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How economic and policy uncertainty shapes the stringency of climate change policies☆

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A B S T R A C T

This paper examines the impact of uncertainty on the stringency of climate change policies using data for 37 advanced and emerging economies over the period 1990–2020. We find that higher uncertainty is significantly associated with greater stringency in market-based climate change policies, such as carbon taxes and emissions trading schemes, while non-market-based and technology-support policies show no statistically significant effects. These results suggest that uncertainty particularly influences policy areas that are politically costly and involve stronger distributive implications. The relationship remains robust across multiple sensitivity tests, including an instrumental variable approach, and is stronger in fully democratic countries and where governments are politically weak, but diminishes during economic downturns. We theoretically and empirically link our results to the literature analyzing the impact of uncertainty on the implementation of structural reforms, according to which periods of high uncertainty reduce the capacity of voters to attribute short-run economic costs to policy decisions.

1. Introduction

Climate change is one of the key challenges of the twenty-first century. Since the Industrial Revolution, human activity has accelerated global warming through the accumulation of CO_2 and other greenhouse gases in the atmosphere, leading to environmental degradation and a rising frequency of extreme weather events such as floods, heatwaves, and droughts (IPCC, 2018). These developments threaten ecosystems and pose serious risks to human health, food security, and economic stability (Stern, 2008; Burke et al., 2015). As a result, governments face increasing pressure to implement effective policies aimed at reducing emissions and mitigating climate-related damages (OECD, 2022; Bettarelli and Yarveisi, 2023).

However, the implementation of strict climate change policies (CCPs) often involves significant economic and distributional trade-offs. In the short term, stringent CCPs can affect macroeconomic performance through lower output and productivity growth, higher energy costs, and potential labor market adjustments, while also influencing income and regional inequality (Orlov and Aaheim, 2017; Bettarelli et al., 2024a, 2025; Brand et al., 2023). These side effects may heighten the political sensitivity of climate action, leading governments to delay or weaken reforms due to fears of public backlash and electoral losses (Furceri et al., 2023; Markkanen and Anger-Kraavi, 2019). As a result, the adoption and stringency of CCPs are often shaped not only by environmental considerations but also by broader economic and political constraints.

The existing literature on the drivers of CCPs remains relatively limited and has primarily focused on external influences, such as international pressure and policy diffusion. Studies have shown that the adoption of CCPs in one country can increase the likelihood of similar policies elsewhere. Kammerer and Namhata (2018) find that countries are more inclined to implement CCPs when collaborating with others that have already introduced such measures. Baldwin et al. (2019) note that developing countries often "replicate" the climate policies of donor countries, while Steinebach et al. (2021) emphasize the importance of trade relationships and membership in international organizations in promoting policy convergence. Similarly, Fankhauser et al. (2016), analyzing 63 countries between 1990 and 2012, show that international

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agreements—such as the Kyoto Protocol—and high-profile events like the Conference of the Parties (COP) can catalyze policy adoption by attracting media attention and increasing global pressure.

A related strand of literature has examined the domestic determinants of climate policy, emphasizing factors such as public awareness and institutional trust. Public perception of climate change plays a crucial role in shaping both policy support and effectiveness (Simon, 2023). Dabla-Norris et al. (2023) find that populations more exposed to climate risks tend to support stronger mitigation policies, while Umit and Schaffer (2020) show that trust in political institutions is positively correlated with the demand for stringent climate measures across European countries.

Another line of research that we build upon examines how uncertainty and crises affect the implementation of structural reforms, providing useful insights for understanding policy change under pressure (Alesina and Drazen, 1991; Drazen and Grilli, 1993; Bonfiglioli et al., 2022). Structural reforms, like climate policies, often entail short-term economic and distributional costs, making them politically costly for governments (Ciminelli et al., 2019). Existing studies suggest that periods of instability—such as economic downturns, financial crises, or heightened uncertainty—can open windows of opportunity for reform by weakening opposition and reducing the political cost of policy change (Drazen and Easterly, 2001; Gokmen et al., 2019). In addition, high uncertainty may blur voters' ability to distinguish between policy effects and broader economic conditions (Alesina and Cukierman, 1990), mitigating political myopia and allowing governments to pursue longer-term goals (Bonfiglioli and Gancia, 2013).[1]

Empirical evidence broadly supports these theoretical predictions. Studies find that episodes of economic or political turbulence—such as inflation, recession, or debt crises—are often followed by reform acceleration across labor, energy, and financial markets (Drazen and Easterly, 2001; Mahmalat and Curran, 2017; Bettarelli et al., 2024c). Bonfiglioli and Gancia (2013), using data for 20 OECD countries from 1975 to 2000, show that higher macroeconomic uncertainty is associated with greater fiscal discipline, while Bonfiglioli et al. (2022) demonstrate that economic uncertainty, measured by stock market volatility, increases the likelihood of structural reform implementation across sectors.[2]

Taken together, these strands of literature highlight important gaps in the understanding of climate policy adoption. On the one hand, studies on the drivers of climate policy have not considered the potential role of uncertainty as a determinant of policy design and stringency. On the other hand, research on uncertainty and structural reforms has not extended its analysis to climate policy, which involves distinct political economy dynamics, intertemporal trade-offs, and objectives.

This paper addresses these gaps by examining how uncertainty affects the stringency of climate change policies and by distinguishing its impact across different types of policy instruments—market-based, non-market-based, and technology-support measures. To the best of our knowledge, this is the first empirical analysis to explore this relationship systematically.

In terms of data, we combine a country-level index of economic and political uncertainty developed by Ahir et al. (2022)—the World Uncertainty Index (WUI)—with the OECD Environmental Policy Stringency (EPS) index as an indicator of climate change policies.[3] The OECD provides both an aggregate EPS index and three subcategories distinguishing between market-based (e.g., carbon taxes), non-market-based (e.g., emission limits), and technology-support policies (e.g., subsidies for green R&D). Each of these subcategories is further disaggregated into individual policy instruments, which we treat as an additional dimension of our dataset. The resulting panel covers three dimensions—country, time, and policy instrument—and includes 37 advanced and emerging economies over the period 1990–2020, for a total of approximately 14,000 observations.[4] Notably, because different climate policy instruments impose heterogeneous economic and political costs on governments (Furceri et al., 2023), these data allow us to examine how uncertainty affects distinct types of CCPs. For instance, economic costs are likely to be higher for climate policies such as market-based measures (e.g., carbon pricing), which have been found to exert larger negative effects on economic activity—resulting in job losses and higher prices (Bettarelli et al., 2025).

Our baseline results show that heightened uncertainty is significantly associated with increased stringency in market-based CCPs. In terms of magnitude, a major uncertainty shock—such as during the Great Recession, when global uncertainty rose by about 40%—may have increased the stringency of market-based CCPs by roughly one standard deviation in the annual change of the index in our sample (about +0.55 points). By contrast, uncertainty has no statistically significant effect on the adoption of non-market-based or technology-support measures. These findings are consistent with previous research suggesting that the political cost of CCPs is primarily tied to market-based instruments (Furceri et al., 2023), which impose more visible short-term costs on firms and households.

To ensure the robustness of our results and strengthen identification, we conduct several additional exercises. First, we include a comprehensive set of economic, political, and institutional controls to mitigate omitted-variable bias. Second, we extend the analysis using alternative climate policy data, i.e., the emissions-weighted carbon price dataset developed by Dolphin and Merkle (2024), which covers a broader set of countries and extends the sample period to 2024, thereby capturing the recent surge in global uncertainty. Third, we account for the possibility that our general measure of uncertainty may capture weather-related risks—such as extreme weather events or temperature anomalies—that could simultaneously affect both uncertainty and climate policy decisions. Fourth, we verify that our results are robust to alternative measures of uncertainty, including the Economic Policy Uncertainty (EPU) index and exchange rate volatility. Finally, we implement an instrumental variable (IV) approach exploiting exogenous sources of uncertainty—such as revolutions and global uncertainty spillovers from major economies—confirming that our main findings are not driven by endogeneity concerns.

[1] A vast literature also investigates the macroeconomic costs of heightened uncertainty. In general, uncertainty discourages investment, as firms postpone or scale back irreversible decisions—a mechanism consistent with real options theory (Myers, 1977; Bernanke, 1983; Dixit and Pindyck, 1994; Bloom, 2009). Empirical studies show that uncertainty negatively affects economic growth, investment, and employment (Bloom, 2009; Gilchrist et al., 2014; Caggiano et al., 2017; Barrero et al., 2017), and more recently, innovation and R&D activity (Bhattacharya et al., 2017; Lin et al., 2021; Bettarelli et al., 2024b).

[2] Other studies suggest that crises and uncertainty may hinder the capacity of governments to implement reforms, due to the fragmentation of the legislative body and increased political gridlock (Fernandez and Rodrik, 1991; Binder, 2003; Cason and Mui, 2003; Mian et al., 2014; Potter, 2018).

[3] Researchers have developed various approaches to measure uncertainty, including proxies based on the volatility of macroeconomic and financial variables (Leahy and Whited, 1996; Bloom, 2009; Jurado et al., 2013; Binder et al., 2022), text-based indices such as the Economic Policy Uncertainty and Geopolitical Risk indices (Baker et al., 2016; Caldara and Iacoviello, 2022), and survey- or model-based measures capturing expectations, disagreement, or structural shock volatility (Binder, 2017; Jo and Sekkel, 2019; Sheen and Wang, 2021). While these methods have advanced our understanding of uncertainty, they mostly cover advanced economies, which motivates our use of the World Uncertainty Index (Ahir et al., 2022), offering consistent cross-country and time-series comparability.

[4] The number of countries and the period covered (1990–2020) are limited by the availability of the OECD Environmental Policy Stringency (EPS) Index. However, we rely on this dataset as it provides harmonized and comparable measures across countries and policy types, which is essential for analyzing heterogeneous responses to uncertainty.

Next, we explore potential sources of non-linearity in the relationship between uncertainty and CCP stringency. We first test whether the effect of uncertainty is amplified in fully democratic countries, where electorates can hold governments more effectively accountable. We then assess whether the role of uncertainty is stronger for politically weak governments—those with narrow parliamentary majorities or limited institutional autonomy—which are typically more reluctant to enact costly reforms. Finally, following Alesina and Drazen (1991), Drazen and Grilli (1993), and Ciminelli et al. (2019), we examine whether the marginal effect of additional uncertainty diminishes during economic recessions. Results confirm that uncertainty significantly promotes the adoption of stricter market-based CCPs, but only in fully democratic settings. Moreover, the effect weakens for politically strong governments and during recessions.

To clarify the mechanism behind our empirical results, we develop a stylized political-economy model linking climate policy adoption, political support, and macroeconomic uncertainty. Building on models of electoral accountability under imperfect information (Alesina and Cukierman, 1990; Rogoff, 1990) and on evidence that crises can facilitate reforms (Drazen and Grilli, 1993; Bonfiglioli and Gancia, 2013), the model highlights that the electoral cost of reform depends on voters' ability to attribute economic outcomes to policy decisions. We capture this mechanism through an attribution parameter that declines with macroeconomic uncertainty. When uncertainty is high, voters are less able to distinguish policy-induced effects from broader shocks, which reduces the electoral penalty associated with reforms that generate short-run disruption. This, in turn, relaxes political constraints and increases the likelihood that costly climate policies—particularly market-based instruments—are implemented. Consistent with this mechanism, we show empirically that while climate policy adoption reduces support for the government, this effect becomes weaker when macroeconomic uncertainty is high.

The rest of the paper is structured as follows: Section 2 introduces the dataset; Section 3 describes the empirical methodology; Section 4 presents the main results; Section 5 theoretically and empirically analyzes the mechanisms driving our results; Section 6 concludes.

2. Data

For the main empirical analyses, we assemble a panel dataset covering three dimensions: 37 countries, 13 climate policy instruments, over the period 1990–2020.[5]

2.1. Climate change policies

To measure the degree of stringency of CCPs, we use the Environmental Policy Stringency (EPS) Index developed by the OECD (Botta and Koźluk, 2014). The index quantifies the stringency of environmental regulation on a scale from zero (no policy) to six (most stringent policy) and covers 40 countries over the period 1990–2020. It includes 13 policy instruments grouped into three categories: market-based instruments (e.g., carbon taxes, tradable emission permits), non-market-based instruments (e.g., emission limits), and technology-support measures (e.g., public R&D subsidies and feed-in tariffs).

Fig. 1 presents the distribution of the EPS index across countries. It shows that environmental regulation remained relatively lax until around 2000 but became progressively more stringent thereafter, reflecting growing international commitment to environmental goals. Differences emerge across policy types: market-based CCPs display lower average stringency and greater cross-country dispersion compared with other instruments, suggesting that these policies are politically more challenging to implement (see Figs. A1–A3 in the Appendix). Specifically, Fig. A1 details the distribution of the three subcategories of the EPS—market-based (Panel A), non-market-based (Panel B), and technology-support policies (Panel C)—and confirms the upward trend observed in the aggregate index. Fig. A2 illustrates the average yearly change in EPS by country, ranging from 0.025 in New Zealand to 0.154 in France, while Fig. A3 shows that by 2020, the stringency of environmental policies varied widely, from a low of 0.83 in New Zealand to a high of 4.89 in France, particularly for market-based measures.

In terms of annual changes in the stringency of environmental regulation, most observations are zero—approximately 90% for the aggregate EPS index, 89.7% for the market-based EPS, 94.3% for the non-market-based EPS, and 84.8% for the technology-support EPS. For the non-zero changes (see Figs. A4–A5 in the Appendix), the distributions are concentrated around -1 and $+1$, indicating that adjustments in policy stringency are generally modest.

As an alternative measure of (market-based) CCPs, we use the emissions-weighted carbon price dataset developed by Dolphin and Merkle (2024) (hereafter, the Dolphin index). The Dolphin index covers 198 advanced and emerging economies, from 1990 to 2024, and includes carbon taxes, emissions trading systems (ETS), and their combinations. Its broader temporal coverage allows us to explicitly account for the most recent high-uncertainty years.

2.2. Economic and political uncertainty

To capture country-level economic and political uncertainty, we rely on the World Uncertainty Index (WUI) developed by Ahir et al. (2022). The WUI represents a systematic effort to construct a globally comparable panel measure of uncertainty covering both advanced and developing economies over multiple decades. The index is based on textual analysis of quarterly Economist Intelligence Unit (EIU) country reports—qualitative assessments produced for each country and widely used by analysts to monitor macroeconomic and political developments.

The construction of the WUI proceeds in two steps. First, for each country and quarter, the frequency of terms related to uncertainty ("uncertain," "uncertainty," "uncertainties") is identified in the full text of the corresponding EIU report. Second, these raw counts are normalized by the total number of words in the document, ensuring that differences in report length or structure do not introduce measurement bias. The resulting index reflects the salience of uncertainty in expert assessments of domestic conditions and is thus directly comparable across countries and over time. To align with our policy data, we aggregate the quarterly series into annual averages.[6]

Fig. 2 reports the average evolution of the WUI across our country–year sample. The WUI captures uncertainty arising from both short-lived shocks—such as elections, geopolitical tensions, or abrupt policy shifts—and structural developments, including prolonged political instability or strategic realignments. Consistent with this design, the global WUI exhibits pronounced peaks around major global disruptions, including the September 11 attacks, the 2008–09 financial crisis, the Eurozone sovereign debt crisis, Brexit, and the COVID-19 pandemic. These dynamics indicate that the index is sensitive to events that reshape expectations and planning horizons at both the national and international levels.

In addition to the country-specific index, Ahir et al. (2022) develop the World Uncertainty Spillover Index (WUSI), which measures the degree of uncertainty in a country that is explicitly linked to developments in major foreign economies. In our empirical analysis, we use spillovers from the G7 economies plus China as instrument for domestic uncertainty, exploiting variation driven by external rather than domestic factors. This instrumental-variable approach mitigates

[5] Tables A1 and A2 in the Appendix show the list of climate policy instruments and countries included in the analysis.

[6] Our results remain robust when using alternative annual aggregations, such as the median or the 75th percentile of the quarterly WUI distribution.

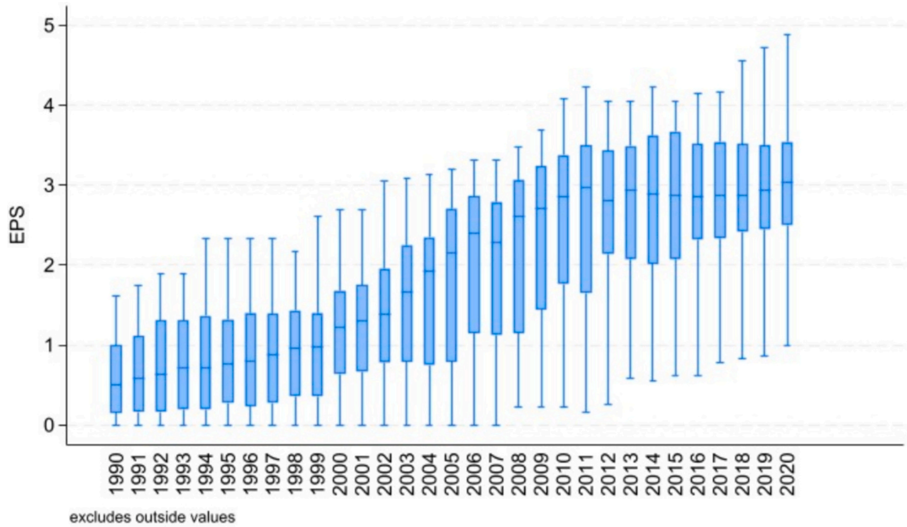

Fig. 1. Evolution of the EPS index over time (median, 25th percentile, 75th percentile).

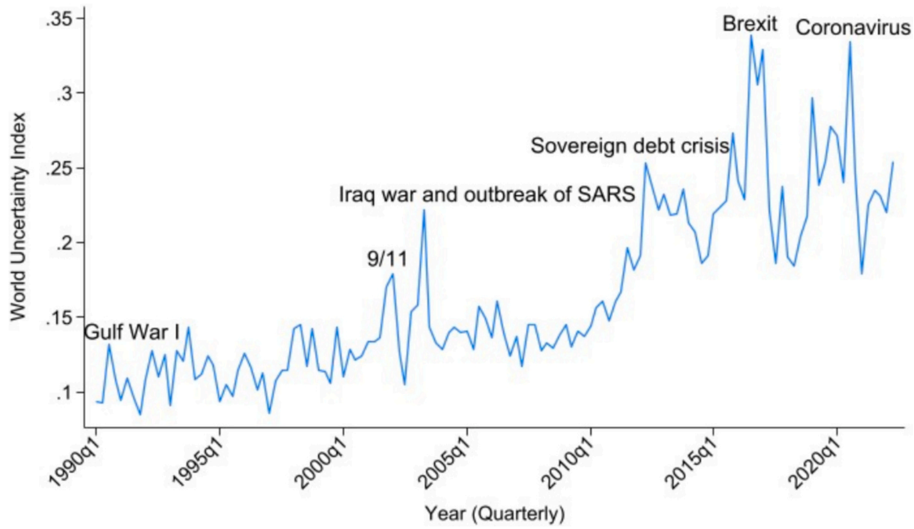

Fig. 2. Evolution of the World Uncertainty Index (WUI) over time.

concerns of endogeneity and reverse causality, helping isolate the causal impact of uncertainty on climate policy stringency.

Finally, we consider two alternative measures of uncertainty as robustness check. First, we use the Economic Policy Uncertainty (EPU) index (Baker et al., 2016), which captures economic policy uncertainty by analyzing domestic newspapers.[7] This index is based on an unbalanced panel of 22 countries over the period 1995–2023. Second, following Baker et al. (2023), we use the exchange rate volatility (ERV) from the Global Financial Database. Exchange rates are defined as the closing rate relative to the US Dollar, excluding periods of fixed exchange rates and zero-volatility observations. The US exchange rate is measured against a trade-weighted basket of currencies.[8]

2.3. Other variables

The relationship between uncertainty and environmental regulation may be influenced by several factors, including political and economic dynamics. Therefore, we consider additional variables. To ease the presentation of data, we split them into *economic and financial* variables, *development* indicators, *political* data, and *weather-related* controls.

In terms of *economic and financial* variables, we consider that economic crises may affect both uncertainty and the probability of green policy adoption. Thus, we create four dummy variables capturing years of recession, banking or currency crises, and sovereign debt crises (Laeven and Valencia, 2012). We set these dummies equal to one if any of the above crises occurred in the 3 years before the uncertainty shock, to also capture the long-term effect of crises. Subsequently, we incorporate the inflation rate, based on data from the World Bank, as elevated inflation may deter governments from implementing environmental policies due to the potential inflationary pressures associated with CCPs (Bettarelli et al., 2025).

Following Bonfiglioli et al. (2022), we account for *development* indicators, i.e., the (log of) GDP per capita, and two dummy variables equal to one if a country is member of OECD and if a country is expected

[7] Even if conceptually similar, the EPU differs from the WUI for its time/country coverage, and measurement techniques, i.e., EPU tracks events of economic and policy uncertainty from newspaper articles, while the WUI counts mentions of uncertainty from the Economist Intelligence Unit (EIU) reports. The use of alternative uncertainty indexes ensures that our results are not driven by specificity of the WUI.

[8] Table A3 in the appendix reports descriptive statistics and sources of all variables.

to join the European Union in the two years after the uncertainty shock. These variables capture the policy pressure to adopt environmental regulations.

Political data are drawn from the Database of Political Institutions (Scartascini et al., 2021), covering about 180 countries, over 45 years (1975–2020). To assess governments' strength, we collect data on the seats share of the ruling coalition and the constitutional system in force, as presidential systems are typically more independent in the implementation of reforms. The strength of governments may also vary over the electoral cycle, with governments generally stronger at the beginning of their mandate. We capture this effect using a dummy equal to one in election years. Next, we consider the ideological orientation of the ruling coalition, using a dummy equal to 1 for left-wing governments. We also use the Polity5 index (Marshall and Gurr, 2020) to measure the quality of democracy, with values ranging from −10 (strongly autocratic) to +10 (strongly democratic). To measure political support for government, we use the government popular support index from the International Country Risk Guide (ICRG), which is based on opinion polls and ranges from 0 (very low political support) to 4 (very high political support).

We also collect *weather-related* indicators to ensure that our general measure of uncertainty does not merely capture weather-induced shocks, which could bias our results through omitted-variable effects. Specifically, we alternatively include in the baseline model indicators of temperature anomalies—defined as the deviation of a month's average surface temperature from the average temperature of the same month over the period 1991–2020—and the economic costs associated with extreme weather events, including tornadoes, hailstorms, thunderstorms, blizzards, and severe wind episodes, with data obtained from EM-DAT.

Table A3 in the Appendix provides summary statistics for these variables.

3. Empirical methodology

Empirically, we assess the effect of uncertainty on the stringency of climate change policies by estimating the following equation using ordinary least squares (OLS):

$$\Delta y_{i,s,t} = \lambda_{is} + t_{st} + \beta WUI_{i,t-1} + \delta y_{i,s,t-1} + \epsilon_{i,s,t} \quad (1)$$

Subscripts *i, s,* and *t* indicate country, individual policy instrument and time, respectively. The dependent variable $\Delta y_{i,s,t}$ represents the annual variation of the degree of stringency of environmental regulation, in country *i*, policy *s*, between *t* and *t-1*. To investigate how the effect of uncertainty varies across types of CCPs, we estimate Eq. (1) using the aggregate EPS, market-based, non-market-based, and technology-support CCPs as dependent variables, alternatively. *WUI* is (the log of) the uncertainty shock, one-year lagged.[9] Our baseline specification also includes the initial level of regulation to capture potential policy convergence. In addition, Eq. (1) incorporates country–policy and policy–time fixed effects. The country–policy fixed effects control for unobserved, time-invariant heterogeneity across countries and policy instruments—such as institutional quality, political preferences, or structural characteristics—that may influence the level of regulation. The policy–time fixed effects, in turn, absorb any global shocks or common trends in environmental regulation and uncertainty that affect all countries simultaneously within a given policy area and year (e.g., international agreements, coordinated climate initiatives, or global uncertainty surges such as the 2008 financial crisis). Together, these fixed effects ensure that identification relies on within-country and within-policy variation over time. Standard errors are computed using the Driscoll-Kraay method. Eq. (1) is estimated on an unbalanced panel of 37 countries over the period 1990–2020, covering a total of 13 individual policy instruments. The number of observations varies by policy category: 13,988 for the aggregate Environmental Policy Stringency (EPS) index, 6456 for the market-based EPS, 4304 for the non-market-based EPS, and 3228 for the technology-support EPS.[10]

4. Results

4.1. Baseline results and robustness checks

Table 1 reports the estimated β coefficients from Eq. (1), using as the dependent variables the aggregate Environmental Policy Stringency (EPS) index and its subcomponents, alternatively. Column (1) shows that uncertainty is not significantly associated with changes in the aggregate EPS index, although the coefficient is positive. However, the aggregate result masks substantial heterogeneity across policy types.

Column (2), focusing on market-based CCPs, shows that uncertainty significantly increases the stringency of instruments such as carbon taxes and emissions trading systems. The effect is economically meaningful: a one–standard deviation increase in the (log of) WUI—equivalent to about +0.82%—increases the stringency of market-based CCPs by roughly 0.0135 points. To contextualize, a major global shock like the Great Recession of 2007—when uncertainty rose by approximately 40% worldwide—would correspond to a one–standard deviation increase in the stringency of market-based CCPs (about +0.55 point). This result is consistent with several real-world cases. For example, the European Union's 2008 implementation of Phase II of the Emissions Trading System (EU ETS) followed a period of heightened global uncertainty. Likewise, Brazil's 2001 "blackout crisis" preceded the introduction of the CIDE fuel tax in 2002, and Sweden's early 1990s financial crisis (+65% in uncertainty) was followed by the introduction of a carbon tax, both representing significant increases in market-based

Table 1
The impact of the World Uncertainty Index on the EPS index and its sub-categories.

Variables	(1) EPS	(2) Market-based EPS	(3) Non market-based EPS	(4) Technology support EPS
WUI_{t-1}	0.0068 (0.0045)	0.0135** (0.0063)	−0.0029 (0.0074)	0.0062 (0.011)
Observations	13,988	6456	4304	3228
R-squared	0.076	0.078	0.080	0.071
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES

Notes: The table shows the response of the Environmental Policy Stringency (EPS) index and its sub-categories to a 1- standard deviation increase in the World Uncertainty Index (WUI), estimated using Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

[9] The WUI enters Eq. (1) with a one-year lag to reduce reverse causality and account for policy implementation lags. Moreover, we apply a logarithmic transformation to the WUI to reduce skewness in its distribution and improve the statistical properties of the variable, thereby facilitating more robust estimation and clearer interpretation of the results. However, results are qualitatively similar if we include the WUI in level.

[10] Although the EPS index and its subcategories are available for 40 countries, three countries—Estonia, Luxembourg, and Iceland—are missing from the WUI dataset.

policy stringency.

In contrast, uncertainty has no statistically significant effect on non-market-based or technology-support CCPs, as shown in Columns (3) and (4). These findings are consistent with prior research (e.g., Brand et al., 2023; Furceri et al., 2023), which highlights that market-based instruments—particularly carbon taxes—carry higher political and economic costs. Under such conditions, policymakers may use periods of elevated uncertainty as windows of opportunity to advance price-based reforms that might otherwise face public or political resistance. Conversely, when the political costs are lower, as in the case of regulatory or technology-support measures, uncertainty does not appear to play a decisive role in shaping policy adoption.

To assess the robustness of our results and strengthen identification, we conduct several complementary exercises. First, we introduce a comprehensive set of control variables that may influence both the implementation of stringent CCPs and the level of country-specific uncertainty, thereby mitigating potential omitted-variable bias. Specifically, we augment Eq. (1) with a vector of controls including GDP growth, as well as the economic, financial, political, and development indicators described in Section 2.[11] Second, one potential concern is that our general measure of uncertainty may partly capture specific weather-related shocks that simultaneously raise uncertainty and/or motivate governments to tighten climate policies. To address these possibilities, we augment our baseline with additional controls, included alternatively, for temperature anomalies and economic costs of extreme weather events, both measured at the country-year level. Third, we estimate alternative empirical specifications including country-specific linear trends and clustering standard errors at the country level. Fourth, we sequentially exclude each country from the sample to verify that results are not driven by outliers. Fifth, we use alternative annual aggregations of the WUI, such as the median and the 75th percentiles of the quarterly WUI distribution. Sixth, we use the Dolphin index—including ETS, carbon taxes, and their combination—as alternative to EPS, both using the full sample available in Dolphin and Merkle (2024) and the subsample covered by the EPS index. Finally, we re-estimate the models using alternative measures of uncertainty, such as the Economic Policy Uncertainty (EPU) index and exchange rate volatility. Results, reported in Tables A4–A16 and Fig. A6 in the Appendix, confirm the robustness of our baseline findings.

We also acknowledge potential endogeneity concerns in our estimations, including reverse causality, omitted-variable bias, and measurement error. As already noted, extreme climate-related shocks could simultaneously increase uncertainty and induce governments to adopt stricter CCPs (Kousky, 2014; Wang et al., 2024), potentially biasing our estimates upward. Similarly, measurement errors in uncertainty indicators may affect the estimated coefficients. Although our empirical design mitigates some of these issues by including a lagged uncertainty term and an extensive set of control variables, residual endogeneity cannot be fully ruled out. Thus, to further strengthen identification, we implement an instrumental-variable (IV) approach. We employ two alternative instruments that capture exogenous sources of variation in uncertainty. First, following Baker et al. (2023), we use "revolution shocks," defined as violent conflicts between the government and politically organized groups seeking to overthrow it. These events are largely driven by political instability rather than environmental or climate-related considerations, thereby satisfying the exclusion restriction and allowing us to isolate exogenous movements in uncertainty. Second, we use the World Uncertainty Spillover Index (WUSI) developed by Ahir et al. (2022), which measures the degree to which uncertainty in a given country is driven by developments in major economies (the G7 plus China). This approach captures uncertainty stemming from global shocks that are plausibly unrelated to domestic policy decisions. While the WUSI may also contain some measurement noise, its validity as an instrument is preserved as long as the first-stage residuals remain uncorrelated with CCP adoption. In addition, the inclusion of time fixed effects controls for the common (average) impact of G7 plus China uncertainty on country *i*'s policy, implying that our second stage estimates capture the differential spillover of foreign uncertainty to uncertainty in country *i*. The relevance and strength of both instruments are confirmed through standard first-stage diagnostic tests.

The IV equation reads as follows:

$$
\begin{aligned}
WUI_{i,t-1} &= \lambda_{is} + t_{st} + \varphi Z_{i,t-1} + \delta y_{i,s,t-1} + \varepsilon_{i,s,t} \Delta y_{i,s,t} \\
&= \lambda_{is} + t_{st} + \beta \widehat{WUI}_{i,t-1} + \delta y_{i,s,t-1} + \varepsilon_{i,s,t}
\end{aligned}
\tag{2}
$$

where Z denotes the one-period lag of the instruments described above, which are used both alternatively and together in the estimation.

Table 2, and Tables A17–A19 in the Appendix, report the results of the instrumental-variable (IV) estimations, including both first- and second-stage outcomes. The first-stage results confirm that both instruments—the Revolution shock and the World Uncertainty Spillover Index (WUSI)—are strong and valid predictors of country-level uncertainty. The Kleibergen–Paap F-statistics substantially exceed the conventional Stock–Yogo critical thresholds.[12] This indicates that weak-instrument concerns are unlikely to bias our results. Moreover, when using two instruments for one endogenous variable, we can report the Hansen J-statistic, which tests whether the instruments are uncorrelated with the error term and thus correctly excluded from the headline equation. The test fails to reject the null of over-identification, thus further supporting the validity of the exclusion restriction.

The second-stage estimates corroborate our baseline findings. Country-level uncertainty has a statistically significant and positive effect on the stringency of market-based CCPs, while its impact on non-market-based and technology-support policies remains insignificant. The estimated coefficients obtained using the IV approach are slightly smaller in magnitude than those from the baseline OLS specification, suggesting that the latter may be subject to mild upward bias, possibly driven by reverse causality. Overall, these results reinforce the robustness of the positive relationship between uncertainty and the adoption of market-based climate policies.

4.2. Heterogeneity depending on the quality of democracy

Our results suggest that uncertainty may help governments mitigate the political costs of implementing market-based climate change policies (CCPs). Such policies—like carbon taxes and emissions trading systems—often entail visible short-term economic costs and therefore face strong political resistance. In periods of heightened uncertainty, however, governments may find it easier to advance these reforms, as uncertainty blurs voter perceptions and temporarily weakens electoral accountability. We thus expect this effect to be more pronounced in fully democratic settings, where electoral pressures are greatest.

To explore this mechanism, we distinguish between fully democratic and other regimes. In non-democratic or partially democratic systems—where electoral risks are lower and political accountability weak-

[11] These controls are likely correlated with the adoption of CCPs and/or uncertainty. GDP growth can affect the stringency of CCPs, since during recessions, governments may postpone the adoption of CCPs to avoid exacerbating economic costs. Moreover, economic downturns inherently contribute to heightened uncertainty. The same reasoning applies to the other *economic and financial variables*, like (banking, currency, debt) crises, and inflation. *Development indicators* capture economic development, typically associated with higher stringency of green regulation, and external pressures for environmental policies. Finally, *political indicators* influence the capacity of governments to implement costly policy reforms, like CCPs. In addition, the political cycle, as well as the business cycle, could affect uncertainty levels, typically high during elections.

[12] 32 for the Revolution instrument and 192 for the WUSI.

Table 2
IV analysis using market-based EPS.

Variables	(1)	(2)	(3)
	IV-shocks	IV-WUSI	IV-shocks and WUSI
WUI_{t-1}	0.0071***	0.0061*	0.0081*
	(0.0018)	(0.0036)	(0.0041)
IV first stage			
$Revolution_{t-1}$	3.737***		3.658*** (0.7633)
World Uncertainty Spillover $Index_{t-1}$	(0.6554)	0.0104*** (0.0008)	0.0101*** (0.0007)
Kleibergen-Paap F-test	32.53	192.07	573.20
Stock-Yogo 10%	16.38	16.38	19.93
Hansen J statistic	//	//	0.154
P-value	//	//	0.6950
Observations	6144	5424	5136
R-squared	0.281	0.344	0.324
Country-Sector FE	YES	YES	YES
Sector-Year FE	YES	YES	YES
Initial EPS index	YES	YES	YES

Notes: The table shows the response of market-based EPS to a 1-standard deviation increase in the World Uncertainty Index (WUI), using an instrumental variable (IV) approach based on Eq. (2). The first column uses "revolution shock" as instrument; the second column uses the World Uncertainty Spillover Index (WUSI) as instrument; the third column uses both. The table presents second-stage results and first-stage statistics. The regressions include a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

er—the role of uncertainty in enabling the adoption of costly reforms is likely to be reduced. Empirically, we use the Polity5 index, which ranges from −10 (full autocracy) to +10 (full democracy), to classify political regimes (Desilver, 2019). Countries scoring 10 are coded as full democracies (FD = 1), while all others are grouped as other regimes (OTH = 1 – FD). We then extend Eq. (1) by interacting the uncertainty measure with these regime dummies, allowing the estimated effects of uncertainty to differ across political systems.:

$$\Delta y_{i,s,t} = \lambda_{is} + t_{st} + \beta_1 WUI_{i,t-1} {}^* FD_i + \beta_2 WUI_{i,t-1} {}^* OTH_i + \delta y_{i,s,t-1} + \varepsilon_{i,s,t} \quad (3)$$

The results, reported in Table 3, support our hypothesis. They show that uncertainty exerts a positive and statistically significant effect on the implementation of climate change policies, but only in fully democratic countries and for market-based instruments, which tend to involve higher political costs. In contrast, the estimated effects are not statistically significant for non-market-based or technology-support policies, nor for countries that are not fully democratic, where electoral pressures are weaker and the political costs of reform lower.

Table 3
The impact of the World Uncertainty Index on the EPS index and its subcategories: full democracies versus other countries.

Variables	(1)	(2)	(3)	(4)
	EPS	Market-based EPS	Non market-based EPS	Technology support EPS
$Fulldem\_WUI_{t-1}$	0.0083	0.0194***	−0.0077	0.0078
	(0.0063)	(0.0073)	(0.0109)	(0.0170)
$Others\_WUI_{t-1}$	0.0017	0.0045	0.0046	−0.0091
	(0.0068)	(0.0087)	(0.0112)	(0.0200)
Observations	13,481	6222	4148	3111
R-squared	0.080	0.083	0.081	0.078
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES

Notes: The table shows the response of the EPS index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI), interacted with dummy variables identifying full-democracies (Polity5 score = 10) and other countries (Polity5 score < 10), based on Eq. (3). The regressions include a one-period lag of the dependent variable (either the EPS index or its subcategories), as well as country-policy and policy-year fixed effects. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Given that most fully democratic countries in our sample are advanced economies, we further examine whether the results are driven by the level of economic development. Following the IMF classification, we divide the sample into advanced economies (AEs) and emerging market and developing economies (EMDEs), and re-estimate Eq. (3) including two dummy variables for these groups. The results, presented in Table A20 in the Appendix, reinforce earlier conclusions: the positive and significant effect of uncertainty on market-based CCPs is confined to advanced economies. This pattern suggests that institutional and economic capacity—alongside democratic accountability—plays an important role in shaping how uncertainty translates into environmental policy action.

4.3. Heterogeneity depending on the strength of government

We next examine whether the impact of uncertainty depends on government political strength, based on the idea that stronger governments are better equipped to implement costly reforms and therefore less reliant on uncertainty as a window of opportunity. To capture political strength, we use two alternative measures. The first is the seat share of the ruling coalition in country i at time t, which reflects the extent of legislative support available to the government. The second is a dummy variable for presidential systems, which generally grant greater executive authority and stability compared to parliamentary regimes. Both variables are drawn from the Database of Political Institutions (DPI).

Since previous results indicate that uncertainty significantly affects only market-based CCPs in fully democratic countries, we restrict this analysis to that subset of cases for the sake of clarity and comparability. This allows us to assess whether the degree of political strength—-through legislative backing or institutional design—modifies the extent to which uncertainty facilitates the implementation of politically sensitive environmental reforms.[13]

Empirically, we augment Eq. (1) with interaction terms including the uncertainty shock and the mediating variables (*MV*) of interest, i.e., margin of majority and the presidential dummy, alternatively:

[13] Nevertheless, we provide results for other countries and CCPs in the Appendix.

$$\Delta y_{i,s,t} = \lambda_{is} + t_{st} + \beta_1\, WUI_{i,t-1} + \beta_2 \left(WUI_{i,t-1} * MV_{i,t-1}\right) + \beta_3\, MV_{i,t-1} + \delta\, y_{i,s,t-1} + \varepsilon_{i,s,t} \tag{4}$$

We report the results in Table 4, columns 1 and 2. Consistent with our expectations, the interaction term between uncertainty and government seat share is negative and statistically significant, indicating that the stronger the governing coalition, the smaller the role of uncertainty in driving the adoption of market-based CCPs (Table 4, column 1). Using the estimated coefficients from Eq. (4), we compute the marginal effect of uncertainty across different levels of majority share and identify a threshold of approximately 64%, beyond which uncertainty no longer has a significant effect on the stringency of market-based CCPs. Fig. 3 illustrates how the effect of uncertainty diminishes as government strength increases.[14]

In Table 4, column 2, we find a similar pattern for presidential systems: greater executive autonomy is associated with a weaker influence of uncertainty on the adoption of stringent market-based CCPs.

4.4. *Heterogeneity depending on the business cycle*

Previous theoretical and empirical studies highlight that recessions can act as catalysts for structural reforms, as the welfare losses they generate may outweigh the short-term costs of reform implementation (Alesina and Drazen, 1991; Bruno and Easterly, 1996). In fact, studies empirically confirm that periods of economic downturn allow governments to embark on structural reforms that would be hard to implement in normal times (Bettarelli et al., 2024b), potentially including CCPs.[15] As a result, we expect the effect of uncertainty on the stringency of CCPs to become less pronounced during recessions. To examine this interaction, we create a dummy variable equal to one for years with negative GDP growth and include it as a mediating term in Eq. (4). This allows us to test whether the role of uncertainty in promoting the stringency of market-based CCPs weakens when governments already face the economic and political pressures associated with recessions.

Results reported in Table 4, column 3, confirm that the effect of uncertainty weakens during recessions, as indicated by the negative and statistically significant coefficient of the interaction term.[16]

Tables A21–A23 in the Appendix replicate all heterogeneity analyses for the other types of CCPs—namely, the aggregate EPS, non-market-based policies, and technology-support measures—focusing on the subsample of full democracies. Tables A24–A27 report the corresponding results for the remaining countries. Consistent with expectations, we do not find any statistically significant effects.[17]

[14] To calculate the seat share at which the effect of WUI on market-based CCPs becomes zero, we use the coefficients from the estimation of Eq. (4). In detail, the marginal effect is: $\partial\left(\Delta y_{i,s,t}\right)/\partial WUI_{i,t-1} = \beta_1 + \beta_2 \times \mathit{Seatshare}_{i,t}$. Setting $\partial\left(\Delta y_{i,s,t}\right)/\partial WUI_{i,t-1} = 0$, we obtain: $\mathit{Seatshare}_{i,t} = -\beta_1/\beta_2$.

[15] In fact, climate policies are often integrated into broader reform package (Fischer and Newell, 2008).

[16] We also test the robustness of the heterogeneity exercises by including all mediating variables—seats share, constitutional systems and recession—within the same equation, and results do not qualitatively change (see Table 4, column 4).

[17] In addition, we also investigate the role of other variables, potentially mediating the role of uncertainty in the implementation of strict CCPs. Specifically, we interact the WUI with (i) the electoral system (i.e., majoritarian vs. proportional)—as governments in winner-take-all systems are typically more independent in the adoption of reforms—and (ii) a variable measuring the proximity to elections, as costs of reforms are expected to be higher close to elections (source: DPI). However, neither of these exercises report significant coefficients of interaction terms, even if they show the expected (negative) sign.

5. Mechanisms: electoral costs under uncertainty

This section examines the mechanism underlying our main findings, focusing on how macroeconomic uncertainty shapes the electoral costs of climate policy adoption. We argue that higher uncertainty weakens voters' ability to attribute economic outcomes to government actions, thereby reducing the political penalty associated with reforms that generate short-run disruption. Section 5.1 develops a stylized political-economy model that formalizes this mechanism and delivers testable predictions, while Section 5.2 provides supporting empirical evidence.

5.1. *A stylized political-economy model*

The model studies how macroeconomic uncertainty affects the political feasibility of climate policy reforms. The key mechanism is that when economic conditions are uncertain, observed outcomes are less informative about the contribution of government policy. As a result, reforms that temporarily worsen economic performance generate weaker electoral punishment. This mechanism is consistent with models of electoral accountability under imperfect information (Alesina and Cukierman, 1990; Rogoff, 1990) and with theories highlighting how crises can facilitate structural reforms (Drazen and Grilli, 1993; Bonfiglioli and Gancia, 2013).

Consider a two-period setting. In period 0, an incumbent government chooses whether to implement a reform, $r \in \{0, 1\}$. Reform generates long-run benefits $B > 0$ but entails short-run economic disruptions $\kappa > 0$, such as higher energy prices or sectoral reallocation. Implementing the reform also entails a direct political implementation cost $C > 0$.

Economic outcomes are given by:

$$y = \theta - \kappa r + \varepsilon \tag{5}$$

where $\theta \sim N\left(\overline{\theta}, \sigma_\theta^2\right)$ denotes government's competence and $\varepsilon \sim N\left(0, \sigma^2\right)$ is an aggregate shock. The variance σ^2 captures uncertainty. Higher uncertainty increases the dispersion of outcomes without affecting their mean, thereby reducing their informativeness about policy.

Voters evaluate the incumbent based on expected performance. When uncertainty is high, they place less weight on the policy-induced component of outcomes. We capture this in reduced form through an attribution parameter $\lambda \in (0, 1)$, decreasing in uncertainty:

$$\lambda = \lambda\left(\sigma^2\right), \frac{\partial \lambda}{\partial \sigma^2} < 0 \tag{6}$$

Electoral support depends positively on expected economic performance. For simplicity, assume electoral support is linear in perceived economic outcomes:

$$p(r) = a + b(\overline{\theta} - \lambda \kappa r), b > 0 \tag{7}$$

The electoral cost of effect of reform is:

$$p(1) - p(0) = -b\lambda\kappa < 0 \tag{8}$$

Because λ declines with uncertainty, the magnitude of this penalty becomes smaller when uncertainty rises:

$$\frac{\partial}{\partial \sigma^2}[p(1) - p(0)] = -b\kappa \frac{\partial \lambda}{\partial \sigma^2} > 0 \tag{9}$$

The incumbent values both remaining in office and implementing successful policies. Government utility is:

$$U_G(r) = Rp(r) - Cr + \beta Br \tag{10}$$

where $R > 0$ denotes the value of holding office and $\beta \in (0, 1)$ discounts future benefits. The government adopts the reform if:

$$-C + \beta B + R[p(1) - p(0)] \geq 0 \tag{11}$$

Table 4
The impact of the World Uncertainty Index on market-based EPS index: non-linear estimates.

Variables	(1)	(2)	(3)	(4)
WUI_{t-1}	0.123**	0.0252***	0.0295***	0.151***
	(0.0485)	(0.009)	(0.0097)	(0.0524)
$Seatshare\_WUI_{t-1}$	−0.0019**			−0.0021**
	(0.0008)			(0.0009)
$Pres\_WUI_{t-1}$		−0.0399*		−0.0501**
		(0.0204)		(0.0214)
$Recession\_WUI_{t-1}$			−0.0607***	−0.0551**
			(0.0225)	(0.0219)
Observations	3990	3990	3990	3990
R-squared	0.094	0.094	0.094	0.097
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
Full-Democracies	YES	YES	YES	YES

Notes: The table shows the response of market-based EPS index to a 1-standard deviation increase in the World Uncertainty Index (WUI), as well as its interaction with the seat-share of government (first column), a dummy variable indicating presidential system (second column), a dummy variable for recessions (third column), and the mediating variables together (fourth column). Estimates are based on Eq. (4). The models also include one-period lag not-interacted mediating variables, a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. The analysis is conducted considering only countries with a Polity5 index score equal to 10. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

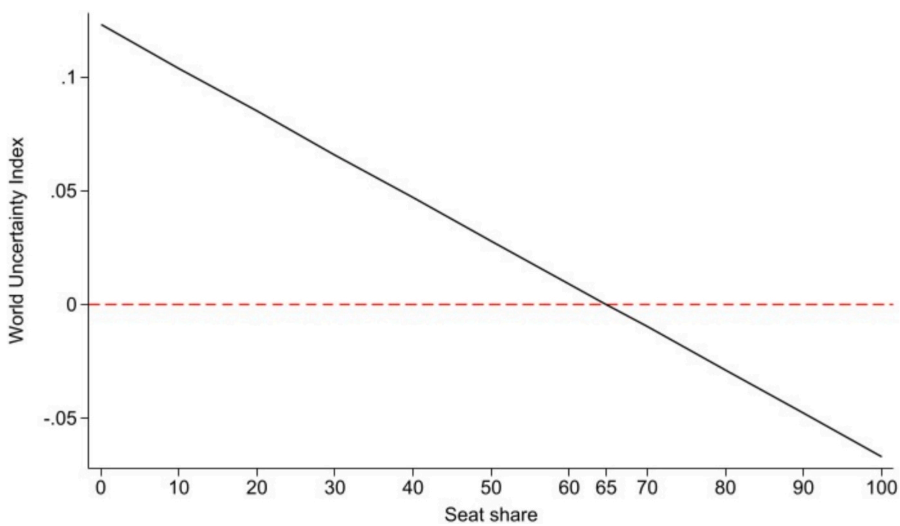

Fig. 3. The impact of the World Uncertainty Index on market-based EPS index, across different levels of seat-share.

which yields:

$$-C + \beta B - Rb\lambda\kappa \geq 0 \quad (12)$$

Higher uncertainty reduces the electoral penalty $Rb\lambda\kappa$, relaxing the reform condition and increasing the likelihood of adoption. This effect is stronger for reforms with larger short-run costs, such as market-based climate policies.

Proposition 1. An increase in macroeconomic uncertainty attenuates the electoral penalty associated with reform and increases the likelihood of reform adoption.

Proof. From Eq. (8), the electoral penalty associated with reform is $p(1) - p(0) = -b\lambda\kappa$. From Eq. (6), the attribution parameter satisfies $\partial\lambda/\partial\sigma^2 < 0$. Therefore: $\partial/\partial\sigma^2[p(1) - p(0)] = -b\kappa\partial\lambda/\partial\sigma^2 > 0$. An increase in uncertainty reduces the magnitude of the electoral penalty associated with reform. From the reform condition in Eq. (12), a lower value of λ reduces the electoral cost of reform and relaxes the condition under which reform is adopted.

The model yields a clear empirical prediction. Climate policy adoption reduces political support due to its short-run costs, but this effect becomes weaker when uncertainty is higher. Importantly, the model does not require uncertainty to increase political support overall; it only predicts that uncertainty attenuates the marginal electoral cost of reform. The empirical analysis tests these predictions.

5.2. Empirical evidence

To empirically test the validity of the theoretical mechanisms outlined in the previous sub-section, we estimate the following model:

$$PoliticalSupport_{it} = \beta CCP_{it} + \gamma WUI_{it} + \delta(CCP_{it} \times WUI_{it}) + \eta_i + \rho_t + \varepsilon_{it} \quad (13)$$

where *PoliticalSupport* measures the support for government, with data drawn from the International Country Risk Guide (ICRG, 2020); *CCP* refers to, alternatively, the aggregate EPS index and its sub-components;

WUI is the World Uncertainty Index; η_i and ρ_t are country and time fixed effects, included to control for time-invariant country characteristics and common global shocks.

Results are reported in Table A28 in the Appendix. Consistent with theoretical predictions, we find that climate policies tend to reduce political support for governments ($\beta < 0$), reflecting the short-run economic costs associated with their implementation. Importantly, this negative effect is significantly larger for market-based instruments, consistent with the model's prediction that reforms imposing higher direct economic costs generate stronger electoral penalties. The interaction between climate policy and uncertainty is positive ($\delta > 0$), indicating that these political costs become weaker when macroeconomic uncertainty is higher. Consistent with this mechanism, the attenuation effect is observed for the aggregate Environmental Policy Stringency (EPS) index and, more strongly, for market-based policies, while it does not materialize for other types of instruments—such as non-market-based and technology-support policies—which are typically less costly and therefore less politically sensitive. In addition, macroeconomic uncertainty itself tends to reduce political support for governments, reflecting its broader negative effects on economic conditions (see, for example, Ahir et al., 2022).

6. Conclusions

In a context of rising climate concerns, understanding the political economy drivers of climate policy adoption is of central importance. In this article, we build on the literature on uncertainty and structural reforms to examine whether periods of heightened uncertainty facilitate the implementation of more stringent climate change policies, with particular attention to differences across policy instruments.

Empirically, we assemble a novel dataset covering 37 advanced and emerging economies over the period 1990–2020, combining detailed information on 13 climate policy instruments with country-level measures of economic and political uncertainty based on the World Uncertainty Index. This allows us to assess how changes in uncertainty relate to changes in the stringency of CCPs, and how this relationship varies across institutional and macroeconomic environments.

Our results point to a nuanced but consistent pattern. Higher uncertainty is associated with a greater likelihood of implementing more stringent climate policies, particularly for market-based instruments—such as carbon pricing—that entail higher short-run political costs. This effect is concentrated in fully democratic countries and advanced economies, where electoral accountability is stronger. At the same time, the effect is weaker when governments are politically strong (e.g., enjoy large majority) or operate in presidential systems, suggesting that institutional structures shape the extent to which uncertainty affects reform incentives. Moreover, the effect diminishes during periods of negative economic growth, indicating that recessions themselves may create conditions conducive to reform, reducing the additional role of uncertainty.

These findings are consistent with a mechanism whereby higher macroeconomic uncertainty weakens voters' ability to attribute short-run economic disruptions to government policy, thereby attenuating the electoral costs of implementing climate reforms. In this sense, uncertainty can create windows of opportunity for the adoption of policies that are otherwise politically costly.

From a policy perspective, our results suggest that governments—especially in democratic and advanced economies—may be better positioned to introduce market-based climate policies during periods of heightened uncertainty, when political resistance is lower. At the same time, the weaker role of uncertainty in contexts with strong governments or different institutional settings highlights the importance of political structures in shaping reform dynamics. Strengthening institutional capacity and policy credibility may therefore help sustain ambitious climate policy implementation even outside periods of crisis.

CRediT authorship contribution statement

Luca Bettarelli: Writing – original draft, Formal analysis, Data curation, Conceptualization. **Davide Furceri:** Writing – original draft, Supervision, Formal analysis, Conceptualization. **Loredana Pisano:** Writing – original draft, Formal analysis, Data curation, Conceptualization.

Appendix A

Figures

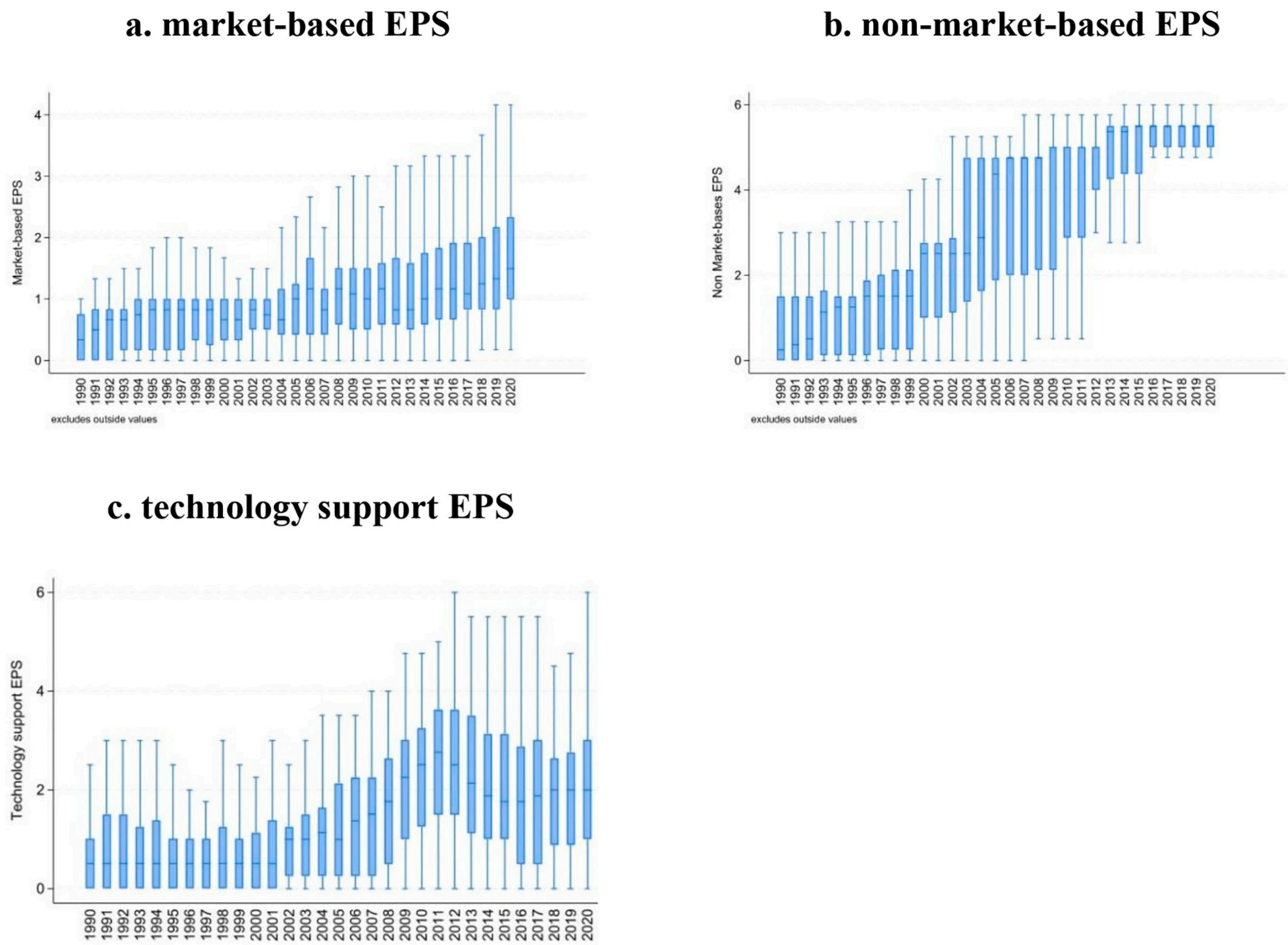

Fig. A1. Evolution of the sub-categories of the EPS index over time (median, 25th percentile, 75th percentile).
Source: OECD.

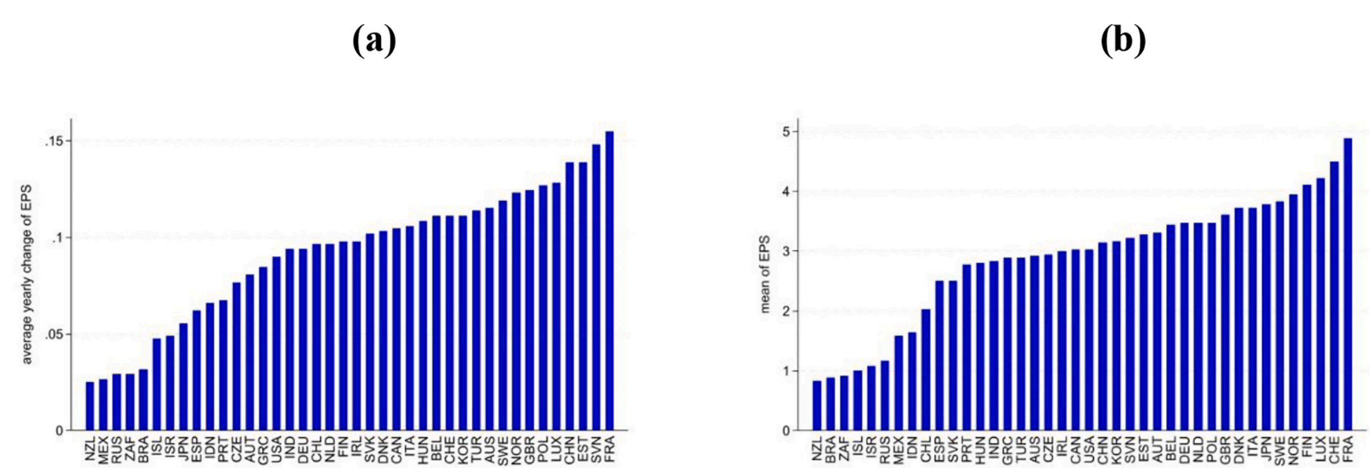

Fig. A2. Average change of the EPS index across countries (panel A) and distribution of EPS index across countries in 2020 (panel B).
Source: OECD.

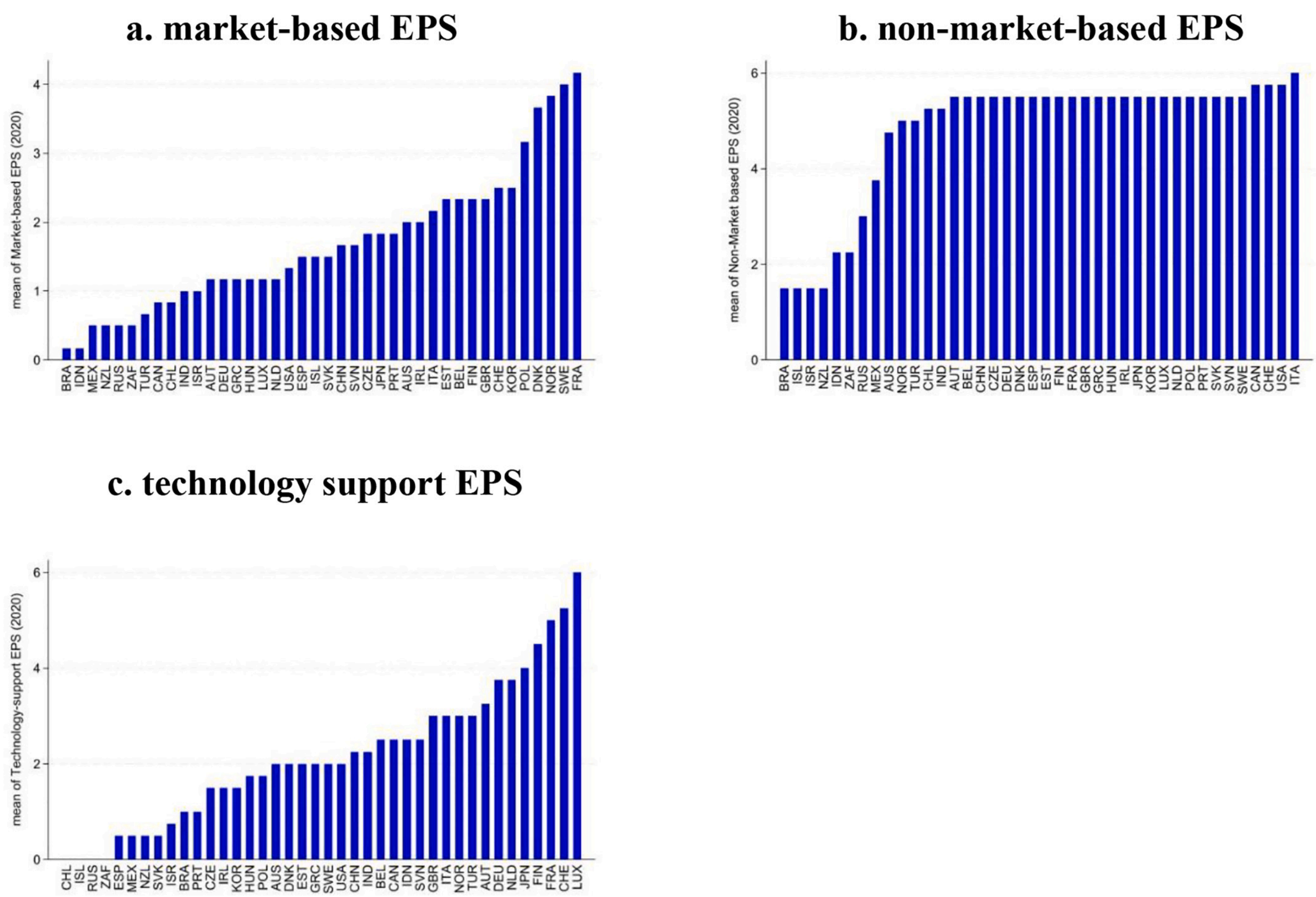

Fig. A3. Distribution of the sub-categories of the EPS index across countries in 2020.
Source: OECD.

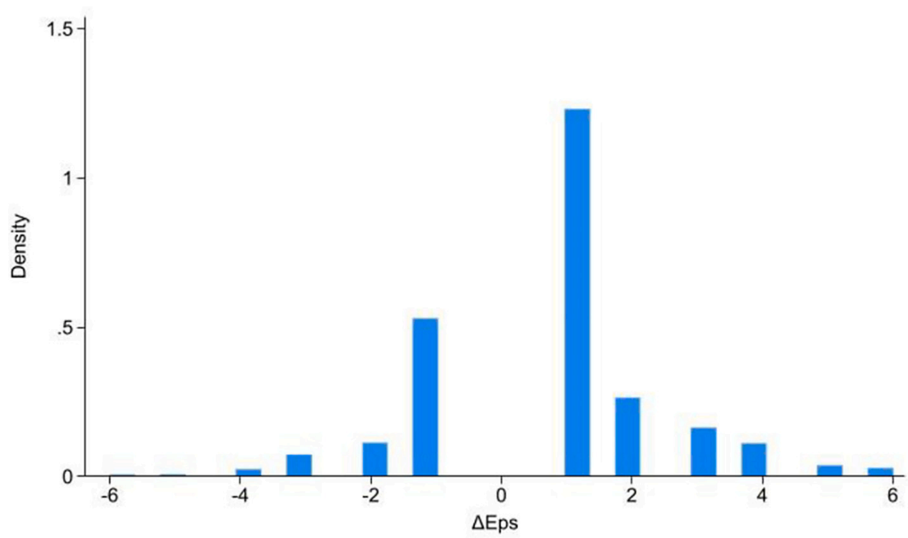

Fig. A4. Annual variation of the EPS index.
Source: OECD.

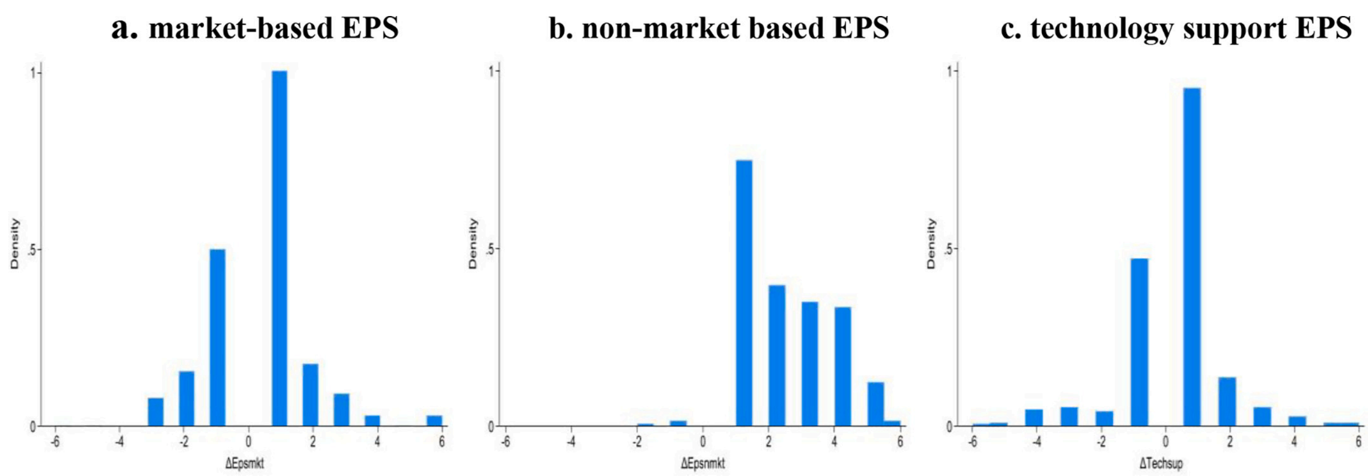

Fig. A5. Annual variation of EPS's sub-components.
Source: OECD.

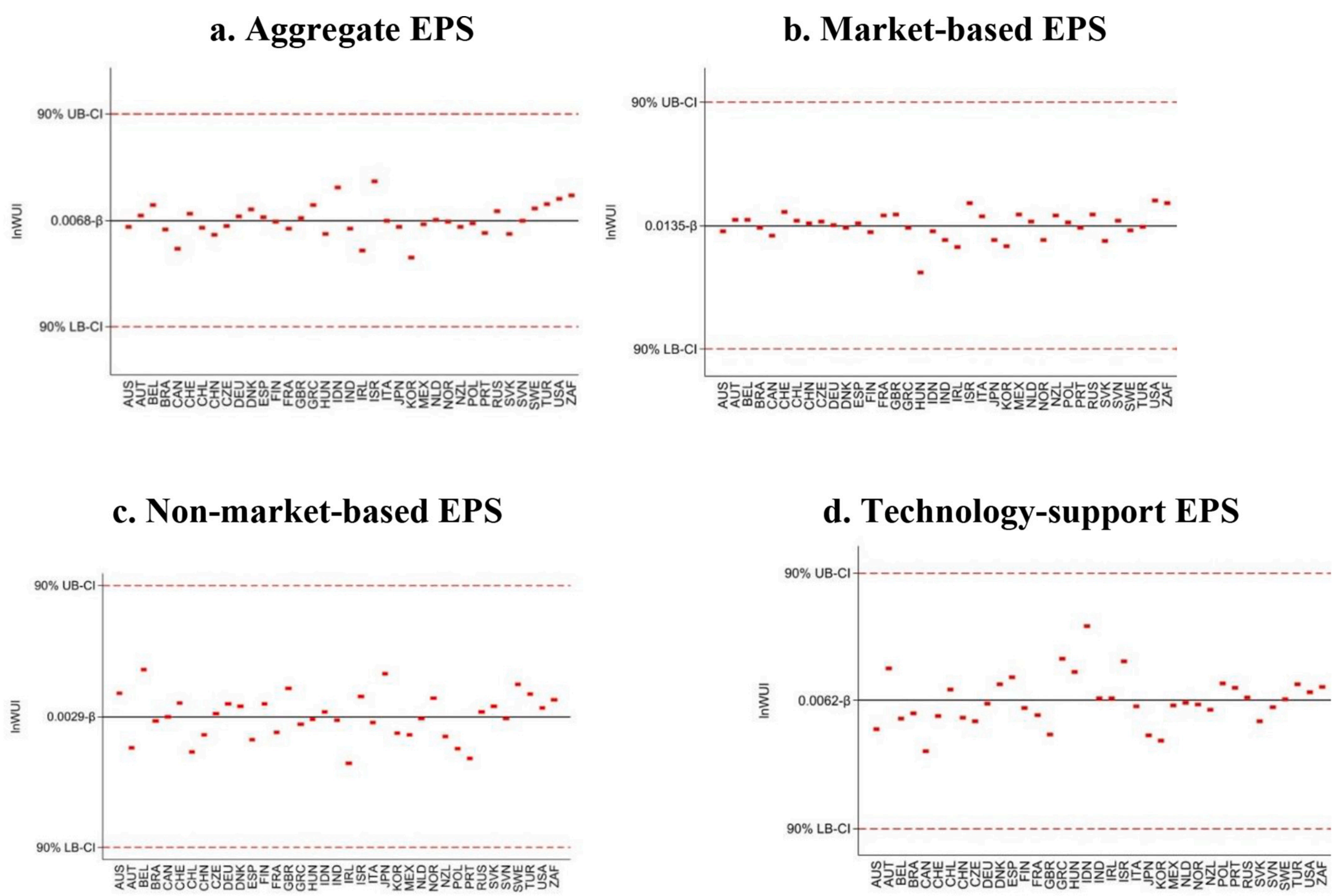

Fig. A6. Baseline estimates excluding one country at time, with 90% confidence bands.
Notes: The figures show the response of the EPS index and its sub-categories to a one-standard-deviation increase in the World Uncertainty Index (WUI), excluding one country at a time. The 90 percent confidence bands of the baseline model are represented by dashed red lines. The black line represents the coefficient of the baseline model, as in Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. In each panel, the estimates obtained by excluding one country at a time fall within the confidence bands of the baseline estimation. The x-axis reports the country excluded.

Tables

Table A1
The EPS index split by policy instrument.

Environmental Policy Stringency (EPS) Index	Market-based EPS	Taxes and Certifications	• CO2 certification • Renewable Energy Certificates • CO2 • Nox • Sox • Diesel
	Non market-based EPS	Performance Standards	• ELV Nox • ELV Sox • ELV PM • ELV Sulphur
	Technology-support EPS	Adoption Support	• Adoption support Solar • Adoption support Wind
		Upstream Support	• R&D Expenditure

Source: OECD.

Table A2
List of countries included in the analysis.

List of countries				
Australia	Denmark	Ireland	Norway	Sweden
Austria	Finland	Israel	Poland	Switzerland
Belgium	France	Italy	Portugal	Turkey
Brazil	Germany	Japan	Russia	United Kingdom
Canada	Greece	Korea	Slovakia	United States
Chile	Hungary	Mexico	Slovenia	
China	India	Netherlands	South Africa	
Czech Rep.	Indonesia	New Zealand	Spain	

Table A3
Descriptive statistics of all variables used in the analysis.

Variable	Obs	Mean	Std. Dev.	Min	Max	Sources
ΔEPS_area	14,040	0.074	0.617	−6	6	OECD (2022)
ΔEPSMKT_area	6480	0.044	0.557	−6	6	OECD (2022)
ΔEPSNMKT_area	4320	0.137	0.644	−2	6	OECD (2022)
ΔTECHSUP_area	3240	0.052	0.685	−6	6	OECD (2022)
WUI (log)	14,469	−1.966	0.819	−4.545	0.295	Ahir et al. (2022)
Seats share	14,443	56.063	9.222	42.857	74.096	Scartascini et al. (2021)
GDP growth	13,910	0.019	0.033	−0.143	0.233	World Bank
Banking crisis	14,469	0.017	0.13	0	1	Laeven and Valencia (2012)
Currency crisis	14,469	0.013	0.111	0	1	Laeven and Valencia (2012)
Sovereign debt crisis	14,469	0.003	0.052	0	1	Laeven and Valencia (2012)
Banking crisis (previous 3 years)	14,469	0.053	0.224	0	1	Laeven and Valencia (2012)
Currency crisis (previous 3 years)	14,469	0.038	0.191	0	1	Laeven and Valencia (2012)
Sovereign debt crisis (previous 3 years)	14,469	0.008	0.09	0	1	Laeven and Valencia (2012)
Inflation	14,430	14.335	130.623	−4.478	2947.733	World Bank
lnGDP	14,001	10.247	0.606	7.352	11.391	World Bank
OECD countries	14,469	0.54	0.498	0	1	Bonfiglioli et al. (2022)
EU pre-entry	14,469	0.007	0.084	0	1	Bonfiglioli et al. (2022)
Democracy index	13,507	8.635	3.287	−7	10	Marshall and Gurr (2020)
left_party	14,443	0.379	0.485	0	1	Scartascini et al. (2021)
Presidential system	14,443	0.299	0.458	0	1	Scartascini et al. (2021))
Legislative-elections	14,443	0.274	0.446	0	1	Scartascini et al. (2021)
Executive-elections	14,443	0.073	0.26	0	1	Scartascini et al. (2021)
Recession	13,910	0.193	0.394	0	1	World Bank
Recession (previous 3 years)	14,469	0.353	0.478	0	1	World Bank
WUI median	13,429	−1.958	0.791	−4.208	0.227	Ahir et al. (2022)
WUI p75	14,469	−1.534	0.712	−3.851	0.471	Ahir et al. (2022)
Temperature_anomaly	14,469	0.005	0.608	−2.382	2.248	EM-DAT
Economic costs_disasters	11,141	0.214	0.783	0	13.822	EM-DAT
lnEPU	6383	4.695	0.4605	3.2959	6.2966	Baker et al. (2016)
Exc. rate vol.	14,300	6.664	5.534	0.02632	33.2068	Baker et al. (2023)
ΔTax_dolphin	5005	0.0701	0.9985	−9.221	30.8406	Dolphin and Merkle (2024)
ΔETS_dolphin	5005	0.1338	2.0045	−14.73	24.8856	Dolphin and Merkle (2024)
ΔALL_dolphin	5005	0.2038	2.2142	−14.72	30.8406	Dolphin and Merkle (2024)
Political support	3159	0.7322	0.2739	−1.281	1.3652	ICRG (2020)

Table A4
Baseline analysis including GDP growth as additional control.

Variables	(1) EPS	(2) Market-based-EPS	(3) Non-market-based-EPS	(4) Technology-support-EPS
WUI $_{t-1}$	0.0079*	0.0149**	−0.0036	0.0089
	(0.0045)	(0.0064)	(0.0077)	(0.0107)
EPS $_{t-1}$	−0.164***			
	(0.0170)			
GDPgrowth $_{t-1}$	−0.256	0.0072	−1.044**	0.247
	(0.240)	(0.266)	(0.415)	(0.675)
Epsmkt $_{t-1}$		−0.158***		
		(0.0346)		
Epsnmkt $_{t-1}$			−0.168***	
			(0.0282)	
Techsup $_{t-1}$				−0.167***
				(0.0220)
Observations	13,442	6204	4136	3102
R-squared	0.079	0.078	0.088	0.073
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
GDP Growth	YES	YES	YES	YES

Notes: The table shows the response of the EPS index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI). Estimates are based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. A one-period lag of GDP growth is also included as control variable. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A5
Baseline analysis including economic and financial controls.

Variables	(1) EPS	(2) Market-based-EPS	(3) Non-market-based-EPS	(4) Technology-support-EPS
WUI $_{t-1}$	0.0081*	0.0142**	−0.0022	0.0096
	(0.0047)	(0.0066)	(0.0080)	(0.0110)
EPS $_{t-1}$	−0.164***			
	(0.0170)			
GDPgrowth $_{t-1}$	−0.578*	−0.0374	−1.497***	−0.459
	(0.307)	(0.351)	(0.497)	(0.877)
Recession $_{t-1}$	−0.0346*	−0.0192	−0.0136	−0.0926
	(0.0208)	(0.0212)	(0.0392)	(0.0565)
BC $_{t-1}$	0.0802*	0.0139	0.222***	0.0250
	(0.0453)	(0.0704)	(0.0725)	(0.0509)
CC $_{t-1}$	−0.0064	−0.00817	−0.0563	0.0624
	(0.0342)	(0.0399)	(0.0817)	(0.0593)
SDC $_{t-1}$	−0.0496	−0.0372	−0.237	0.183*
	(0.0773)	(0.0666)	(0.204)	(0.0932)
Recession3 $_{t-1}$	−0.0143	0.0101	−0.0284	−0.0443**
	(0.0129)	(0.0172)	(0.0276)	(0.0220)
BC3 $_{t-1}$	−0.0019	−0.0117	−0.0045	0.0228
	(0.0264)	(0.0294)	(0.0548)	(0.0625)
CC3 $_{t-1}$	0.00697	0.0458	−0.0926*	0.0604
	(0.0292)	(0.0419)	(0.0472)	(0.0586)
SDC3 $_{t-1}$	0.0385	−0.0354	0.155	0.0394
	(0.0558)	(0.0357)	(0.143)	(0.123)
Inflation $_{t-1}$	−0.0002	0.0019***	−0.0027**	−0.0009
	(0.0007)	(0.0006)	(0.0014)	(0.0017)
Epsmkt $_{t-1}$		−0.159***		
		(0.0349)		
Epsnmkt $_{t-1}$			−0.168***	
			(0.0278)	
Techsup $_{t-1}$				−0.168***
				(0.0224)
Observations	13,442	6204	4136	3102
R-squared	0.080	0.079	0.093	0.075
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
GDP Growth	YES	YES	YES	YES
Other Economic and Financial controls	YES	YES	YES	YES

Notes: The table shows the response of the EPS index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI). Estimates are based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. Controls include GDP growth, inflation and four dummy variables capturing economic crises: recession, banking crises (BC), currency crises (CC), and sovereign debt crises (SDC). Additional controls include three-year crisis dummies (BC3, CC3, SDC3, and recession3), which are equal to one if the crisis occurred in the three years before the uncertainty shock. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A6
Baseline analysis including development controls.

Variables	(1) EPS	(2) Market-based-EPS	(3) Non-market-based-EPS	(4) Technology-support-EPS
WUI $_{t-1}$	0.00867*	0.0144**	−0.0012	0.0105
	(0.00469)	(0.0066)	(0.0082)	(0.0111)
EPS $_{t-1}$	−0.165***			
	(0.0171)			
GDPgrowth $_{t-1}$	−0.461	0.0428	−1.308***	−0.371
	(0.307)	(0.342)	(0.493)	(0.911)
Recession $_{t-1}$	−0.0293	−0.0158	−0.0039	−0.0888
	(0.0208)	(0.0210)	(0.0385)	(0.0578)
BC $_{t-1}$	0.0890**	0.0196	0.237***	0.0325
	(0.0449)	(0.0696)	(0.0712)	(0.0500)
CC$_{t-1}$	−0.0023	−0.0038	−0.0611	0.0762
	(0.0349)	(0.0353)	(0.0875)	(0.0630)
SDC$_{t-1}$	−0.0202	−0.0198	−0.186	0.213**
	(0.0770)	(0.0649)	(0.203)	(0.0990)
Recession3 $_{t-1}$	−0.0076	0.0143	−0.0173	−0.0371*
	(0.0129)	(0.0177)	(0.0274)	(0.0219)
BC3 $_{t-1}$	0.0078	−0.0051	0.0137	0.0293
	(0.0263)	(0.0294)	(0.0537)	(0.0623)
CC3 $_{t-1}$	0.0023	0.0425	−0.106**	0.0628
	(0.0290)	(0.0405)	(0.0497)	(0.0583)
SDC3 $_{t-1}$	0.0637	−0.0204	0.197	0.0671
	(0.0557)	(0.0349)	(0.144)	(0.121)
Inflation $_{t-1}$	0.0005	0.0023***	−0.0015	−0.0006
	(0.0006)	(0.0006)	(0.0013)	(0.0016)
lnGDP $_{t-1}$	0.160***	0.101*	0.261***	0.155
	(0.0420)	(0.0541)	(0.0807)	(0.115)
OECD $_{t-1}$	0.0039	0.0078	0.0425	−0.0493
	(0.0216)	(0.0235)	(0.0453)	(0.0541)
EU $_{t-1}$	−0.0239	−0.0305	−0.0146	−0.0216
	(0.0289)	(0.0452)	(0.0365)	(0.0688)
Epsmkt $_{t-1}$		−0.160***		
		(0.0350)		
Epsnmkt $_{t-1}$			−0.174***	
			(0.0290)	
Techsup $_{t-1}$				−0.168***
				(0.0222)
Observations	13,442	6204	4136	3102
R-squared	0.081	0.080	0.096	0.076
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
GDP Growth	YES	YES	YES	YES

Notes: The table shows the response of the EPS index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI). Estimates are based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. Controls include GDP growth, inflation, four dummy variables capturing economic crises—i.e., recession, banking crises (BC), currency crises (CC), and sovereign debt crises (SDC)—and three-year crisis dummies (BC3, CC3, SDC3, and recession3), which are equal to one if the crisis occurred in the three years before the uncertainty shock. Additionally, development controls are included: the log of GDP per capita, two dummies equal to one if the country is a member of the OECD or EU. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A7
Baseline analysis including political controls.

Variables	(1) EPS	(2) Market-based-EPS	(3) Non-market-based-EPS	(4) Technology-support-EPS
WUI $_{t-1}$	0.0103	0.0186**	−0.0019	0.0105
	(0.0063)	(0.0086)	(0.0098)	(0.0160)
EPS $_{t-1}$	−0.174***			
	(0.0174)			
GDPgrowth $_{t-1}$	−0.457	−0.0169	−1.198**	−0.389
	(0.315)	(0.344)	(0.501)	(0.956)
Recession $_{t-1}$	−0.0257	−0.0131	0.0015	−0.0857
	(0.0221)	(0.0222)	(0.0416)	(0.0616)
BC $_{t-1}$	0.0807*	0.0147	0.219***	0.0286
	(0.0446)	(0.0693)	(0.0714)	(0.0540)
CC $_{t-1}$	−0.0114	−0.0126	−0.0740	0.0700
	(0.0363)	(0.0368)	(0.0915)	(0.0680)
SDC $_{t-1}$	−0.0029	−0.0026	−0.184	0.255**
	(0.0767)	(0.0645)	(0.201)	(0.102)
Recession $_{t-3}$	−0.0044	0.0170	−0.0115	−0.0363

(continued on next page)

Table A7 (*continued*)

Variables	(1)	(2)	(3)	(4)
	EPS	Market-based-EPS	Non-market-based-EPS	Technology-support-EPS
	(0.0133)	(0.0183)	(0.0275)	(0.0234)
BC $_{t-3}$	0.00251	−0.009	0.0091	0.0202
	(0.0258)	(0.0288)	(0.0515)	(0.0642)
CC $_{t-3}$	0.0079	0.0442	−0.102*	0.0777
	(0.0297)	(0.0421)	(0.0514)	(0.0589)
SDC $_{t-3}$	0.0680	−0.0159	0.200	0.0783
	(0.0561)	(0.0356)	(0.143)	(0.119)
Inflation $_{t-1}$	0.0005	0.0023***	−0.0013	−0.0006
	(0.0006)	(0.0006)	(0.0014)	(0.0016)
lnGDP $_{t-1}$	0.155***	0.0921	0.278***	0.130
	(0.0428)	(0.0608)	(0.0823)	(0.100)
OECD $_{t-1}$	0.0304	0.0159	0.0795	0.0054
	(0.0255)	(0.0258)	(0.0544)	(0.0582)
EU $_{t-1}$	−0.0228	−0.0280	−0.0125	−0.0235
	(0.0291)	(0.0458)	(0.0378)	(0.0684)
Democracy_polity $_{t-1}$	−0.0114***	−0.0029	−0.0248***	−0.0123*
	(0.0034)	(0.0034)	(0.0075)	(0.0065)
Left.party $_{t-1}$	−0.0023	0.0225	−0.0384**	−0.0059
	(0.0108)	(0.0138)	(0.0186)	(0.0251)
Pres $_{t-1}$	−0.0165	−0.0182	−0.0018	−0.0343
	(0.0143)	(0.0167)	(0.0257)	(0.0377)
Leg-elec $_{t-1}$	−0.0194	−0.0204*	0.0019	−0.0454
	(0.0132)	(0.0117)	(0.0310)	(0.0313)
Exec-elec $_{t-1}$	0.0190	0.0339*	−0.0382	0.0654
	(0.0217)	(0.0204)	(0.0505)	(0.0478)
Epsmkt $_{t-1}$		−0.168***		
		(0.0364)		
Epsnmkt $_{t-1}$			−0.184***	
			(0.0294)	
Techsup $_{t-1}$				−0.180***
				(0.0200)
Observations	12,961	5982	3988	2991
R-squared	0.086	0.086	0.101	0.083
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
GDP Growth	YES	YES	YES	YES
Other Economic and Financial controls	YES	YES	YES	YES
Development controls	YES	YES	YES	YES
Political controls	YES	YES	YES	YES

Notes: The table shows the response of the EPS index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI). Estimates are based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. Controls include GDP growth, inflation, four dummy variables capturing economic crises—i.e., recession, banking crises (BC), currency crises (CC), and sovereign debt crises (SDC)—and three-year crisis dummies (BC3, CC3, SDC3, and recession3)—which are equal to one if the crisis occurred in the three years before the uncertainty shock—the log of GDP per capita, two dummies equal to one if the country is a member of the OECD or EU. Additional political factors are accounted for: presidential systems, left-wing orientation of the governing party, election dummies, and the degree of democracy. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A8

Baseline analysis including temperature anomalies.

Variables	(1)	(2)	(3)	(4)
	EPS	Market-based-EPS	Non-market-based-EPS	Technology-support-EPS
WUI$_{t-1}$	0.0065	0.0130**	−0.0031	0.0062
	(0.0045)	(0.0064)	(0.0074)	(0.0108)
Temperature anomalies$_{t-1}$	0.415	0.702	0.328	−0.0430
	(0.304)	(0.628)	(0.209)	(0.175)
Observations	13,988	6456	4304	3228
R-squared	0.077	0.079	0.080	0.071
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES

Notes: The table shows the response of the Environmental Policy Stringency (EPS) index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI). Estimates are based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. Regressions also include temperature anomalies as additional control. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A9
Baseline analysis including cost of extreme weather-related events.

Variables	(1)	(2)	(3)	(4)
	EPS	Market-based-EPS	Non-market-based-EPS	Technology-support-EPS
WUI_{t-1}	0.0064	0.0137*	0.0009	−0.0014
	(0.0054)	(0.0074)	(0.0100)	(0.0116)
Extreme weather $events_{t-1}$	−0.0066	−0.0021	−0.0220	0.0037
	(0.0073)	(0.0049)	(0.0178)	(0.0143)
Observations	10,751	4962	3308	2481
R-squared	0.078	0.070	0.085	0.079
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES

Notes: The table shows the response of the Environmental Policy Stringency (EPS) index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI). Estimates are based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. Regressions also include economic costs of extreme weather-related events as additional control. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A10
Baseline analysis including country-specific linear trends.

Variables	(1)	(2)	(3)	(4)
	EPS	Market-based EPS	Non-market-based EPS	Technology support EPS
WUI_{t-1}	0.0069	0.0135**	−0.0029	0.0062
	(0.0045)	(0.0063)	(0.0074)	(0.0108)
Observations	13,988	6456	4304	3228
R-squared	0.076	0.078	0.080	0.072
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
Country-Specific Linear Trends	YES	YES	YES	YES

Notes: The table shows the response of the Environmental Policy Stringency (EPS) index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI), based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. Regressions also include country-specific linear trends. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A11
Baseline analysis with clustered standard errors at country level.

Variables	(1)	(2)	(3)	(4)
	EPS	Market-based EPS	Non-market-based EPS	Technology support EPS
WUI_{t-1}	0.0068	0.0135*	−0.0029	0.0062
	(0.0064)	(0.0067)	(0.0123)	(0.0201)
Observations	13,988	6456	4304	3228
R-squared	0.076	0.078	0.080	0.071
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES

Notes: The table shows the response of the Environmental Policy Stringency (EPS) index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI), based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. Standard errors are clustered at country level. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A12
The impact of the World Uncertainty Index (yearly median) on the EPS index and its sub-categories.

Variables	(1)	(2)	(3)	(4)
	EPS	Market-based-EPS	Non-market-based-EPS	Technology-support-EPS
WUI_median_{t-1}	0.0003	0.0141**	−0.0247***	0.0062
	(0.0056)	(0.0067)	(0.0086)	(0.0143)
Observations	12,948	5976	3984	2988
R-squared	0.079	0.079	0.087	0.072
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES

Notes. The table shows the response of the Environmental Policy Stringency (EPS) index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI), based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A13
The impact of the World Uncertainty Index (yearly 75th percentile) on the EPSindex and its sub-categories.

Variables	(1)	(2)	(3)	(4)
	EPS	Market-based-EPS	Non-market-based-EPS	Technology-support-EPS
WUI_p75 $_{t-1}$	0.0065	0.0101*	−0.0002	0.0079
	(0.0043)	(0.0058)	(0.0079)	(0.0100)
Observations	13,988	6456	4304	3228
R-squared	0.076	0.077	0.080	0.071
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES

Notes: The table shows the response of the Environmental Policy Stringency (EPS) index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI), based on Eq. (1). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A14
The impact of the World Uncertainty Index on the Dolphin's Emissions-weighted Carbon Prices (ECP): emissions trading systems, carbon taxes, and their combination.

Variables	(1)	(2)	(3)
	ETS	TAX	ALL
lnWUI$_{t-1}$	0.0660*	0.0377**	0.0999**
	(0.0371)	(0.0157)	(0.0383)
Observations	4564	4564	4564
R-squared	0.020	0.025	0.010
Country FE	YES	YES	YES
Year FE	YES	YES	YES
Initial CCPs	YES	YES	YES

Notes. The table reports the response of Emissions Trading Systems (ETS), carbon taxes, and their combination, with data drawn from Dolphin and Merkle (2024), to a one-standard-deviation increase in the World Uncertainty Index (WUI), estimated using Eq. (1). The regressions include a one-period lag of the dependent variable, as well as country and year fixed effects. The estimates are based on a sample of 143 countries over the period 1990–2024, including 4564 observations.

Table A15
The impact of the World Uncertainty Index on the Dolphin's Emissions-weighted Carbon Prices (ECP): emissions trading systems, carbon taxes, and their combination, using the EPS sample.

Variables	(1)	(2)	(3)
	ETS	TAX	ALL
lnWUI$_{t-1}$	−0.0316	0.170***	0.169**
	(0.0510)	(0.0518)	(0.0627)
Observations	1106	1106	1106
R-squared	0.159	0.072	0.076
Country FE	YES	YES	YES
Year FE	YES	YES	YES
Initial CCPs	YES	YES	YES

Notes. The table reports the response of Emissions Trading Systems (ETS), carbon taxes, and their combination (based on Dolphin and Merkle, 2024) to a one-standard-deviation increase in the World Uncertainty Index (WUI), estimated using Eq. (1). The regressions include a one-period lag of the dependent variable, as well as country and year fixed effects. The estimates are based on the OECD EPS index sample, covering 37 countries for the period 1990–2020, including 1106 observations.

Table A16
The impact of the Economic Policy Uncertainty Index (EPU) and the exchange rate volatility on the EPS index and its sub-categories.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	EPS	Market-based EPS	Non-market-based EPS	Technology support EPS	EPS	Market-based EPS	Non-market-based EPS	Technology support EPS
EPU_{t-1}	0.0221** (0.0095)	0.034*** (0.0115)	−0.0053 (0.0238)	0.0356** (0.0165)				
Exch.Rate Vol_{t-1}					0.0070 (0.0070)	0.0172** (0.0082)	0.0072 (0.0130)	−0.0135 (0.0168)
Observations	6162	2844	1896	1422	13,858	6396	4264	3198
R-squared	0.089	0.099	0.091	0.077	0.076	0.084	0.078	0.069
Country-Sector FE	YES	YES	YES	YES	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES	YES	YES	YES	YES

Notes. The table shows the response of the Environmental Policy Stringency (EPS) index and its sub-categories to a 1-standard-deviation increase in the (log of) the economic policy uncertainty Index (EPU) (columns 1–4) and the Exchange Rate Volatility (columns 5–8), estimated using Eq. (1).The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. The estimates are based on a sample of 18 countries over the period 1990–2020 in columns 1–4, and 36 countries over the period 1990–2020 in columns 5–8. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A17
IV analysis using the aggregate EPS index.

Variables	(1)	(2)	(3)
	IV-shocks	IV-WUSI	IV-shocks and WUSI
WUI_{t-1}	0.0007	0.0068*	0.0073*
	(0.0063)	(0.0035)	(0. 0041)
IV first stage			
$Revolution_{t-1}$	3.957*** (0.6599)		3.602***(0.5165)
World Uncertainty Spillover $Index_{t-1}$		0.0011*** (0.0008)	0.0101***(0. 0005)
Kleibergen-Paap F-test	69.29	424.57	1233.0
Stock-Yogo 10%	16.38	16.38	19.93
Hansen J statistic	//	//	0.167
P-value	//	//	0.6829
Observations	13,312	11,752	11,128
R-squared	0.229	0.249	0.124
Country-Sector FE	YES	YES	YES
Sector-Year FE	YES	YES	YES
Initial EPS index	YES	YES	YES

Notes: The table shows the response of the EPS to a 1-standard deviation increase in the World Uncertainty Index (WUI), using an instrumental variable (IV) approach based on Eq. (2). The first column uses "revolution shock" as instrument; the second column uses the World Uncertainty Spillover Index (WUSI) as instrument; the third column uses both. The table presents second-stage results and first-stage statistics. The regressions include a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A18
IV analysis using non-market-based EPS index.

Variables	(1)	(2)	(3)
	IV-shocks	IV-WUSI	IV-shocks and WUSI
WUI_{t-1}	−0.0101	0.0016	−0.0014
	(0.0255)	(0.0083)	(0. 0092)
IV first stage			
$Revolution_{t-1}$	3.544*** (0.7657)		3.3684***(0.8799)
World Uncertainty Spillover $Index_{t-1}$		0.0105*** (0.0009)	0.0102***(0. 0009)
Kleibergen-Paap F-test	21.43	129.71	369.27
Stock-Yogo 10%	16.38	16.38	19.93
Hansen J statistic	//	//	0.057
P-value	//	//	0.8112
Observations	4096	3616	3424
R-squared	0.192	0.246	0.236
Country-Sector FE	YES	YES	YES
Sector-Year FE	YES	YES	YES
Initial EPS index	YES	YES	YES

Notes: The table shows the response of non-market-based EPS to a 1-standard deviation increase in the World Uncertainty Index (WUI), using an instrumental variable (IV) approach based on Eq. (2). The first column uses "revolution shock" as instrument; the second column uses the World Uncertainty Spillover Index (WUSI) as instrument; the third column uses both. The table presents second-stage results and first-stage statistics. The regressions include a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A19
IV analysis using technology-support EPS index.

Variables	(1)	(2)	(3)
	IV-shocks	IV-WUSI	IV-shocks and WUSI
WUI_{t-1}	−0.0037	0.0103	0.0118
	(0.0051)	(0.0065)	(0.0087)
IV first stage			
$Revolution_{t-1}$	3.7543*** (0.9368)		3.6902***(1.0938)
World Uncertainty Spillover $Index_{t-1}$		0.0105***(0.0011)	0.0101*** (0.0010)
Kleibergen-Paap F-test	16.06	99.31	298.44
Stock-Yogo 10%	16.38	16.38	19.93
Hansen J statistic	//	//	1.532
P-value	//	//	0.2158
Observations	3072	2712	2568
R-squared	0.124	0.102	0.109

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Table A19 (*continued*)

Variables	(1)	(2)	(3)
	IV-shocks	IV-WUSI	IV-shocks and WUSI
Country-Sector FE	YES	YES	YES
Sector-Year FE	YES	YES	YES
Initial EPS index	YES	YES	YES

Notes: The table shows the response of technology-support EPS to a 1-standard deviation increase in the World Uncertainty Index (WUI), using an instrumental variable (IV) approach based on Eq. (2). The first column uses "revolution shock" as instrument; the second column uses the World Uncertainty Spillover Index (WUSI) as instrument; the third column uses both. The table presents second-stage results and first-stage statistics. The regressions include a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A20

The impact of the World Uncertainty Index on the EPS index and its sub-categories: advanced economies (AE) and emerging market and developing economies (EMDE).

Variables	(1)	(2)	(3)	(4)
	EPS	Market-based EPS	Non-market-based EPS	Technology support EPS
AE_WUI_{t-1}	0.0098 (0.0062)	0.0180** (0.0079)	-0.0100 (0.0106)	0.0204 (0.0156)
$EMDE\_WUI_{t-1}$	0.0005 (0.0067)	0.0038 (0.0096)	0.0124 (0.0119)	−0.0242 (0.0168)
Observations	13,988	6456	4304	3228
R-squared	0.076	0.078	0.080	0.072
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES

Notes: The table shows the response of the Environmental Policy Stringency (EPS) index and its sub-categories to a 1-standard deviation increase in the World Uncertainty Index (WUI), interacted with dummy variables for Advanced Economies (AE) and Emerging Market and Developing Economies (EMDE). The regressions include a one-period lag of the dependent variable (either the EPS index or its sub-categories), as well as country-policy and policy-year fixed effects. The estimates are based on a sample of 37 countries over the period 1990–2020. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A21

The impact of the World Uncertainty Index on the aggregate EPS index: a non-linear approach on full democracies.

Variables	(1)	(2)	(3)	(4)
WUI_{t-1}	0.0643	0.0126	0.0197**	0.0820*
	(0.0401)	(0.0081)	(0.0078)	(0.0420)
$Seatshare\_WUI_{t-1}$	−0.0009			−0.0011
	(0.0007)			(0.0007)
$Pres\_WUI_{t-1}$		−0.0224		−0.0272
		(0.0202)		(0.0204)
$Recession\_WUI_{t-1}$			−0.0605***	−0.0569***
			(0.0184)	(0.0183)
Observations	8645	8645	8645	8645
R-squared	0.094	0.093	0.094	0.095
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
Full-Democracies	YES	YES	YES	YES

Notes: The table shows the response of the EPS index to a 1-standard deviation increase in the World Uncertainty Index (WUI), as well as its interaction with seat-share of government (first column), a dummy for presidential systems (second column), and a dummy for recessions (third column). In column 4, all mediating variables are included together. Estimates are based on Eq. (4). The model also includes each mediating variable alone, with a one-period lag, a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. The analysis focuses on full democracies, i.e., countries with a Polity5 index score of 10. The estimates are based on a sample of 37 countries over the period 1990–2020. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A22

The impact of the World Uncertainty Index on non-market-based EPS index: a non-linear approach on full democracies.

Variables	(1)	(2)	(3)	(4)
WUI_{t-1}	0.0762	−0.0151	0.00276	0.0627
	(0.0874)	(0.0115)	(0.0112)	(0.0810)
$Seatshare\_WUI_{t-1}$	−0.0015			−0.0012
	(0.0016)			(0.0015)
$Pres\_WUI_{t-1}$		0.0389		0.0328
		(0.0467)		(0.0445)
$Recession\_WUI_{t-1}$			−0.0749**	−0.0730**
			(0.0287)	(0.0281)
Observations	2660	2660	2660	2660
R-squared	0.103	0.103	0.104	0.105
Country-Sector FE	YES	YES	YES	YES

(*continued on next page*)

Table A22 (*continued*)

Variables	(1)	(2)	(3)	(4)
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
Full-Democracies	YES	YES	YES	YES

Notes: The table shows the response of non-market-based EPS index to a 1-standard deviation increase in the World Uncertainty Index (WUI), as well as its interaction with seat-share of government (first column), a dummy for presidential systems (second column), and a dummy for recessions (third column). In column 4, all mediating variables are included together. Estimates are based on Eq. (4). The model also includes each mediating variable alone, with a one-period lag, a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. The analysis focuses on full democracies, i.e., countries with a Polity5 index score of 10. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A23
The impact of the World Uncertainty Index on technology-support EPS index: a non-linear approach on full democracies.

Variables	(1)	(2)	(3)	(4)
WUI_{t-1}	−0.0588	0.0231	0.0223	−0.0200
	(0.0882)	(0.0247)	(0.0230)	(0.0999)
$Seatshare\_WUI_{t-1}$	0.0014			0.0009
	(0.0017)			(0.0018)
$Pres\_WUI_{t-1}$		−0.0677		−0.0610
		(0.0468)		(0.0486)
$Recession\_WUI_{t-1}$			−0.0428	−0.0404
			(0.0541)	(0.0549)
Observations	1995	1995	1995	1995
R-squared	0.087	0.085	0.085	0.088
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
Full-Democracies	YES	YES	YES	YES

Notes: The table shows the response of technology-support EPS index to a 1-standard deviation increase in the World Uncertainty Index (WUI), as well as its interaction with seat-share of government (first column), a dummy for presidential systems (second column), and a dummy for recessions (third column). In column 4, all mediating variables are included together. Estimates are based on Eq. (4). The model also includes each mediating variable alone, with a one-period lag, a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. The analysis focuses on full democracies, i.e., countries with a Polity5 index score of 10. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A24
The impact of the World Uncertainty Index on market-based EPS index: a non-linear approach focusing on non-full democracies.

Variables	(1)	(2)	(3)	(4)
WUI_{t-1}	0.0695	−0.0065	0.0031	0.0729
	(0.0712)	(0.0255)	(0.0103)	(0.0722)
$Seatshare\_WUI_{t-1}$	−0.0012			−0.0015
	(0.0012)			(0.0012)
$Pres\_WUI_{t-1}$		0.0097		0.0199
		(0.0298)		(0.0314)
$Recession\_WUI_{t-1}$			−0.0042	0.0002
			(0.0190)	(0.0177)
Observations	2010	2010	2016	2010
R-squared	0.100	0.099	0.101	0.103
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
Full-Democracies	NO	NO	NO	NO

Notes: The table shows the response of market-based EPS index to a 1-standard deviation increase in the World Uncertainty Index (WUI), as well as its interaction with seat-share of government (first column), a dummy for presidential systems (second column), and a dummy for recessions (third column). In column 4, all mediating variables are included together. Estimates are based on Eq. (4).The model also includes each mediating variable alone, with a one-period lag, a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. The analysis focuses on full democracies, i.e., countries with a Polity5 index score of 10. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A25
The impact of the World Uncertainty Index on the aggregate EPS index: a non-linear approach focusing on non-full democracies.

Variables	(1)	(2)	(3)	(4)
WUI_{t-1}	0.0491	−0.0155	0.0075	0.0396
	(0.0472)	(0.0177)	(0.0085)	(0.0483)
$Seatshare\_WUI_{t-1}$	−0.0008			−0.001
	(0.0008)			(0.0007)

(*continued on next page*)

Table A25 (*continued*)

Variables	(1)	(2)	(3)	(4)
$Pres\_WUI_{t-1}$		0.0304		0.0355
		(0.0211)		(0.0216)
$Recession\_WUI_{t-1}$			−0.0064	−0.0024
			(0.0186)	(0.0184)
Observations	4355	4355	4368	4355
R-squared	0.077	0.078	0.077	0.078
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
Full-Democracies	NO	NO	NO	NO

Notes: The table shows the response of the aggregate EPS index to a 1-standard deviation increase in the World Uncertainty Index (WUI), as well as its interaction with seat-share of government (first column), a dummy for presidential systems (second column), and a dummy for recessions (third column). In column 4, all mediating variables are included together. Estimates are based on Eq. (4). The model also includes each mediating variable alone, with a one-period lag, a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. The analysis focuses on full democracies, i.e., countries with a Polity5 index score of 10. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A26
The impact of the World Uncertainty Index on the non-market-based EPS index: a non-linear approach focusing on non-full democracies.

Variables	(1)	(2)	(3)	(4)
WUI_{t-1}	0.0980*	−0.0087	0.0211	0.0633
	(0.0560)	(0.0278)	(0.0133)	(0.0561)
$Seatshare\_WUI_{t-1}$	−0.0014			−0.0012
	(0.0009)			(0.0009)
$Pres\_WUI_{t-1}$		0.0405		0.0354
		(0.0301)		(0.0330)
$Recession\_WUI_{t-1}$			−0.0405	−0.0381
			(0.0388)	(0.0397)
Observations	1340	1340	1344	1340
R-squared	0.069	0.069	0.078	0.080
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
Full-Democracies	NO	NO	NO	NO

Notes: The table shows the response of the non-market-based EPS index to a 1-standard deviation increase in the World Uncertainty Index (WUI), as well as its interaction with seat-share of government (first column), a dummy for presidential systems (second column), and a dummy for recessions (third column). In column 4, all mediating variables are included together. Estimates are based on Eq. (4). The model also includes each mediating variable alone, with a one-period lag, a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. The analysis focuses on full democracies, i.e., countries with a Polity5 index score of 10. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A27
The impact of the World Uncertainty Index on technology-support EPS index: a non-linear approach focusing on non-full democracies.

Variables	(1)	(2)	(3)	(4)
WUI_{t-1}	−0.0481	−0.0519	−0.0061	−0.0530
	(0.125)	(0.0460)	(0.0267)	(0.129)
$Seatshare\_WUI_{t-1}$	0.0007			−0.0002
	(0.0022)			(0.0019)
$Pres\_WUI_{t-1}$		0.0636		0.0751
		(0.0588)		(0.0569)
$Recession\_WUI_{t-1}$			0.0337	0.0402
			(0.0513)	(0.0521)
Observations	1005	1005	1008	1005
R-squared	0.076	0.077	0.081	0.084
Country-Sector FE	YES	YES	YES	YES
Sector-Year FE	YES	YES	YES	YES
Initial EPS index	YES	YES	YES	YES
Full-Democracies	NO	NO	NO	NO

Notes: The table shows the response of the technology-support EPS index to a 1-standard deviation increase in the World Uncertainty Index (WUI), as well as its interaction with seat-share of government (first column), a dummy for presidential systems (second column), and a dummy for recessions (third column). In column 4, all mediating variables are included together. Estimates are based on Eq. (4). The model also includes each mediating variable alone, with a one-period lag, a one-period lag of the dependent variable, as well as country-policy and policy-year fixed effects. The analysis focuses on full democracies, i.e., countries with a Polity5 index score of 10. The estimates are based on a sample of 37 countries over the period 1990–2020. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A28
The effects of EPS and its sub-components on popular support of the government, including interactions with the World Uncertainty Index.

Variables	(1)	(2)	(3)	(4)
EPS	−0.116***			
	(0.0216)			
WUI_EPS	0.0895*			
	(0.0431)			
EPSMKT		−0.110**		
		(0.0447)		
WUI_EPSMKT		0.188**		
		(0.0668)		
EPSNMKT			−0.0491***	
			(0.0138)	
WUI_EPSNMKT			0.0354	
			(0.0384)	
TECHSUP				−0.0327***
				(0.00931)
WUI_TECHSUPP				0.0320
				(0.0236)
WUI	−0.378**	−0.427**	−0.337	−0.246**
	(0.166)	(0.156)	(0.200)	(0.109)
Observations	740	740	740	740
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Notes. The table reports the response of the (log of) political support to an increase in the OECD EPS index and its sub-components, including their interactions with the World Uncertainty Index (WUI). Regressions include country and year fixed effects. Estimates are based on Eq. (13), on a sample of 37 countries over the period 2001–2020.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.eneco.2026.109308.

References

Ahir, H., Bloom, N., Furceri, D., 2022. The world uncertainty index. In: NBER Working Paper Series, 29763.
Alesina, A., Cukierman, A., 1990. The politics of ambiguity. Q. J. Econ. 105 (4), 829–850.
Alesina, A., Drazen, A., 1991. Why are stabilizations delayed? Am. Econ. Rev. 81 (5), 1170–1188.
Baker, S.R., Bloom, N., David, S.J., 2016. Measuring economic policy uncertainty. Q. J. Econ. 131 (4), 1593–1636.
Baker, S.R., Bloom, N., Terry, S.J., 2023. Using disasters to estimate the impact of uncertainty. Rev. Econ. Stud. 91 (2), 720–747.
Baldwin, E., Carley, S., Nicholson-Crotty, S., 2019. Why do countries emulate each other's policies? A global study of renewable energy policy diffusion. World Dev. 120 (3), 29–45.
Barrero, J.M., Bloom, N., Wright, I., 2017. Short and long run uncertainty. In: NBER, Working Paper 23676.
Bernanke, B.S., 1983. Irreversibility, uncertainty, and cyclical investment. Q. J. Econ. 98 (1), 85–106.
Bettarelli, L., Yarveisi, K., 2023. Climate change policies and emissions in European regions: disentangling sources of heterogeneity. Reg. Stud. Reg. Sci. 10 (1), 723–734.
Bettarelli, L., Furceri, D., Pizzuto, P., Shakoor, N., 2024a. Climate change policies and income inequality. Energy Policy 191 (2024), 114176.
Bettarelli, L., Furceri, D., Pizzuto, P., Yarveisi, K., 2024b. Crises and energy markets reforms. Energy Econ. 136 (2024), 107706.
Bettarelli, L., Furceri, D., Pizzuto, P., Shakoor, N., 2024c. Uncertainty and innovation in renewable energy. J. Int. Money Financ. 149 (2024), 103202.
Bettarelli, L., Furceri, D., Pisano, L., Pizzuto, P., 2025. Greenflation: empirical evidence using macro, regional and sectoral data. Eur. Econ. Rev. 174, 104983.
Bhattacharya, U., Hsu, P.H., Tian, X., Xu, Y., 2017. What affects innovation more: policy or policy uncertainty? J. Financ. Quant. Anal. 52 (5), 1869–1901.
Binder, A.S., 2003. Stalemate: Causes and Consequences of Legislative Gridlock. Brookings Institution Press.
Binder, C.C., 2017. Measuring uncertainty based on rounding: new method and application to inflation expectations. J. Monet. Econ. 90, 1–12.
Binder, C., McElroy, T.S., Sheng, X.S., 2022. The term structure of uncertainty: new evidence from survey expectations. J. Money Credit Bank. 54 (1), 39–71.
Bloom, N., 2009. The impact of uncertainty shocks. Econometrica 77 (3), 623–685.
Bonfiglioli, A., Gancia, G., 2013. Uncertainty, electoral incentives and political myopia. Econ. J. 123 (568), 373–400.
Bonfiglioli, A., Grino, R., Gancia, G., 2022. Economic uncertainty and structural reforms: evidence from stock market volatility. Quant. Econ. 13, 467–504.
Botta, E., Koźluk, T., 2014. Measuring environmental policy stringency in OECD countries. In: OECD Economics Department Working Papers, 1177.
Brand, C., Günter, C., Hutchinson, J., Saint Guilhem, A., 2023. How Will Higher Carbon Prices Affect Growth and Inflation? The ECB blog.
Bruno, M., Easterly, W., 1996. Inflation's children: tales of crises that beget reforms. Am. Econ. Rev. 86 (2), 213–217.
Burke, M., Hsiang, S.M., Miguel, E., 2015. Global non-linear effect of temperature on economic production. Nature 235–239.
Caggiano, G., Castelnuovo, E., Figueres, J.M., 2017. Economic policy uncertainty and unemployment in the United States: a nonlinear approach. Econ. Lett. 151, 31–34.
Caldara, D., Iacoviello, M., 2022. Measuring Geopolitical Risk. Board of Governors of the Federal Reserve, International Finance Discussion Papers 1222r1.
Cason, T.N., Mui, V.L., 2003. Testing political economy models of reform in the laboratory. Am. Econ. Rev. 93 (2), 208–212.
Ciminelli, G., Furceri, D., Ge, J., Ostry, J.D., Papageorgiou, C., 2019. The political costs of reforms: fear or reality?. In: IMF Staff Discussion Note, 19(08).
Dabla-Norris, E., Khalid, S., Magistretti, G., Sollaci, A., 2023. Public support for climate change mitigation policies: a cross-country survey. In: IMF Working Paper.
Desilver, D., 2019. Despite Global Concerns about Democracy, More than Half of Countries Are Democratic. Pew Research Center.
Dixit, A., Pindyck, R., 1994. Investment under Uncertainty. Princeton University press.
Dolphin, G., Merkle, M., 2024. Emission-weighted carbon price: sources and methods. Scientific Data 11, 1017. https://doi.org/10.1038/s14597-024-03121-6.
Drazen, A., Easterly, W., 2001. Do crises induce reform? Simple empirical tests of conventional wisdom. Econ. Polit. 13 (2), 129–157.
Drazen, A., Grilli, V., 1993. The benefits of crises for economic reforms. Am. Econ. Rev. 83 (3), 598–607.
Fankhauser, S., Gennaioli, C., Collins, M., 2016. Do international factors influence the passage of climate change legislation? Clim. Pol. 1752–7457.
Fernandez, R., Rodrik, D., 1991. Resistance to reform: status quo bias in the presence of individual-specific uncertainty. Am. Econ. Rev. 81 (5), 1146–1155.
Fischer, C., Newell, R.G., 2008. Environmental and technology policies for climate mitigation. J. Environ. Econ. Manag. 55 (2), 142–162.
Furceri, D., Ganslmeier, M., Ostry, J., 2023. Are climate change policies politically costly? Energy Policy 178.
Gilchrist, S., Sim, J.W., Zakrajšek, E., 2014. Uncertainty, financial frictions, and investment dynamics. In: NBER, Working Paper 20038.
Gokmen, G., Onorato, M.G., Nannicini, T., Papageorgiou, C., 2019. Policies in hard times: assessing the impact of financial crises on structural reforms. Econ. J. 131 (638), 2529–2552.
IPCC, 2018. Summary for policymakers. In: Global Warming of 1.5°C. Cambridge University Press, Cambridge, UK and New York, NY, USA. https://doi.org/10.1017/9781009157940.001.
Jo, S., Sekkel, R., 2019. Macroeconomic uncertainty through the lens of professional forecasters. J. Bus. Econ. Stat. 37 (3), 436–446.
Jurado, K., Ludvigson, S.C., Ng, S., 2013. Measuring uncertainty. In: NBER, Working Paper 19456.

Kammerer, M., Namhata, C., 2018. What drives the adoption of climate change mitigation policy? A dynamic network approach to policy diffusion. Policy. Sci. 51 (4).
Kousky, C., 2014. Informing climate adaptation: a review of the economic costs of natural disasters. Energy Econ. 46, 576–592.
Laeven, L., Valencia, F., 2012. Systemic banking crises database: an update. In: IMF Working Paper, 12/163.
Leahy, J.V., Whited, T.M., 1996. The effect of uncertainty on investment: some stylized facts. J. Money Credit Bank. 28 (1), 64–83.
Lin, Y., Dong, D., Wang, J., 2021. The negative impact of uncertainty on R&D investment: international evidence. Sustainability 13 (5), 1–21.
Mahmalat, M., Curran, D., 2017. Do crises induce reform? A critical review of conception, methodology and empirical evidence of the 'crisis hypothesis'. J. Econ. Surv. 32 (3), 579–960.
Markkanen, S., Anger-Kraavi, A., 2019. Social impacts of climate change mitigation policies and their implications for inequality. Clim. Pol. https://doi.org/10.1080/14693062.2019.1596873.
Marshall, M.G., Gurr, T.R., 2020. Polity 5: Political Regime Characteristics and Transitions, 1800–2018 Dataset Users' Manual. Center for Systemic Peace.
Mian, A., Sufi, A., Trebbi, F., 2014. Resolving debt overhang: political constraints in the aftermath of financial crises. Am. Econ. J. Macroecon. 6 (2), 1–28.
Myers, S.C., 1977. Determinants of corporate borrowing. J. Financ. Econ. 5 (2), 147–175.
OECD, 2022. Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate Action, OECD Series on Carbon Pricing and Energy Taxation. OECD Publishing, Paris. https://doi.org/10.1787/e9778969-en.
Orlov, A., Aaheim, A., 2017. Economy-wide effects of international and Russia's climate policies. Energy Econ. 68, 466–477.
Potter, A., 2018. What drives opposition to economic reforms? The role of ex ante uncertainty. Polit. Res. Q. 71 (3), 560–572.
Rogoff, K., 1990. Equilibrium political budget cycles. Am. Econ. Rev. 80 (1), 21–36.
Scartascini, C., Cruz, C., Keefer, P., 2021. The Database of Political Institutions 2020 (DPI2020). Inter-American Development Bank, Washington.
Sheen, J., Wang, B.Z., 2021. Measuring macroeconomic disagreement – a mixed frequency approach. J. Econ. Behav. Organ. 189, 547–566.
Simon, M., 2023. Key predictors for climate policy support and political mobilization: the role of beliefs and preferences. PLOS Clim 2 (8), e0000145. https://doi.org/10.1371/journal.pclm.0000145.
Steinebach, Y., Fernandez-i-Marin, X., Aschenbrenner, C., 2021. Who puts a price on carbon, why and how? A global empirical analysis of carbon pricing policies. Clim. Pol. 21 (3), 277–289.
Stern, N., 2008. The economics of climate change. Am. Econ. Rev. 98 (2).
Umit, R., Schaffer, R.M., 2020. Attitudes towards carbon taxes across Europe: the role of perceived uncertainty and self-interest. Energy Policy 140 (2020), 111385.
Wang, Q.-J., Sharma, S.S., Guo-Hua, N., Chang, C.-P., 2024. Governance, energy utilization and environmental protection: role of extreme events. Energy Econ. 136, 107765.