry forward for firm i, year t, scaled by lagged assets
FI	Foreign income for firm i in a given year scaled by lagged assets
PPE	Property, plant, and equipment for firm i, year t, scaled by lagged assets
Intangible	Intangible assets for firm i, year t, scaled by lagged assets
Equity Income	Equity income in earnings for firm i, year t, scaled by lagged assets
Firm Size	The natural logarithm of the market value of equity for firm i, at the beginning of year t
MTB	Market-to-book ratio for firm i, at the beginning of year t, measured as the market value of equity, scaled by the book value of equity
Dividends	Dividend divided by total assets
Capex	The capital expenditure scaled by lagged assets (Capx/lagged at).
GMST	The Global Mean Surface Temperature, which is the instrument in the 2SLS estimation.