Information and Climate (In)action*

Justin Melnick†

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Abstract

Motivated by three empirical regularities — the growing adoption of climate laws, cross-national policy complementarities, and variation in information disclosed by interest groups about climate change — this paper proposes a formal model exploring how misreporting by anti-climate special interests affects prospects for international and domestic climate policy. Uncertainty about climate change's severity facilitates the strategic dissemination of information by these groups, which can influence public perceptions and discourage reform. The analysis demonstrates that higher rates of misreporting decrease the likelihood of climate action, but that strategic misreporting is most prevalent when climate risks are perceived as moderate. Finally, the model reveals that countries' climate policies act as strategic complements in equilibrium, where misreporting in one country affects others through informational spillovers, explaining both global inaction as well as unilateral climate action. These informational results run counter to traditional theories of collective action in which climate policies are strategic substitutes.

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†Ph.D. Candidate, Department of Politics, New York University. Contact: melnickj@nyu.edu and justinmelnick.github.io.

Uncertainty is a defining characteristic of climate change, given the vast spatiotemporal scope and unpredictable intensity of its effects. These uncertainties shape the political response to climate change (Balcazar and Kennard 2023; Gazmararian and Milner 2024*a*;*b*), as they affect perceptions of welfare losses and economic damages (Cruz and Rossi-Hansberg 2024). Formulating policies to combat climate change requires both politicians and citizens to form beliefs about their vulnerability to climate risks, and to evaluate whether and how such risks justify policy intervention (Goulder and Parry 2008; Blanchard, Gollier and Tirole 2023). A crucial determinant of these beliefs is the information disseminated by special interest groups that stand to lose from climate reform; upward of 60% of historical global carbon dioxide and methane emissions can be traced to 90 oil and gas companies (Heede 2014; Ekwurzel et al. 2017), which possess resource reserves that would yield significant profits but intensify climate change (Green et al. 2022). Interest groups have orchestrated global informational campaigns aimed at distorting public understanding of climate change and dissuading support for large-scale environmental regulations, such as those targeting fossil fuel production and consumption (Antonio and Brulle 2011; Brulle 2014). As the informational landscape evolves, so too do public perceptions and political responses.

This paper's central task is to propose a formal model that explains variation in climate policymaking by positing a novel causal mechanism, changes in the *informational environment*. Three empirical regularities, for which I provide descriptive analysis, motivate the theory. First, the adoption of climate laws has increased substantially over time as the scientific consensus about global environmental vulnerabilities has sharpened. Second, countries appear to enact these laws simultaneously and do so without undercutting each other's ambition or stringency, suggesting effort complementarities in policy across nations. Third, the information disclosed by special interests about the threat of climate change has varied over time; many of these groups initially exploited the uncertainty inherent to climate change in order to stymie climate action (Oreskes and Conway 2011), but ultimately acknowledged environmental harms. These first two facts are particularly counterintuitive from the viewpoint of extant theoretical approaches that emphasize collective action problems inherent to climate policymaking, which would predict that, given temptations to free ride, cross-national efforts to address climate change are strategic substitutes (Ostrom 1990; Stern 2007; Bernauer 2013; Keohane and Victor 2016; Kennard and Schnakenberg 2023). Moreover, while environmental policies have surged, the structure of the collective action problem surrounding the climate dilemma has *ceteris paribus* remained fixed over time — it continues to be true that policies to curb national emissions are individually costly but contribute to a global benefit — thereby suggesting the need for greater theoretical innovation to explain variation in climate policymaking, proffered by the third empirical regularity.

To interrogate the effects of information on climate policymaking, I develop a formal model of both domestic and international climate policy that explicitly incorporates climate-related uncertainties and the strategic dissemination of information by special interests. I begin from first principles by building a microfoundation of domestic climate policy before expanding to a model of international coordination. At the domestic level, I extend a canonical electoral accountability framework (Canes-Wrone, Herron and Shotts 2001) by incorporating a special interest group that strategically designs information (Austen-Smith 1998; Kamenica and Gentzkow 2011; Bergemann and Morris 2019) aimed at deterring climate action. While these special interests possess accurate knowledge about environmental harms, they may "misreport" this information to the public, capitalizing on uncertainty about the severity of climate risks.

I present three main results linking climate policymaking to the informational environment. First, a higher incidence of misreporting by special interests disincentivizes politicians from pursuing climate reforms. This reduced-form relationship works through voter beliefs. Aware that the information they receive is strategically manipulated to promote inaction (Alonso and Padró i Miquel 2023), voters nevertheless form *rational* beliefs that climate action may be unwarranted. In equilibrium, climate reforms can become electorally costly when misreporting distorts voter perceptions of the environmental threat.

Second, by endogenizing special interest behavior, I examine how the optimal level of misreporting depends on downstream policymaking. Special interest groups seek to minimize the probability of climate action, but misreporting is costly. I find that misreporting is most prevalent when the perceived severity of climate risks is intermediate, as uncertainty can be exploited most effectively. Counterintuitively, this relationship is nonmonotonic. If perceived risks are low, special interests need not invest in the infrastructure to misreport because climate action is unlikely. Conversely, as expectations about climate vulnerabilities increase, the need to misreport heightens in order to counteract the possibility of climate reforms; rates of misreporting increase until it becomes too costly to do so, at which point special interests become more truthful, leading to more climate action.

Finally, the third finding highlights how domestic informational environments shape international climate policy. The asymmetry of information across countries — e.g., politicians have differing knowledge of climate severity and face varying levels of misreporting — explains the heterogeneous adoption of climate reforms. Moreover, I identify a phenomenon of *informational spillovers*, when information distortions in one country undermine climate efforts worldwide. These results emanate from a strategic complementarity in politicians' pursuits of climate reforms cross-nationally, which runs contrary to the conventional accounts of international climate cooperation in the literature where policies are thought of as strategic substitutes. This theoretical approach has empirical purchase because it accounts for both continued collective inaction, one of the main takeaways from the extant literature, and instances of unilateral climate action, a novel addition to our understanding of climate policy implementation. It also pinpoints the stasis in climate policymaking to the proliferation of misreporting in countries like the United States, ultimately stagnating global climate action.

By foregrounding variation in the informational environment, this paper helps to illuminate the contours of the ongoing green transition. When assessments of expected vulnerability are low, the probability of climate reform is also low, and misreporting is minimal. As these assessments shift over time, special interests alter their strategies, seeking to delay policy responses. However, the costs of sustained misreporting eventually outweigh its benefits, leading to a more accurate portrayal of climate risks by special interests and a subsequent acceleration in climate policymaking.

Contribution

This paper's theoretical argument makes several contributions to our understanding of the political economy of climate change by probing the incentives of individual citizens, special interests, and policymakers at the domestic and international levels. Primarily, the paper innovates by developing an alternative theoretical framework to explain global climate policymaking that is both domestically microfounded (cf. Battaglini and Harstad 2020; Hagen and Schopf 2024; Melnick and Smith 2024) and internationally novel. Conventional wisdom claims that global climate cooperation efforts are dominated by free-riding concerns as carbon emissions or abatement efforts are often viewed cross-nationally as strategic substitutes (Barrett 2003; Kennard and Schnakenberg 2023). My argument does not rely on free-riding incentives in order to explain the dearth of climate action observed globally, instead pointing to information and uncertainty as obstacles to policymaking. Moreover, by endogenizing features of the informational environment, and positing a structure of strategic complementarities, my argument can go beyond traditional collective action explanations of climate action to explore the emergence of and variation in political responses to climate change across the globe.

A common explanation for the rise in global climate action, which sidesteps collective action challenges, posits that the distributional conflicts generated by climate reforms offer political advantages for domestic incumbents. The literature suggests that policy implementation inherently creates domestic winners and losers, meaning environmental reforms need not be scoped by collective action concerns (Aklin and Mildenberger 2020), pointing instead to factors like electoral institutions (Lipscy 2018; Finnegan 2022), special interest influence (Mildenberger 2020; Stokes 2020), and sectoral conflicts (e.g., Aklin and Urpelainen 2013; Cheon and Urpelainen 2013; Hughes and Urpelainen 2015) as shapers of climate policymaking. This paper argues that uncertainty surrounding the climate crisis renders policy responses malleable, as the delineation between winners and losers shifts depending on the policy instrument. Additionally, this uncertainty makes finding the appropriate policy response to climate change less clear, which can animate distributive conflict and may be exacerbated by strategic messaging from special interests. For example, if true climate vulnerabilities were known, more efficient policy bargains could be negotiated by distributing abatement costs more easily or by compensating climate losers (cf. Gazmararian and Tingley 2023; Bolet, Green and González-Eguino 2024). Thus, this theory presents a complementary argument, positioning distributional concerns within the broader context of informational constraints. The emergence of distributional conflict, I argue, can be a consequence of uncertainty surrounding climate change, which requires that we study the effects of information on climate policy.

Additionally, this paper sheds theoretical light on an understudied role of special interests: communication to the public. Public messaging is a complementary activity for special interests to other political behavior like lobbying, often undertaken to slow climate action (Kim, Urpelainen and Yang 2016; Brulle 2018; 2021; Cory, Lerner and Osgood 2021). Empirical work on climate misinformation or greenwashing has identified how climate losers may promote doubt or denialism in order to stymie climate action (e.g., Oreskes and Conway 2011; Frumhoff, Heede and Oreskes 2015; Supran 2022). Extant theoretical literature considers how interest groups interface with politicians through informational lobbying (e.g., Schnakenberg 2017; Schnakenberg and Turner 2024; Zerbini 2024) or quid pro quo contributions, either to delay climate action (Brulle 2014) or even lobby in favor of climate regulations (Kennard 2020). Conversely, this paper studies how special interests design information targeted at *citizens* to affect their beliefs about the need for climate action — which in equilibrium affects the implementation of climate policy through politicians' incentives for reelection — and, in particular, studies their optimal communication strategy. Intuition may suggest that an anti-climate interest group like a fossil fuel company would consistently disseminate information aimed at undermining climate action. However, I identify conditions under which such a group may strategically choose to convey truthful messages about the severity of climate change. This aligns with empirical observations of a shift in messaging from climate-opposed actors, who increasingly acknowledge the threats posed by climate change (Green et al. 2022; Williams et al. 2022).

My theoretical framework also speaks to literatures spanning mass climate attitudes and the electoral effects of climate policy implementation. In particular, I provide a fully-microfounded model in which individuals receive information about the effects of climate change, and such information is relevant to their voting behavior through their updated *beliefs* about climate-related uncertainties (rather than arguing for a wholesale change in policy preferences). Observational empirical evidence on whether voters reward or punish climate policies at the ballot box is mixed (e.g., Stokes 2016; Urpelainen and Zhang 2022; Bolet, Green and González-Eguino 2024; Colantone et al. 2024; Gazmararian 2024; Voeten 2024), so the model helps to unpack why citizens may believe climate change is an important problem but not necessarily hold politicians accountable for their lack of action.

Motivation

To elaborate on the argument, I provide descriptive analysis to establish three stylized facts: (1) the scope and ambition for climate policymaking has increased over time, (2) countries' adoption of climate laws and the stringency of their subsequent policy commitments have been complementary, and (3) the messaging strategies pursued vis-à-vis the disclosure of truthful information about climate change by special interests have varied over time. These stylized facts help to bolster the empirical plausibility of the formal model and to provide insights into the theoretical mechanisms at play. It should be noted that while information, the primary explicator of interest, is unobserved, and thus measuring what actors know at each point in time is not possible, we can still document variation in observed outcomes, which the theory can jointly explain.

Figure 1 plots data from the Climate Change Laws of the World project (Nachmany et al. 2017).[1] It demonstrates that since 1990, the number of climate laws enacted across the globe is steadily increasing, and this trend is consistent across all regions of the world. Normalizing by number of adopting countries (see Figure A.4), a nation on average moves from adopting 1.4 laws in 1990 to 4.4 laws by 2020.

While countries have adopted more climate laws over time in the aggregate, we may be worried that nations are shirking in their effort or level of ambition on the margins, a feature of the canonical free-riding account of global climate cooperation. This argument casts policy actions as strategic substitutes (Kennard and Schnakenberg 2023), and predicts that climate ambitions should be negatively correlated across countries. This is probed in Figure 2, which plots the OECD's Environmental Policy Stringency Index (Botta and Koźluk 2014; Kruse et al. 2022) over time for 40 countries.[2] The majority of countries in the sample have a positive trend in their policy stringency, meaning that countries' approaches to addressing climate change are becoming more ambitious. Moreover, inspection of Figure 2, as well as estimated correlations across countries

[1] The data covers 198 countries plus the European Union, which I examine between 1990 and 2023 in three-year rolling averages. To be included as a law, a document must have full legal force or set out a current set of government policy objectives motivated by climate change.

[2] The data covers 40 countries between 1990 and 2020 and the index ranges from 0 to 6, which greater values meaning greater stringency. Stringency is defined as the ability to explicitly or implicitly place a price on pollution through market-based (taxes, trading schemes, feed-in tariffs, and deposit and refund schemes) and non-market policies (command-and-control standards and subsidies). I also examine the Climate Actions and Policies Measurement Framework (Nachtigall et al. 2024), which is based on the OECD EPS. See Figure A.6 in the appendix.

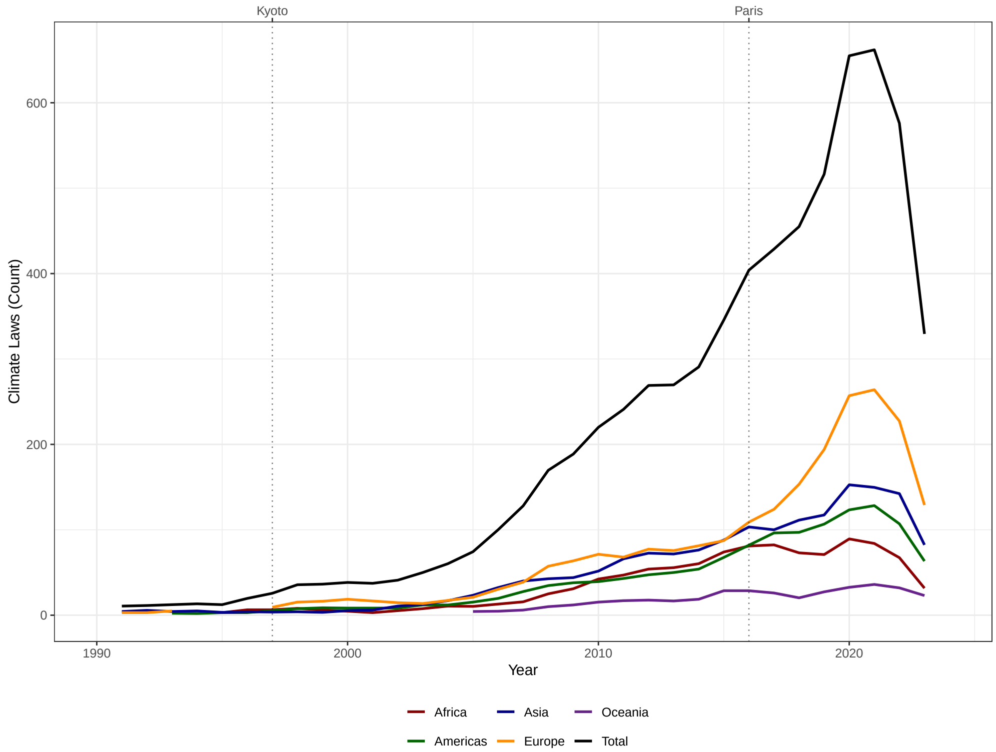

Figure 1: Count of Climate Laws over Time

displayed in Figure A.5, reveals that policy stringency is *positively* correlated across countries, which is inconsistent with prevailing theoretical accounts of strategic substitution. One explanation consistent with this data is a complementarity across countries in their national climate measures, and my theoretical framework pinpoints a novel causal mechanism to explain these potential complementarities in international environmental policymaking: shifts in the information disseminated about the threat of climate change.

The third empirical regularity I rely on is that, as the scientific consensus around climate change has evolved over time, thereby shifting public expectations about vulnerabilities to the climate threat, special interests have shifted the information that they disclose. As an example, Figure 3 displays a timeline of relevant events pertaining to Exxon's disclosure of climate-related information.[3] It is clear that over time, Exxon's messaging strategy has shifted several times. In the late 1970s and early 1980s, Exxon's scientists truthfully communicated the possibility of a climate crisis based on the combustion of fossil fuels and the release of greenhouse gases. However, this changed in the late 1990s and early 2000s, when Exxon exploited

[3]Exxon's corporate-branded documents are not the only means through which it communicated with the public. The company also projected its desired message through organizations like the American Enterprise Institute, the Competitive Enterprise Institute, and the Cato Institute that actively oppose mandatory action on global warming as well as many other environmental standards (Union of Concerned Scientists 2007).

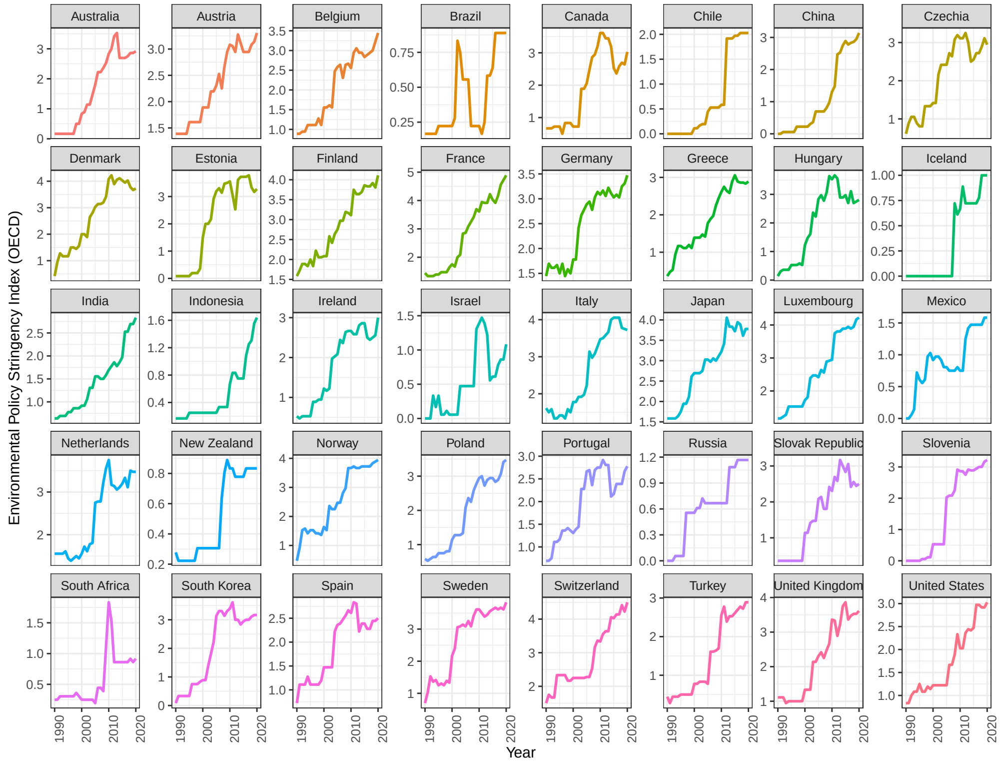

Figure 2: Environmental Policy Stringency over Time

the uncertainty inherent to climate change, orchestrating a public campaign to convince citizens that climate change did not warrant broad policy action. While one would expect Exxon to downplay the effects of climate change because policy reforms would run counter to its interests, the company again shifted its messaging in 2014 when it publicly acknowledged its role in fostering climate risks. Since then, ExxonMobil has advocated for policy solutions like carbon pricing that both recognize the climate threat and take steps toward solving the problem; this pattern of accepting climate science and policies, even lobbying in favor of climate reforms, has been documented within extant literature (Kennard 2020; Green et al. 2022). To be clear, companies like ExxonMobil continue to disclose information minimizing the climate threat (Supran and Oreskes 2021),[4] but there is a noticeable shift in their rhetoric toward acknowledgment relative to the denialism of the early 2000s (Antonio and Brulle 2011). See the appendix for further details about the sources in the figure.

Exxon's behavior is not unique: other companies pursued similar messaging campaigns to dissuade their publics against climate action internationally. Shell and BP, as well as many other firms through the lobbying

[4]Even after acknowledging threats of climate change, ExxonMobil CEO Rex Tillerson said at the company's annual meeting in 2015 that it would be best to wait for more solid science before acting on climate change, stating "what if everything we do, it turns out our models are lousy, and we don't get the effects we predict?" See https://insideclimatenews.org/news/22102015/exxon-sowed-doubt-about-climate-science-for-decades-by-stressing-uncertainty/.

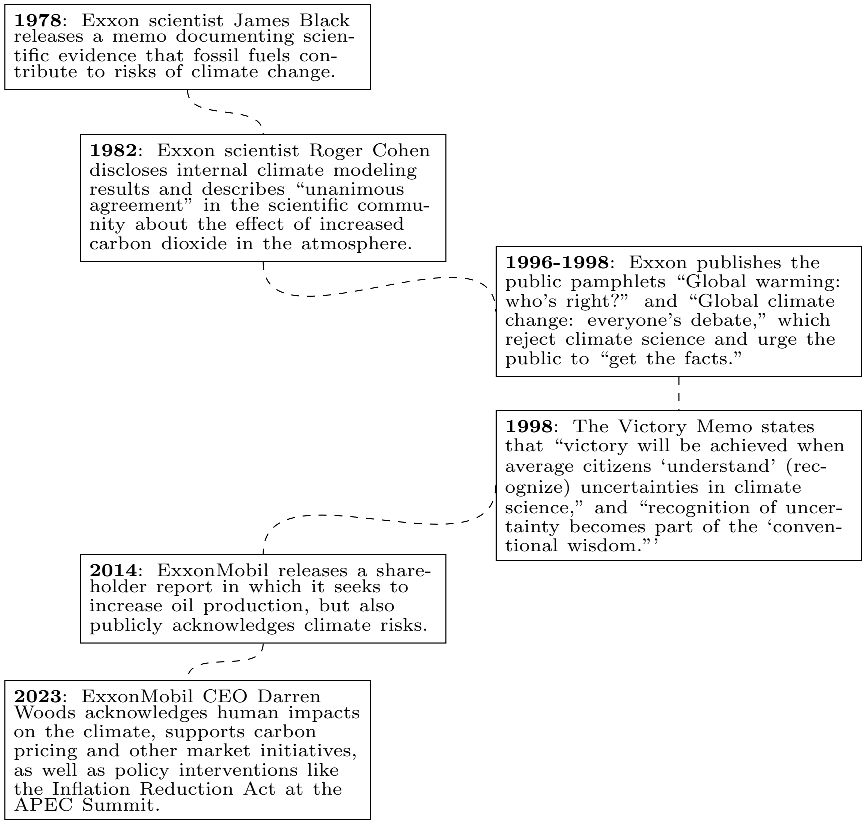

Figure 3: Variation in Exxon's Climate Messaging Over Time

group Global Climate Coalition, produced documents that recognized the well-established scientific basis of increasing greenhouse gas emissions on global climate, but later disseminated information to the public that contradicted these findings. For example, BP's carbon footprint calculator, launched in 2004, sought to individualize responsibility for climate change and minimize the impact of fossil fuel companies on global warming. However, these firms too have transitioned toward more "pro-climate" messaging in recent years (Green et al. 2022); the CEOs of Shell, BP, and several other oil companies publicly expressed support for carbon pricing in 2019,[5] a step toward recognizing the severity of climate change.

I now develop a formal model to link variation in the informational environment to changes in climate policymaking. I first establish domestic microfoundations and demonstrate how messaging strategies by special interests affect the implementation of climate policy and how such campaigns vary over time as a function of expected climate damages. Then I study the prospects for international climate cooperation given these changes in information.

[5] https://www.usnews.com/news/business/articles/2019-06-14/pope-warns-oil-execs-of-need-for-rapid-energy-transition

Model

The model depicts the politics of climate policymaking at home and abroad between two countries, $i = 1, 2$ (also referred to as i and j), which each contain a politician P ("she"), a special interest group S ("it"), and a representative voter V ("he"). There are two policy-relevant states of the world $\omega \in \{0, 1\}$. In simplified terms, ω represents the severity of climate change's effects or the vulnerability of a polity to climate-related damages. Each state of the world carries a "correct" policy response that is commensurate with anticipated environmental harms: state $\omega = 1$ indicates a scenario in which greater climate policy reforms are appropriate because a locality is more vulnerable to climate change's effects, while the case of $\omega = 0$ represents an instance in which the status quo or more modest climate reforms are sufficient. As will be detailed below, players have policy preferences that depend on this underlying state. The true value of ω is unobserved, but players share a common prior that $P(\omega = 1) = \pi \in (0, 1)$, therefore capturing the expected impacts of climate change.

The game begins with the special interest group in each country committing to the design of information about the state of the world ω. This takes the form of an experiment $\mathcal{E}_i(s_i, \omega) = P(s_i|\omega)$, which is a set of probability distributions over possible signals s_i to be transmitted to the voter in their country later in the game where $\mathcal{E}_i(s_i, \omega)$ is the probability that signal s_i is sent in country i when the state of the world is ω under experiment $\mathcal{E}_i(\cdot, \cdot)$. The signal s_i is akin to a report about climate change's severity, which can take on two values $s_i \in \{0, 1\}$, thereby providing the voter with context about ω. Since I focus on the case of an anti-climate interest group like ExxonMobil, S's seeks to convince their domestic public that $\omega = 0$, implying that the correct policy response is to take minimal climate action. Given the incentives of the interest group, as well as the dichotomous nature of the state of the world, the choice of an experiment can be expressed as

$$\mathcal{E}_i(s_i = 0, \omega = 0) = 1. \;\; \mathcal{E}_i(s_i = 1, \omega = 0) = 0.$$
$$\mathcal{E}_i(s_i = 0, \omega = 1) = \beta_i. \;\; \mathcal{E}_i(s_i = 1, \omega = 1) = 1 - \beta_i.$$

Whenever the true state is $\omega = 0$, the group will always send the signal $s_i = 0$. However, if $\omega = 1$, there is some probability $\beta_i \in [0, 1]$ that the special interest in country i reports signal $s_i = 0$. I will therefore refer to β_i as the level or intensity of "misreporting" about the true effects of climate change in country i. Higher values of β_i mean that the special interest is more likely to send the message that climate change warrants minimal action, even though the true state of the world is that climate change poses severe harms. The signal structure implies that the choice of β_i is isomorphic to the choice of the experiment $\mathcal{E}_i(s_i, \omega)$.

S chooses β_i optimally in order to maximize the chances that the politician enacts policy congruent with $\omega = 0$; the group receives a payoff of 1 in this eventuality and zero otherwise (detailed below). Spending resources to develop the capacity to misreport is costly, and comes at a cost $c(\beta_i)$ where $c(\cdot)$ is an increasing and convex cost function where $c(0) = 0$ and $c'(0) = 0$.

After the special interest group has committed to its experiment, the game proceeds into the *climate policy subgame*, which is a variation on Canes-Wrone, Herron and Shotts (2001). Given each β_i, the politicians in each country must take a policy action on climate change, $a_i \in \{0, 1\}$. The action $a_i = 1$ represents broad climate reform or more intensive policies that might regulate the production of fossil fuels, and $a_i = 0$ captures the status quo or minimal policy measures.[6] The politician's action as well as the special interest's signal are observable to the voter who decides whether to retain or replace the politician based on her policy and the special interest's report about the state, $r_i \in \{0, 1\}$.

While climate change's effects remain uncertain, the politician has an informational advantage over the voter because she observes a signal about the state ω, indicating the relative success of potential climate reforms. The precision of this signal varies across politicians; the politician has a private type $\theta_i \in \{0, 1\}$ indicating her "competence." The voter's prior about the politician's competence is $P(\theta_i = 1) = \tau_i \in (0, 1)$. Politicians' types are not known internationally, and I assume that the prior probability that each politician is competent, τ_i and τ_j respectively, is sufficiently high.[7] The signal is formulated as $x_i^\theta = \omega + \nu_i^\theta$ where $\nu_i^\theta \sim G(\cdot)$, has zero mean and admits a log-concave probability density function $g(\cdot)$ with the monotone likelihood ratio property (one example would be the normal distribution, $\nu_i^\theta \sim N(0, \frac{1}{\alpha_\theta})$). I focus on the limiting case where $var(\nu_i^1) = 0 < var(\nu_i^0)$, so a competent politician learns the state perfectly.[8] Let $G(t; \omega) = P(x_i^0 \leq t|\omega)$, be the cumulative distribution of the incompetent type's signal given the value of ω. Since x_i^0 is centered around the true state and $g(\cdot)$ satisfies the monotone likelihood ratio property, this signal is informative relative to the prior (Milgrom 1981), meaning that the incompetent politician has more information about what the "correct" policy choice should be in the face of a potential climate crisis. However, since her signal is not perfect, an incompetent politician must form beliefs about the state, and subsequently about what the correct policy is, based on the signal x_i^0.

The politician and the voter share the same intrinsic policy preferences: each want policy to match the

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[6]Climate reform is costless to implement, and modeling additional costs of implementation would only bias results toward $a_i = 0$.

[7]The assumption on politician competence serves to rule out pandering on behalf of the competent politician, and consequently a pooling equilibrium in which all politicians pursue climate action. See Assumption A.1 and Lemma A.4 in the appendix.

[8]This is without loss of generality, all that is required is that a competent type's signal of ω is more precise than the incompetent type's signal.

state of the world, or $a_i = \omega$, meaning that broad climate reforms are adopted only when it is appropriate to do so. However, since domestic climate policies also reverberate internationally, politicians care about the behavior of other nations; politician i also wants politician j to choose $a_j = \omega$. Everyone needs to "get policy right," which comports with the simplest form of "consensus decisionmaking" pioneered at the United Nations in international climate negotiations. If politicians both match their policy actions to the state of the world, they enjoy a policy payoff normalized to 1. Each politician also cares about remaining in office, and receives a payoff normalized to 1 if the voter reelects her.

Upon announcement of global climate policies, the representative voters in each country observe the triple (a_i, s_i, a_j) and retain or replace their leaders based on their assessments of competence $\mu_i(a_i, s_i, a_j) = P(\theta_i = 1|a_i, s_i, a_j)$. The voter receives a payoff of 1 if he reelects a competent politician and a payoff of zero if he reelects an incompetent politician. If he removes the incumbent, replacing her with a challenger, his payoff is a random draw $\varepsilon_i \sim F(\cdot)$ where $F(\cdot)$ is a known distribution function. This payoff could represent the expected competence of an electoral challenger, and thus the possibility that climate policy will be executed competently in the future, or the value of the incumbent politician on all other electorally salient dimensions that are independent of climate policy. The shape and support of the distribution $F(\cdot)$ modulate how much the voter cares about climate policy relative to other issues, capturing salience as well as structural electoral factors such as partisan asymmetry or incumbency advantages.

For players in country i (country j's are analogous), payoffs can therefore be formalized as follows:

$$u_S = 1 - a_i - c(\beta_i).$$

$$u_P = a_i a_j \omega + (1 - a_i)(1 - a_j)(1 - \omega) + r_i.$$

$$u_V = r_i \theta_i + (1 - r_i)\varepsilon_i.$$

The timing of the game is summarized as follows:

0. Nature randomly draws the state ω.

1. The interest groups in each country commit to signal distributions $\mathcal{E}_i(s_i, \omega)$ by choosing $(\beta_i, \beta_j) \in [0, 1]^2$.

2. The politicians observe signals x_i^θ and choose climate policies, $(a_i, a_j) \in \{0, 1\}^2$.

3. The interest groups' signals $(s_i, s_j) \in \{0, 1\}^2$ and the shocks $(\varepsilon_i, \varepsilon_j) \in \mathbb{R}^2$ are realized. The voters form posterior beliefs $(\mu_i(a_i, s_i, a_j),\ \mu_j(a_j, s_j, a_i) \in [0, 1]^2)$ and choose to retain or replace their politicians, $(r_i, r_j) \in \{0, 1\}^2$.

I examine weak Perfect Bayesian equilibria. A strategy for the special interest group i is a choice of β_i that is a best response to the choice β_j by interest group j given equilibrium behavior in the climate policy subgame. In the subgame, a strategy for politician i is a mapping from her type θ_i and private signal x_i^θ into an action, given beliefs about what she expects politician j to do. The voter's strategy is a reelection rule that is sequentially rational given politician i's policy action, politician j's policy action, interest group i's signal about the state of the world, and the realization of the shock ε_i. Voter i's beliefs about politician i's competence are formed by Bayes's Rule wherever possible.

Comments on and Interpretation of the Model

The model setup makes several simplifying assumptions and thus warrants further discussion mapping theoretical components to relevant empirical elements of the politics of climate change. I elaborate on some of these themes below.

Interpretation of the state and actions. There is a connection between "appropriate" policy responses and the state of the world, which immediately generates distributional conflict between the special interest, which has state-independent preferences, and the politician and voter, who have state-dependent preferences over policy. This conflict arises directly because of the fact that there is uncertainty about what types of policies should be implemented. The state ω and actions a_i, a_j are assumed to be binary, but provide sufficient richness to capture this fundamental tension in climate politics (Colgan, Green and Hale 2021). By way of interpretation, policy $a_i = 0$, which is the preferred choice of the special interest group regardless of the state of the world, might typify minimal climate reforms or even upholding the status quo, or other consumer-facing policies that still allow for the combustion of fossil fuels. Policies that invoke the "individualization of responsibility" fall under this umbrella. Policy $a_i = 1$ would encompass more comprehensive climate policy reform or policies that are more likely to affect production of fossil fuels. One could imagine a model with a continuous state of the world and continuous action space, allowing for more fine-grained interpretations of policy outcomes, but this adds mathematical complexity without providing additional substantive insights.

The special interest and assumptions on information. I model the strategic dissemination of information by a single interest group that opposes climate action, which designs its messaging by pre-specifying an experimental protocol to generate reports on the state of the world. While I focus on a sole anti-climate actor's incentives for tractability, one could interpret s_i as the "net messaging" a voter receives from multiple interest groups. Concentrating on a single group allows us to better analyze the incentive structure for misreporting, and focusing on an anti-climate group captures the empirical regularity of anti-climate lobbying and its role in stalling climate policy, especially in the United States (Dunlap and McCright 2011; Brulle 2014; Dunlap and McCright 2015). Although pro-environmental organizations (e.g., the Sierra Club) also engage in public messaging to highlight the risks of climate change, the persistence of global climate inaction underscores the importance of understanding how anti-climate messaging influences policy outcomes.[9]

The design of information about ω follows a special structure in which the special interest group designs the experiment's protocols $\mathcal{E}_i(s_i, \omega)$ without knowing the true state of the world, conducts an experiment to ascertain ω, and then reports the results as s_i according to $\mathcal{E}_i(s_i, \omega)$. These assumptions of symmetric uncertainty and commitment are reminiscent of Kamenica and Gentzkow (2011) and can be interpreted as follows. The interest group allocates resources to develop a climate model with the goal of determining ω. Before running the model, S commits to a disclosure rule, which dictates the probability of reporting evidence about climate change that is unfavorable in the event that such evidence is found.[10] If the special interest were to only report $s_i = 0$, it would be completely uninformative about the severity of climate change. Hence, the commitment to β_i captures the idea that the special interest must with some probability disclose information about the effects of climate change that may run counter to its interests. Symmetric uncertainty guarantees that there is no signaling on behalf of the special interest group in choosing β_i; it simply represents this observable bias in the amount of certainty needed for S to acknowledge the threat of climate change. Alternatively, β_i can be interpreted as the group's ability to suppress whistleblowing regarding the true vulnerability to climate change when $\omega = 1$, as there may be a risk that climate scientists rebuke the special interest group and bring such evidence to the public.

Manufacturing misreporting is costly and the special interest incurs $c(\beta_i)$ for developing the infrastructure to be able to misreport. This represents the costs involved in commissioning fabricated scientific reports to develop public-facing informational campaigns downplaying the effects of climate change (Oreskes and Conway 2011). Downstream, $c(\beta_i)$ could also capture the anticipated reputational costs associated with misreporting, or the costs needed to restrain possible whistleblowing.

The politician does not know s_i when implementing climate policy; her information about ω is external to what the interest group communicates to the voter (x_i^θ is unrelated to s_i). This shuts down any infor-

[9]The appendix includes an extension in which the special interest group has a bias in favor of climate action, in which all results bias toward climate action rather than inaction.

[10]This is analogous to choosing a level of certainty required to "reject the null hypothesis of no climate change" if it discovers that $\omega = 1$. The parameter β_i represents the significance level at which S fails to reject the null hypothesis, while $1 - \beta$ captures the probability of issuing a report acknowledging that the effects of climate change are more severe.

mational lobbying (Schnakenberg 2017; Schnakenberg and Turner 2024; Zerbini 2024) or other quid pro quo lobbying approaches (Grossman and Helpman 1994) in which the interest group directly interfaces with the politician. Results would not be qualitatively different if the politician could condition her strategy on s_i; however, I opt for the present approach because it isolates the relationship between the special interest's messaging strategy and the voter's beliefs.

The politician's incentives and the basis of the selection problem. The politician in the model does not have latent policy preferences for particular climate policy responses (e.g., Maskin and Tirole 2004; Blumenthal 2024); instead, she wishes to enact the appropriate policy given expectations about the severity of climate change. On policy, the politician and the voter have aligned incentives. The voter thus rewards politicians whom are viewed as competent, or were more likely to have done the right thing.

The politician's competence lends itself to several interpretations. We may think that some politicians are more likely to implement successful climate reforms given information that they have at their disposal about the true threat of climate change. This may arise due to variation in bureaucratic quality or variation in the quality of scientific knowledge. In addition, competence may signify a heightened ability to implement policy congruent with the voter's willingness to pay for climate policy, given their prior belief about the need for such policy measures.

Analysis: Domestic Politics

Before moving to the international model, I solve the game for the case of a single country, thereby providing intuitions for the domestic microfoundations. In this section, I will suppress dependence on country i to reduce notational clutter. This section establishes two main results about the relationship between information and climate policymaking. Result 2 demonstrates that as special interests are more likely to misreport to the domestic public, politicians are less incentivized to take climate action. Result 3 shows that the optimal level of misreporting is nonmonotonic in climate change's expected severity (and subsequently the *ex ante* expectation that climate reform is appropriate).

Proceeding by backward induction, first consider the *climate policy subgame*, in which β is an exogenous parameter, but governs the distribution of signals that could be transmitted to the voter about the need for climate action. When evaluating the politician's competence, the voter draws inferences based on both the politician's actions and the information provided by the special interest group regarding the state of the world. Since both the politician and the voter prefer policy to align with the true state of the world, the politician's actions reveal information about both her type and her beliefs regarding the urgency of climate policy. Moreover, even though the special interest's message does not communicate information about θ directly, the voter's belief correlates uncertainty about the politician's competence and uncertainty about the true severity of climate change in equilibrium, $\mu(a, s) = P(\theta = 1|a, s)$.

It is straightforward to observe that following any policy choice a and signal s, the voter reelects the politician if and only if $\mu(a, s) \geq \varepsilon$, so the probability of retention from the politician's perspective is $F(\mu(a, s))$. It is also clear that the competent politician always prefers to choose $a = \omega$, which stems from the fact that she has perfect information about the need for climate policy. Herein I consider the behavior of the incompetent politician.

The incompetent type does not precisely know the state of the world, so she must form beliefs about the true severity of climate change. Given the value of her private signal $x^0 = x$, the incompetent politician's posterior belief about the state is $\eta(x) = P(\omega = 1|x) = \frac{\pi g(x;1)}{\pi g(x;1)+(1-\pi)g(x;0)}$. These beliefs affect her personal assessment about potential environmental damages, as well as which messages she believes the voter could observe from the special interest. Write $\Delta(s) = F(\mu(1, s)) - F(\mu(0, s))$ as the difference in the politician's reelection odds between taking climate action and not, holding the interest group's signal fixed. The incompetent politician thus chooses $a = 1$ if and only if

$$\eta(x) + (1-\beta)\eta(x)F(\mu(1,1)) + (1-\eta(x)+\beta\eta(x))F(\mu(1,0)) \geq (1-\eta(x)) + (1-\beta)\eta(x)F(\mu(0,1)) + (1-\eta(x)+\beta\eta(x))F(\mu(0,0))$$

$$\Leftrightarrow \quad \underbrace{2\eta(x) - 1}_{\text{net belief } a=1 \text{ correct}} + \underbrace{(1-\beta)\eta(x)\Delta(1)}_{\text{net electoral return if } s=1} + \underbrace{(1-\eta(x)+\beta\eta(x))\Delta(0)}_{\text{net electoral return if } s=0} \geq 0.$$

The politician weighs her posterior belief that $\omega = 1$ with the difference in reelection odds that each policy choice induces. If her belief that broad climate reform is correct is sufficiently high, then she chooses $a = 1$. Otherwise, she selects policy $a = 0$. Since the incompetent type's information is imperfect, she can sometimes make the "wrong" policy choice. Denote the signal $\tilde{x}$ that makes the incompetent politician indifferent between choosing $a = 1$ and $a = 0$, solving the above at equality. Increasing $\tilde{x}$ requires the incompetent type to be more certain that $\omega = 1$ in order to take action, thereby decreasing the range of signals that would result in climate reform, while decreasing $\tilde{x}$ galvanizes the incompetent politician toward climate action, meaning she needs lower quality information to choose $a = 1$.

The climate policy subgame has a unique equilibrium, as detailed in the following proposition. Proofs of all formal results are in the appendix.

Proposition 1 *A unique cutoff $\tilde{x}^*$ exists, admitting a unique perfect Bayesian equilibrium to the climate* *policy subgame. A politician of type θ chooses policy $a = 1$ upon observing signal x^θ with probability $\sigma^*(\theta, x^\theta) \in [0, 1]$. These probabilities are*

$$\sigma^*(1, x^1) = x^1 = \omega.$$
$$\sigma^*(0, x^0) = 1 - G(\tilde{x}^*; \omega).$$

Upon observing policy a and signal s, the voter reelects the politician with probability $F(\mu^*(a, s; \tilde{x}^*))$.

In equilibrium, the voter uses climate policy and the signal from the interest group to ascertain the politician's competence, and the politician's pursuit of climate action is sequentially rational given the tradeoff between policy goals and electoral rewards. Policy "failures" come from the fact that the incompetent type does not always know whether climate reform is appropriate or not. The selection problem thus underscores the desire for voters to choose politicians who are more likely to implement "successful" climate policies given their assessment of the climate threat in equilibrium. Accordingly, the conditional probabilities of taking action exhibit monotonicity: the incompetent type is always less likely to match her climate policy to the true state: $\sigma^*(1, 1) = 1 \geq \sigma^*(0, 1) > \sigma^*(0, 0) \geq \sigma^*(1, 0) = 0$.

The special interest's signal, s, plays a crucial role in shaping the equilibrium dynamics of the policy-making process. Recall that $s = 1$ signals that climate change is a serious issue requiring significant action, while $s = 0$ indicates the opposite. Given that the interest group is biased toward maintaining the status quo, since new climate regulations like those targeting fossil fuels would likely be detrimental to its interests, a signal of $s = 0$ could either reflect the truthful claim that climate change is not a pressing problem or represent strategic misreporting intended to delay or prevent policy action. By contrast, a signal of $s = 1$ is wholly informative about ω, as it contradicts the interest group's inherent bias.

Truthful revelation from the signal $s = 1$ has important implications for how the voter interprets the politician's action. Most dramatically, upon observing $s = 1$ and $a = 0$, then the voter also knows for sure that the politician is incompetent. Failing to get policy correct displays incompetence, and the voter maximally punishes the politician at the ballot box. If the voter observes $s = 1$ and $a = 1$, then he updates favorably on the politician's competence as he knows for sure that the politician did the right thing.

When the voter observes the signal $s = 0$, his inference about the politician's competence is less clear. In this case, climate inaction could be the correct policy, indicating that the interest group's signal was truthful and the politician made the right decision. However, there are two other sources of informational asymmetry: the interest group's signal may have misreported severity of climate change, or the incompetent type may have been incorrect in her policy choice. As we shall see, the special interest group can thus exploit this additional source of uncertainty through its misreporting to orient policy away from climate action.

Equilibrium Climate Action

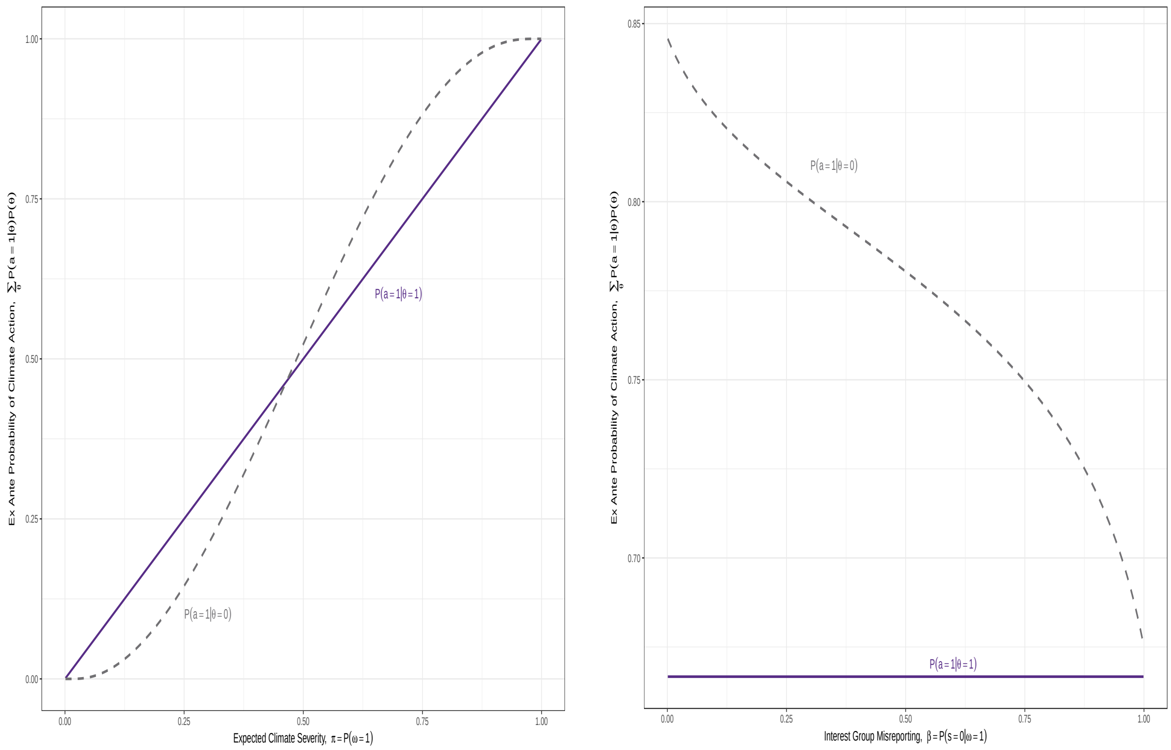
Since both the politician's competence θ and her signal about the state of the world x are unobserved, it is useful to work with the *ex ante* probability of climate action, or the total probability that a politician chooses $a = 1$. This is written as

$$A(\tilde{x}^*) = \underbrace{\tau\pi}_{\substack{\text{competent type} \\ \text{takes action if } \omega=1}} + \underbrace{(1-\tau)\pi(1-G(\tilde{x}^*;1))}_{\text{incompetent type takes action if } \omega=1} + \underbrace{(1-\tau)(1-\pi)(1-G(\tilde{x}^*;0))}_{\text{incompetent type takes action if } \omega=0}.$$

The first result pertains to the expected severity of climate change π. As it becomes clearer that the climate crisis is unfolding, warranting bolder action, the politician is more likely to implement climate reforms. A competent politician always matches her action to the state, so if she learns that it is appropriate to implement climate reforms then she will do so. Similarly, as π increases, the incompetent type's posterior belief about the true severity of climate change ω increases, meaning she becomes more willing to take action as well. Formally, the cutoff $\tilde{x}^*$ decreases in π, which increases the probability that the incompetent type plays $a = 1$. However, since her information is not perfect, this implies that the incompetent politician is more likely to take action with lesser quality information; she becomes more willing to take climate action even if it is not warranted. In so doing, she actually "over-reforms," introducing more action than is appropriate (Bueno de Mesquita 2007), thinking this is the policy that voters want. The left panel of Figure 4, which illustrates the politician's willingness to take climate action as a function of π, shows that when $\omega = 1$ is the more likely state of the world, the incompetent type (grey dashed line) pursues reforms more than the competent type (solid purple line).

Result 1 *The ex ante probability of climate action increases with the severity of climate change π.*

Now consider how the politician's equilibrium strategy changes with the special interest's level of misreporting β. Increasing the level of misreporting — making it more likely that the interest group sends $s = 0$ when $\omega = 1$ — decreases the probability of climate action from the incompetent type. Formally, the cutoff $\tilde{x}^*$ is increasing in β. The intuition is most easily seen when thinking about the case where β is low, so the group is a more truthful interlocutor of the state. As mentioned above, the worst case scenario for the incompetent politician would be to choose $a = 0$ and for the special interest to later disseminate $s = 1$, as it



(a) Expected Climate Severity π

(b) Interest Group Misreporting β

Figure 4: *Ex Ante* Probability of Climate Action

would fully reveal her incompetence. So if β is low, then the incompetent politician is more incentivized to choose $a = 1$ so that her action is more likely to match the signal sent by the group. Then, as β increases, meaning the interest group is more likely to send the signal $s = 0$ regardless of the state, the incompetent politician's action mirrors the special interest's anticipated message. Increasing the level of misreporting incentivizes climate inaction because the voter becomes more likely to believe the politician is competent when observing consistency between her actions and the interest group's signal. Since the voter cannot disentangle the group's strategic motivations from the action of the politician, the voter becomes more scrutinizing of climate action in a world where misreporting is rampant. Subsequently, the incompetent politician optimally decreases the probability of climate action.

While the competent type is unaffected by the special interest's misreporting, the *ex ante* probability of climate action decreases because of the informational effects on the incompetent politician's behavior. This can be seen in the right panel of Figure 4: the competent type's probability of choosing $a = 1$ is constant in β (solid purple line), while the incompetent type's willingness to pursue climate reforms is decreasing in the level of misreporting (grey dashed line). As a result, the total expected level of climate action goes down.

Result 2 *The ex ante probability of climate action is decreasing in the special interest's misreporting β.*

The analysis thus far highlights how the informational environment conditions climate policymaking in terms of both *ex ante* beliefs about climate severity and messages sent by anti-climate interests. Politicians and voters both prefer climate policy *ex ante* when it is the appropriate solution to the environmental crisis. As the anticipated severity of climate change rises, the likelihood of implementing such policies also increases, suggesting that climate action should progressively intensify as more is learned about potential damages. However, misreporting exerts a countervailing force. In a context of extensive misreporting, politicians are less inclined to pursue climate reforms due to the electoral consequences of implementing such policies. Since the voter becomes less likely to view climate reforms as correct, the incompetent politician diminishes her pursuits of reform. Conversely, in a scenario where interest groups truthfully disclose the impacts of climate change, we would expect to observe more reform.

Equilibrium Information Structure

Zooming out, I determine how the special interest optimally designs information about the state of the world. Given the equilibrium behavior in the climate policy subgame, the interest group seeks to minimize the *ex ante* probability of climate action plus any costs associated with committing to misreporting. As made clear above, since the proliferation of misreported information about the state always slows down climate action by the incompetent politician, the special interest's ideal strategy would be to set $\beta = 1$, always sending $s = 0$. However, information design is costly for the special interest. The group's objective function is

$$\max_{\beta \in [0,1]} \; 1 - A(\tilde{x}^*) - c(\beta),$$

such that the optimal β^* is characterized by the corresponding first-order condition:

$$\underbrace{(1-\tau)\frac{d\tilde{x}^*}{d\beta}\Big(\pi g(\tilde{x}^*; 1) + (1-\pi) g(\tilde{x}^*; 0)\Big)}_{\text{marginal benefit of incompetent type taking inaction}} = \underbrace{c'(\beta)}_{\text{marginal costs of misreporting}}.$$

Lemma 1 *Given equilibrium behavior in the climate policy subgame, there exists an optimal $\beta^* \in [0, 1]$.*

The special interest trades off the marginal benefits of spreading misreported information, which unambiguously leads to an increased probability of climate inaction if an incompetent politician is in office as per Result 2, and the marginal costs of developing the infrastructure to misreport.

Now consider how the group's truthfulness relates to the underlying severity of climate change π. The prior π captures the level of *ex ante* policy discord between the special interest group and the public. When π is low, the correct policy is more likely to be aligned with the preferences of interest group: bold climate reforms are not necessary on average. But when π is high, there are greater incentives to misreport because the more likely policy *ex ante* goes against the preferences of the special interest. Moreover, observe that, by the envelope theorem, the interest group's equilibrium utility is decreasing in the expected severity of climate change π, $\frac{du_S^*}{d\pi} = -\frac{dA(\tilde{x}^*)}{d\pi} < 0$, thereby motivating the need for tools like misreporting to influence the likelihood of climate action.

Interestingly, the optimal β^* is nonmonotonic in π, taking an inverse-U shape. That is, if the expected risks of climate change are minimal or highly likely, then the special interest designs a relatively truthful signal. Intuitively, if climate change poses a minimal threat such that action is almost never appropriate, then the interest group does not need to expend resources to achieve its preferred outcome; it is likely that the politician would choose $a = 0$ in the absence of a signal to obfuscate inference. Conversely, if π is very high, then the interest group's signal $s = 0$ would not be credible, as the voter leans heavily on the prior. In this case, it becomes prohibitively costly for the interest group to misreport both because of the material costs $c(\beta)$ but also because these messages would be rationally discounted by the voter.

However, if climate risks are middling, meaning that the incompetent politician and the voter are the most unsure about whether climate policy is appropriate, then the interest group is least truthful. This generates the most uncertainty *ex ante* about whether climate policy is the correct reform to pursue. Here, a signal $s = 0$ carries most weight as it sways the public toward inaction, thereby discouraging the politician from pursuing climate reforms. Figure 5 illustrates the result. This nonmonotonicity comports with the trajectory of information disseminated by companies such as Exxon, reminiscent of the timeline in Figure 3: when climate change's risks were poorly understood in the 1980s or there was little *ex ante* threat, Exxon's scientists toed the scientific consensus. Into the 1990s, their strategy changed toward convincing the public that climate change was not an issue that warranted a large policy response, corresponding to a time where knowledge about climate change's risks began to increase. This informational campaign began to wind down by the 2010s, a time where expected damages were increasing further, with Exxon acknowledging the severity of the climate problem.

Result 3 *The interest group's optimal information structure is nonmonotonic in the ex ante severity of climate change π: misreporting is most likely when π is intermediate.*

This result underscores the cross-cutting nature of uncertainty in climate policymaking: when politicians

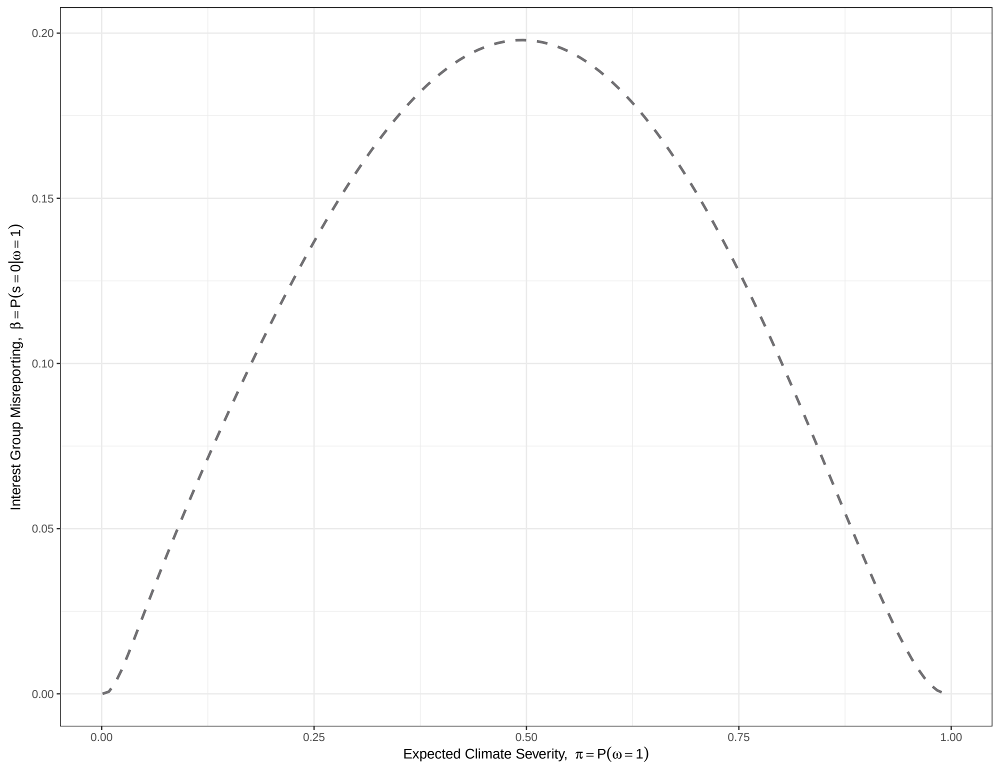


Figure 5: Effects of Expected Climate Severity on Interest Group Misreporting

and voters do not precisely know their vulnerabilities to climate change, they must make assessments about what types of policy responses are appropriate to address the problem. Furthermore, as is expected by the distributional nature of climate policy (Colgan, Green and Hale 2021), there may be special interest groups with an interest in delaying action, but can disseminate information to the public about the severity of the climate threat. When the *ex ante* uncertainty about a polity's climate vulnerability is sufficiently high, then special interest groups can exploit this uncertainty by proliferating information that downplays the risks of climate change and is likely to stymie political action.

Takeaways: Domestic Politics

To summarize, the domestic politics analysis has yielded the following insights:

- Politicians, confronting reelection concerns, wish to demonstrate to the voter that they have taken appropriate climate measures. Climate action is informative of leader competence. Concomitantly, interest groups, who have a vested interest in preventing climate action, can distort voter assessments of the appropriateness of climate policy by affecting beliefs about the state of the world. This creates a tension for the voter between the politician's action and the special interest's signal when assessing politician competence. The voter is more likely to update favorably on the politician's competence when the politician's action and the special interest's signal align.

- Increasing the prevalence of misreporting means that the special interest is more likely to downplay the need for climate reform. While voters rationally downweight the probability of such a false negative, the signal still affects voter beliefs and subsequently the incompetent politician's willingness to take climate action. In particular, increasing misreporting decreases the likelihood that the incompetent politician takes action because of the aforementioned consistency that drives voter beliefs about competence.
- To realize its policy goals, the special interest has an incentive to design a reporting scheme as biased toward inaction as possible because it can affect politician behavior through voter beliefs. However, doing so is costly, and the interest group balances the marginal benefits of inducing inaction from the incompetent politician with the marginal costs. Such benefits are highest when the *ex ante* severity of climate change is middling, or when the correct policy response is most uncertain. The probability of misreporting is thus nonmonotonic in the prior expectations of vulnerabilities to climate change.

I now turn to characterizing how strategic complementarities across nations affect the prospects for international climate action.

Analysis: International Cooperation

This section analyzes the full model which considers the interplay between domestic politics and international climate cooperation. I consider how the informational effects described in the previous section interact with international efforts to coordinate climate policies. Results 4 and 5 establish the core of the theory: across borders, climate policies are strategic *complements* in equilibrium because both nations want to match their policy to the perceived climate threat. Hence, any domestic factors that suppress policymaking in one nation can spill over and affect decisionmaking internationally.

In the climate policy subgame, the politicians in both nations enact national climate policies that contribute to a joint international outcome. Voters in each country seek to ascertain their politician's competence given international climate policy as well as the signal about national climate vulnerability as transmitted by the domestic interest group. Voter i's posterior belief about politician i's competence is therefore $\mu_i(a_i, s_i, a_j) = P(\theta_i = 1|a_i, s_i, a_j)$. Given these beliefs, voter i reelects politician i if and only if

$\mu_i(a_i, s_i, a_j) \geq \varepsilon_i$, occurring with probability $F(\mu_i(a_i, s_i, a_j))$. To consider the difference in electoral returns for politician i fixing the signal s_i and politician j's action, write $\Delta_i(s_i, a_j) = F(\mu_i(1, s_i, a_j)) - F(\mu_i(0, s_i, a_j))$.

At the international level, politician i must form an assessment of politician j's likelihood of taking climate action, or the belief that politician j views climate change as sufficiently severe. Because signals are all centered around the true ω, they are correlated across countries. Climate change presents a common values uncertainty problem. This means that, from politician i's perspective who has signal $x_i^\theta = x_i$, $x_j^\theta | x_i \sim \eta(x_i)G(\cdot; 1) + (1 - \eta(x_i))G(\cdot; 0)$. Politician i uses her updated beliefs about the state $\eta(x_i)$ to infer what politician j knows about the *global* climate threat (or lack thereof).

As in the single country case, competent politicians always follow their signals: since the international climate response requires both politicians to match their actions to the state of the world, it is optimal in policy terms to do the right thing. However, incompetent politicians, who do not know the true vulnerability to climate change, must consider two factors. First, as in the domestic politics analysis, an incompetent politician must consider how her actions play domestically in terms of informing the voter about her type. Second, her climate policy must be a best response to the other nation's climate policymaking. Let $y_j = P(a_j = 1 | x_i)$ be the probability that politician j takes climate action from the perspective of the incompetent politician i who has received signal $x_i^0 = x_i$. She then pursues climate action herself, $a_i = 1$, if and only if

$$\underbrace{2y_j - 1}_{\substack{\text{net belief } a_i=1 \text{ correct} \\ + \text{ coordination}}} + \underbrace{\eta(x_i)(1-\beta_i)\Big(y_j\Delta_i(1,1) + (1-y_j)\Delta_i(1,0)\Big)}_{\text{net electoral gain if } s_i=1} + \underbrace{(1-\eta(x_i)+\eta(x_i)\beta_i)\Big(y_j\Delta_i(0,1) + (1-y_j)\Delta_i(0,0)\Big)}_{\text{net electoral gain if } s_i=0} \geq 0.$$

In equilibrium, an incompetent politician will pursue climate reform if and only if her signal about its appropriateness is sufficiently high, which means she also has to be convinced that politician j will do the same. In so doing, she endogenizes both the international and domestic strategic interactions in which she finds herself. The equilibrium to the international coordination game is thus characterized by a pair of cutoffs $(\tilde{x}_i^*, \tilde{x}_j^*)$, which delineate the quality of information about the state of the world that an incompetent politician in each country would require to take climate action.

Proposition 2 *A unique pair of cutoffs $(\tilde{x}_i^*, \tilde{x}_j^*)$ exists, admitting a unique perfect Bayesian equilibrium to the international climate policy subgame. A politician of type θ in country i chooses policy $a_i = 1$ upon observing signal x_i^θ with probability $\sigma^*(\theta_i, x_i^\theta) \in [0, 1]$. These probabilities are*

$$\sigma^*(1, x_i^1) = x_i^1 = \omega.$$
$$\sigma^*(0, x_i^0) = 1 - G(\tilde{x}_i^*; \omega).$$

Upon observing policies a_i and a_j and signal s_i, the voter in country i reelects the politician with probability $F(\mu_i^*(a_i, s_i, a_j; \tilde{x}_i^*, \tilde{x}_j^*))$.

Informational Spillovers and International Climate Cooperation

The model highlights two relevant sources of information that affect international climate policymaking. First, the signal x_i^θ — which is informative of the true, common underlying vulnerability to climate change ω — provides information about whether politician j is sufficiently likely to take action. Hence, varying the cutoff rule $\tilde{x}_j$, or the ease with which an incompetent politician j pursues climate reform, also affects how politician i will respond. The next result formalizes that politicians' actions are strategic complements internationally: if politician i knows that politician j uses a more stringent threshold, making it less likely that j takes climate action, then politician i updates negatively on the appropriateness of climate reform and is less likely to take action as well. This stems directly from the fact that politicians need to coordinate their behavior around the true state of the world.

Result 4 *If politician j is less likely to take climate action then so is politician i: $\tilde{x}_i^*$ is increasing in $\tilde{x}_j$.*

The second source of information stems from the special interest group in each country, affecting how voters assess the appropriateness of the international climate policy outcome. Since countries want to coordinate their policy responses at the international level, changes in the domestic environment of one country will affect international climate action. Consider the effects of increased misreporting about the severity of climate change within country i. Since misreporting stagnates climate action in country i (Result 2), and country i's actions matter for country j (Result 4), such misreporting affects country j as well. Indeed, misreporting anywhere affects climate action everywhere, creating an *informational spillover*.

Result 5 *Increasing the misreporting in country i β_i increases incompetent politician j's cutoff $\tilde{x}_j^*$.*

These spillover effects arise because of the equilibrium forces that incentivize global climate coordination. Misreporting in country i has no *direct* effect on policymaking in country j, but spillovers occur because of the *strategic* effects that interlock each politician's willingness to undertake climate policy. Clearly, this willingness is a function of countries' domestic politics: the cutoffs $\tilde{x}_i^*$ and $\tilde{x}_j^*$ depend on one another and, as Result 4 illustrates, amplify each other. Formally, this can be written as

$$\frac{d\tilde{x}_j^*}{d\beta_i} = \underbrace{\frac{\partial \tilde{x}_j^*}{\partial \beta_i}}_{\substack{=0,\\ \text{no direct effect}}} + \underbrace{\frac{\partial \tilde{x}_j^*}{\partial \tilde{x}_i^*}}_{\substack{>0,\\ \text{Result 4}}} \underbrace{\frac{d\tilde{x}_i^*}{d\beta_i}}_{\substack{>0,\\ \text{Result 2}}} > 0.$$

The consequences of informational spillovers on global climate action are immediate. Recall that country i's *ex ante* probability of climate action is

$$A_i(\tilde{x}_i^*) = \tau_i \pi + (1-\tau_i)\pi(1 - G(\tilde{x}_i^*; 1)) + (1-\tau_i)(1-\pi)(1 - G(\tilde{x}_i^*; 0)).$$

Then, we can define *coordinated climate action* as the probability that both nations pursue climate reform, $A_i(\tilde{x}_i^*)A_i(\tilde{x}_j^*)$, *unilateral climate action* as the probability that one only nation pursues climate reform, $(1 - A_i(\tilde{x}_i^*))A_i(\tilde{x}_j^*) + A_i(\tilde{x}_i^*)(1 - A_i(\tilde{x}_j^*))$, and *coordinated climate inaction* as the probability that neither nation pursues climate reform, $(1 - A_i(\tilde{x}_i^*))(1 - A_i(\tilde{x}_j^*))$. Note that all three of these quantities are likely to be nonzero in equilibrium, which provides a more general characterization of the likelihood of global climate action than extant theories. In particular, unilateral climate action is possible in equilibrium: incomplete information about the true severity of climate change ω means that transnational best responses account for the possibility of "miscoordination" because a politician could "get it wrong." In other words, it is possible to observe instances in which some nations pursue climate reforms and others do not; such reform is pursued because it is domestically valuable, even while best responding to possible inaction at the international level (cf. Aklin and Mildenberger 2020).

Given these quantities of interest, we can now state how misreporting affects the prospects for different types of international climate policy outcomes.

Result 6 *Increasing the level of misreporting β_i in country i:*

- *Decreases coordinated climate action.*
- *Increases unilateral climate action if $A_i(\tilde{x}_i^*) > \frac{1}{2}$ and $A_j(\tilde{x}_j^*) > \frac{1}{2}$.*
- *Increases coordinated climate inaction.*

Since policies are strategic complements internationally, the first and third findings of Result 6 follow intuitively. Figure 6 illustrates this result: the solid purple line shows decreased coordinated climate action and the dashed grey line shows increased coordinated climate action as a function of how special interest i reports about the severity of climate change.

The effects of misreporting on unilateral climate action (dashed purple line in Figure 6) are more subtle because we are looking at the effect of increased misreporting in country i while conditioning on the eventuality that countries mismatch their climate policies. Differentiating the definition of unilateral climate action

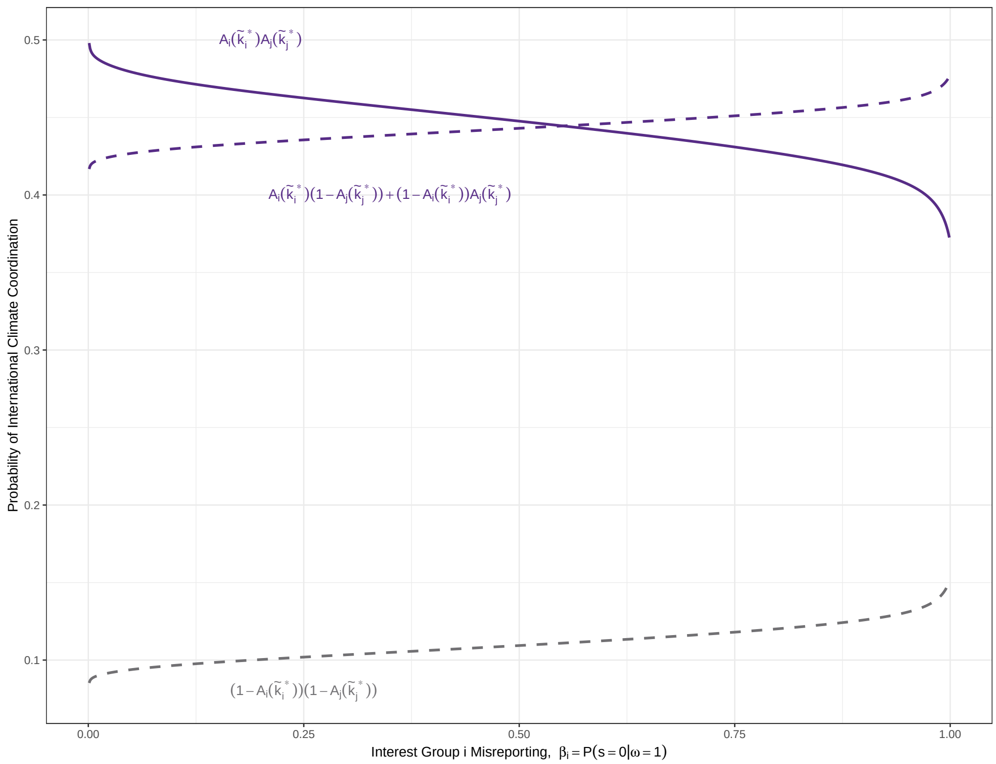


Figure 6: Effects of Interest Group Misreporting on International Climate Coordination

with respect to β_i yields

$$\frac{dA_i(\tilde{x}_i^*)}{d\beta_i}(1-2A_j(\tilde{x}_j^*)) + \frac{dA_j(\tilde{x}_j^*)}{d\beta_i}(1-2A_i(\tilde{x}_i^*)).$$

The sign of this derivative is ambiguous, and depends on the baseline levels of $A_i(\tilde{x}_i^*)$ and $A_j(\tilde{x}_j^*)$. While possible, unilateral climate action is rarer because coordination incentives factor heavily into politicians' decision to pursue climate reforms. Increasing misreporting invokes informational spillovers, which reinforce these coordination incentives, thereby making it difficult to know the direction of the effects of misreporting on unilateral climate action.

Correct Climate Action and Collective Action

In canonical models of international climate cooperation, the free rider problem encapsulates the idea that, relative to a social optimum, countries do not internalize their externalities and, since policies are assumed to be strategic substitutes, there is an underprovision of climate policy (Kennard and Schnakenberg 2023). In this model, I study an alternative version of global climate cooperation, and so I define the globally optimal provision of climate policy via "appropriateness," or the probability that each politician takes action commensurate with the state of the world, $P(a_i = \omega)$. Define this benchmark for each country i as

$$R_i(\tilde{x}_i^*) = \underbrace{\tau_i}_{\substack{\text{competent type} \\ \text{always correct}}} + \underbrace{(1-\tau_i)\pi(1-G(\tilde{x}_i^*;1))}_{\text{incompetent type correct if } \omega=1} + \underbrace{(1-\tau_i)(1-\pi)G(\tilde{x}_i^*;0)}_{\text{incompetent type correct if } \omega=0} .$$

Three points are immediate. First, as shown in the equilibrium analysis, the competent type always takes the correct policy action. Any "policy mistakes" ($a_i \neq \omega$) stem from incompetent politicians. Second, being correct always entails a nonzero probability of climate inaction, the appropriate policy whenever $\omega = 0$, and the benchmark accounts for this eventuality. Third, this benchmark is nonmonotonic in the level of misreporting β_i: as β_i increases it entices the incompetent politician to pursue less climate action, but such an action is less likely to be correct, all else equal, as β_i grows very large.

In traditional theoretical analyses of climate action, the extent of the collective action problem is measured as the distance from the social optimum to the equilibrium level of policy. Analogously, we have

$$\Big|R_i(\tilde{x}_i^*) - A_i(\tilde{x}_i^*)\Big| = \Big|\tau_i(1-\pi) + 2(1-\tau_i)(1-\pi)\Big(G(\tilde{x}_i^*;0) - \frac{1}{2}\Big)\Big|,$$

which is the distance between the probability that country i pursues the correct climate policy ($a_i = \omega$) and the probability that country i pursues *any* climate policy ($a_i = 1$), thereby examining the distance between the social ideal and equilibrium behavior (which of course prices in best responses across countries).

This gap stems from the optimality of climate *inaction* in certain eventualities. The first term represents the competent politician's restraint from reform when she knows that $\omega = 0$. The second term represents the net difference of mistakes made by the incompetent politician, as she takes climate action with nonzero probability in both states of the world (and thus refrains from taking action with nonzero probability). Hence, what appears to be a collective action problem of global climate inaction is driven by two factors: competent types knowing when it is appropriate to pursue climate action and when it is not, and incompetent types making mistakes.

Now consider the effects of misreporting on collective action. Result 7 finds that, in a world of greater misreporting, the extent of the collective action problem is exacerbated. The distance between the probability of pursuing the correct policy and the probability of climate action gets larger.

Result 7 *The extent of the collective action problem is increasing in the levels of misreporting β_i and β_j.*

The result demonstrates the powerful effect that misreporting has on the incompetent politician, as it may dissuade her from taking climate action in order to appear competent in the eyes of the voter. In so doing, she becomes less and less likely to take climate action, which, all else equal, makes her less likely to have chosen the correct policy. Moreover, in a world of international policy coordination, greater misreporting in country i also affects the behavior of country j, which further disciplines the incompetent politician toward inaction. Misreporting exacerbates the severity of the collective action problem through informational expectations that manifest at home and abroad.

Equilibrium Information and International Climate Cooperation

To finalize analysis of the model, consider how special interests i and j design information in their nation to best prevent climate action. As in the single country case, each group seeks to minimize the probability that their country pursues climate reforms, thereby maximizing the functions

$$u_S^i = 1 - A_i\Big(\tilde{x}_i^*(\beta_i, \beta_j)\Big) - c(\beta_i).$$
$$u_S^j = 1 - A_j\Big(\tilde{x}_j^*(\beta_j, \beta_i)\Big) - c(\beta_j).$$

As reflected in the objective function, while special interest group i's primary motivation is to shape information to discourage domestic support for climate policies, cross-national strategic interactions between interest groups are embedded within the problem. This occurs because the cutoffs $\tilde{x}_i^*$ and $\tilde{x}_j^*$ are functions of both β_i and β_j; each politician is playing a mutual best response to their international counterpart given their domestic informational environments. Consequently, special interest group i must optimally design its misreporting strategy, β_i, while considering the strategy of group j, β_j, and vice versa. Taking into account the equilibrium behavior of politicians in the international coordination subgame, these interest groups develop misreporting strategies that serve as cross-national mutual best responses. Each group weighs the marginal value of inducing the incompetent politician into stymieing climate action with the marginal costs of designing misreported information.

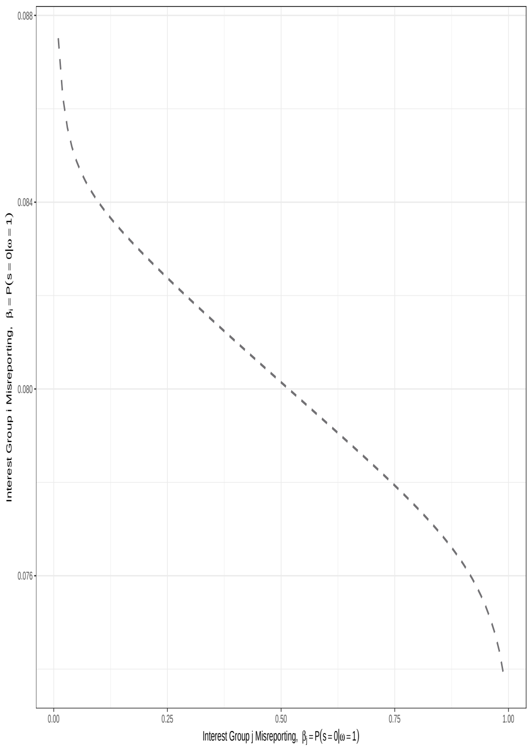
Lemma 2 *Given equilibrium behavior in the international climate policy subgame, there exists an optimal pair* $(\beta_i^*, \beta_j^*) \in [0, 1]^2$.

While Lemma 2 proves existence of mutual best responses, Result 8 formalizes some properties of these best responses.

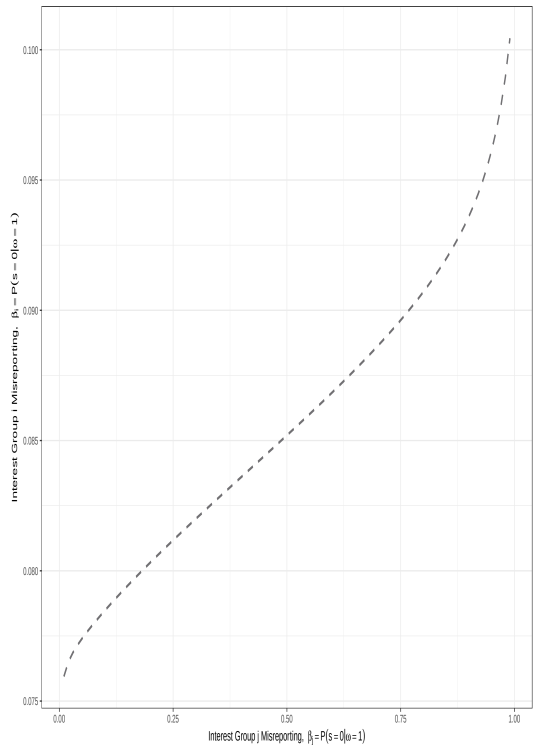
Result 8 *Misreporting levels* β_i *and* β_j *are:*

- *strategic substitutes when the expected severity of climate change* π *is low;*

- *strategic complements when the expected severity of climate change π is high.*



(a) Low Expected Severity ($\pi = 0.3$)



(b) High Expected Severity ($\pi = 0.7$)

Figure 7: Interest Group Misreporting as Strategic Substitutes and Strategic Complements

The shape of special interest i's best response with respect to β_j depends on the expected severity of climate change π and is illustrated in Figure 7. When π is low, misreporting levels across countries are strategic substitutes, meaning that an increase in misreporting in country j *decreases* the optimality of increased misreporting in country i. If special interest j increases its misreporting, this disincentivizes climate action in country j, which spills over on the likelihood that country i takes climate action. The interest groups can effectively free ride off of one another because of the informational spillover effects induced in the international coordination game, which generate collective benefits, without having to incur the material costs of developing misreported information. This dynamic arises when the expected climate threat is low because there is little chance that countries would effectively coordinate on climate policy, thereby disincentivizing interest groups from incurring the costs of designing misreported information.

By contrast, if π is high, then special interests' incentives to misreport are complementary, meaning that an increase in misreporting in country j *increases* the optimality of increased misreporting in country i. In this case, the coordination incentives among politicians push countries toward a greater likelihood of taking climate action. In an attempt to dissuade this action, these groups ramp up their proliferation of misreported information, hoping to capitalize on the informational spillover effects. In so doing, these groups generate complementary incentives across borders in their misreporting in order to maximally guard their anti-climate interests.

This complementary effect is reminiscent of the efforts by fossil fuel companies to coordinate their informational campaigns in the late 1990s and early 2000s. With the creation of the Global Climate Coalition, Exxon led the charge to encourage misreporting across borders. The 1998 Victory Memo outlined the details of a public relations campaign promoting false information about the climate threat that was intended to obfuscate the inferences of individuals toward climate action. Firms like BP followed suit: in 2004, BP released its carbon footprint calculator, an interactive tool designed for consumers to ascertain the greenness of their daily routines. The product sought to convince individuals that altering their quotidian behaviors would be the best way to address the climate threat, rather than pivoting away from fossil fuels.

Discussion

The model provides novel insights to explain empirical regularities about the increase in the depth and breadth of international climate cooperation. In particular, I demonstrate how complementarities in information that politicians have about the severity of climate change translate into complementarities about climate action across borders. Breaking down these complementarities yields several implications.

The strategic complementarities that my model uncovers help to explain the surge in climate policy over time. This trend is puzzling given the collective action dynamic of the global climate problem, as extant theories would not predict this. To explain the increase in climate policy within pre-existing theoretical frameworks, one might point to a secular increase in the demand for climate policy adoption (not dissimilar to the comparative statics on π in this model, see Result 1), while also claiming that the realized provision of climate measures may continue to fall short of a social optimum. Increasing demand for policy could explain the trend of increasing climate action over time; however, conditional on the trend, traditional theories would still predict that cross-border actions are strategic substitutes. Such an explanation would not account for the simultaneous increase in policy ambition. However, by exploring potential strategic complementarities, this model can account for both the increase in policy over time as well as the correlated increases in policy ambition on the margin.

The fundamental prediction of collective action theories is that countries will underprovide climate policy relative to a normatively desirable optimum. This generally involves a benchmark in which countries internalize their externalities. My theory generates an alternative benchmark that accounts for the role of information and the appropriateness of climate policy. With such a benchmark, I demonstrate that the probability of doing the right thing and the probability of taking climate action diverge in a world where misreporting is high (Result 7). This result underscores the failure of politicians to take climate action (even if it is warranted) in a noisy informational environment as they compete with special interests to favorably shape voters' assessments of their competence.

Similar to UNFCCC negotiations, the model requires unanimity or "consensus" to implement international climate policy, thereby incentivizing coordinated climate action across borders. Nevertheless, unilateral climate action can occur in equilibrium, and, moreover, such action can be electorally beneficial. While unilateral action does not yield a globally implementable policy, climate action can have *domestic* benefits because politicians may be signaling competence to their voters. This dynamic underscores a key insight: international cooperation, while desirable, is not strictly necessary to achieve climate policy gains. Politicians may prioritize demonstrating their competence to voters over the benefits of international coordination, further challenging conventional accounts of climate action as purely reliant on global cooperation (cf. Aklin and Mildenberger 2020).

Finally, the model speaks to problems of information design by studying the incentives of special interest groups like ExxonMobil and their decisions to implement messaging campaigns to affirm or reject the existence of climate change. These campaigns have shifted in their tone over time and the model captures this trajectory (Result 3). Consistent with empirical evidence, the theory documents how special interests are most likely to misreport when the underlying understanding of the effects of climate change are intermediate; as the uncertainty surrounding climate change's severity disappears, these groups have become more truthful as it would be too costly to continue to perpetuate their strategy of misreporting. While the costs of designing misreported information may not be on the same magnitude as corporate returns from the continued use of fossil fuels, their downstream costs are nontrivial. In September 2024, California Attorney General Rob Bonta sued ExxonMobil for "deceiving the public to convince us that plastic recycling could solve the plastic waste and pollution crisis when they clearly knew this wasn't possible."[11] These legal penalties and other reputational sanctions demonstrate the costliness of pursuing informational strategies.

[11] https://www.theguardian.com/us-news/2024/sep/23/california-exxon-plastics-lawsuit

Conclusion

This paper posits a unified model of domestic and international climate policymaking that explains several key empirical facts about the political economy of climate change. I point to changes in the domestic informational environment to document variation in climate policy, its intensity and complementarities across borders, as well as the evolution in messaging strategies pursued by special interests about the severity of the climate threat over time. The theoretical analysis demonstrates that when special interests are able to proliferate "misreported" information about climate change's risks to the public, downplaying environmental harms, imperfectly informed politicians cut back on their provision of climate reforms in order to salvage their electoral prospects. In a world of international cooperation, this inaction spills over across borders in a negative feedback loop. The contemporary growth in climate policy adoption can therefore be explained by the transition away from denialism and toward relative truthfulness on behalf of special interests that have found it too costly to continue to misreport as the *ex ante* uncertainty around climate change's severity has decreased over time.

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Appendix: Information and Climate (In)action

Contents

Proofs of Domestic Politics Model

Define $\hat{\sigma}(\theta,\omega)$ as the voter's belief that probability that the politician chooses $a = 1$ when she is of type θ and the state of the world is ω. Define $B(\theta, a, s)$ as proportional to the *ex ante* probability that a politician of type θ chooses action a and signal s is realized. Then we have

$$B(\theta,1,s) = P(\theta)\Big(\pi\hat{\sigma}(\theta,1) + (1-\pi)\hat{\sigma}(\theta,0)\frac{P(s|s\neq\omega)}{P(s|s=\omega)}\Big).$$
$$B(\theta,0,s) = P(\theta)\Big(\pi(1-\hat{\sigma}(\theta,1)) + (1-\pi)(1-\hat{\sigma}(\theta,0))\frac{P(s|s\neq\omega)}{P(s|s=\omega)}\Big).$$

This means that the voter's posterior belief that the politician is competent, following policy choice a, is given by

$$\mu(a,s) = \frac{P(a,s|\theta=1)P(\theta=1)}{P(a,s|\theta=1)P(\theta=1) + P(a,s|\theta=0)P(\theta=0)} = \frac{B(1,a,s)}{B(1,a,s)+B(0,a,s)}.$$

Proof of Proposition 1: It is straightforward that following any history in which the politician chooses policy a and the voter observes signal s the voter has posterior belief $P(\theta = 1|a,s) = \mu(a,s)$, the voter reelects the politician if and only if $\mu(a,s) \geq \varepsilon$, which occurs with probability $F(\mu(a,s))$.

The competent politician, whose signal of ω is perfect, always chooses $a = 1$ following signal $x^1 = 1$:

$$1 + \beta F(\mu(1,0)) + (1-\beta)F(\mu(1,1)) \geq \beta F(\mu(0,0)) + (1-\beta)F(\mu(0,1)) \;\Leftrightarrow\; 1 \geq -\beta\Delta(0) - (1-\beta)\Delta(1).$$

Similarly, she never chooses $a = 1$ following signal $x^1 = 0$:

$$F(\mu(1,0)) \leq 1 + F(\mu(0,0)) \;\Leftrightarrow\; \Delta(0) \leq 1.$$

Given the value of her private signal $x^0 = x$, the incompetent politician's posterior belief about the state is $\eta(x) = P(\omega = 1|x) = \frac{\pi g(x;1)}{\pi g(x;1)+(1-\pi)g(x;0)}$. Write $\Delta(s) = F(\mu(1,s)) - F(\mu(0,s))$. The incompetent type therefore chooses $a = 1$ if and only if

$$\eta(x) + \beta\eta(x)F(\mu(1,0)) + (1-\beta)\eta(x)F(\mu(1,1)) + (1-\eta(x))F(\mu(1,0)) \geq$$
$$(1-\eta(x)) + \beta\eta(x)F(\mu(0,0)) + (1-\beta)\eta(x)F(\mu(0,1)) + (1-\eta(x))F(\mu(0,0))$$

$$\Leftrightarrow \; \eta(x) \geq \frac{1-\Delta(0)}{2+(1-\beta)(\Delta(1)-\Delta(0))}.$$

Define $\tilde{x}$ as the signal that solves

$$2\eta(\tilde{x}) - 1 + (1-\beta)\eta(\tilde{x})\Delta(1;\tilde{x}) + (1-\eta(\tilde{x})+\beta\eta(\tilde{x}))\Delta(0;\tilde{x}) = 0, \tag{1}$$

where the cutoff $\tilde{x}$ induces voter posterior beliefs

$$\mu^*(1,0;\tilde{x}) = \frac{\tau\pi}{\tau\pi + (1-\tau)\pi(1-G(\tilde{x};1)) + (1-\tau)(1-\pi)\frac{\beta}{1-\beta}(1-G(\tilde{x};0))}.$$

$$\mu^*(1,1;\tilde{x}) = \frac{\tau}{\tau + (1-\tau)(1-G(\tilde{x};1))}.$$

$$\mu^*(0,0;\tilde{x}) = \frac{\tau(1-\pi)\frac{\beta}{1-\beta}}{\tau(1-\pi)\frac{\beta}{1-\beta} + (1-\tau)(\pi G(\tilde{x};1) + (1-\pi)\frac{\beta}{1-\beta}G(\tilde{x};0))}.$$

$$\mu^*(0,1;\tilde{x}) = 0.$$

Differentiating Equation 1 with respect to $\tilde{x}$ yields

$$2\frac{\partial\eta(\tilde{x})}{\partial\tilde{x}} + (1-\beta)\frac{\partial\eta(\tilde{x})}{\partial\tilde{x}}(\Delta(1;\tilde{x})-\Delta(0;\tilde{x})) + (1-\beta)\eta(\tilde{x})\frac{\partial\Delta(1;\tilde{x})}{\partial\tilde{x}} + (1-\eta(\tilde{x})\beta\eta(\tilde{x}))\frac{\partial\Delta(0;\tilde{x})}{\partial\tilde{x}}.$$

Since $g(\cdot)$ has the monotone likelihood ratio property, $\eta(\tilde{x})$ is increasing in $\tilde{x}$. Now observe that $\mu^*(1,0;\tilde{x})$ is increasing in $\tilde{x}$ and $\mu^*(0,0;\tilde{x})$ is decreasing in $\tilde{x}$, which means that $\Delta(0)$ is increasing in $\tilde{x}$. Moreover, $\mu^*(1,1;\tilde{x})$ is increasing in $\tilde{x}$ so $\Delta(1)$ is increasing in $\tilde{x}$. Further, by definition of posterior beliefs we have $\Delta(1;\tilde{x}) \geq \Delta(0;\tilde{x})$ so this expression is increasing in $\tilde{x}$. Hence by the intermediate value theorem there is a unique $\tilde{x}^*$ solving Equation 1 such that the incompetent politician plays $a=1$ when $x^0 > \tilde{x}^*$ and plays $a=0$ when $x^0 \leq \tilde{x}^*$. ■

Using the definition of the cutoff $\tilde{x}^*$, define the function $I(\tilde{x})$ as

$$I(\tilde{x}) := 2\eta(\tilde{x}) - 1 + (1-\beta)\eta(\tilde{x})\Delta(1;\tilde{x}) + (1-\eta(\tilde{x})+\beta\eta(\tilde{x}))\Delta(0;\tilde{x}),$$

and note that the equilibrium cutoff is defined by the value $\tilde{x}^*$ such that $I(\tilde{x}^*)=0$. Further observe that, by definition of the existence of the equilibrium cutoff, $\frac{\partial I(\tilde{x})}{\partial\tilde{x}} > 0$.

In addition recall from the main text that the *ex ante* probability of climate action is written as

$$A(\tilde{x}^*) = \tau\pi + (1-\tau)\pi(1 - G(\tilde{x}^*; 1)) + (1-\tau)(1-\pi)(1 - G(\tilde{x}^*; 0)).$$

Corollary A.1 *The equilibrium signal cutoff $\tilde{x}^*$ is decreasing in π.*

Proof of Corollary A.1: By the implicit function theorem,

$$\frac{d\tilde{x}^*}{d\pi} = -\frac{\partial I(\tilde{x})/\partial \pi}{\partial I(\tilde{x})\ \partial \tilde{x}}.$$

Partially differentiating with respect to π yields

$$\frac{\partial I(\tilde{x})}{\partial \pi} = 2\frac{\partial \eta(\tilde{x})}{\partial \pi} + (1-\beta)\frac{\partial \eta(\tilde{x})}{\partial \pi}\Big(\Delta(1; \tilde{x}) - \Delta(0; \tilde{x})\Big) + (1 - \eta(\tilde{x}) + \beta\eta(\tilde{x}))\frac{\partial \Delta(0; \tilde{x})}{\partial \pi}.$$

Now, $\frac{\partial \eta(\tilde{x})}{\partial \pi} = \frac{g(\tilde{x};1)g(\tilde{x};0)}{((1-\pi)G(\tilde{x};0) - \pi G(\tilde{x};1))^2} > 0$, $\frac{\partial \mu^*(1,0;\tilde{x})}{\partial \pi} = \frac{\beta\tau(1-\tau)(1-G(\tilde{x};0))}{(-\pi+\beta(-1+\pi+\tau-\tau\pi)+(1-\tau)(\beta(1-\pi)G(\tilde{x};0)+\pi G(\tilde{x};1)))^2} > 0$ and $\frac{\partial \mu^*(0,0;\tilde{x})}{\partial \pi} = -\frac{\tau\beta(1-\tau)G(\tilde{x};1)}{(\beta(1-\pi)(\tau+(1-\tau)G(\tilde{x};0))+\pi(1-\tau)G(\tilde{x};1))^2} < 0$. Then $\frac{\partial \Delta(0)}{\partial \pi} > 0$ and $\frac{\partial I(\tilde{x})}{\partial \pi} > 0$ so by the implicit function theorem, $\frac{d\tilde{x}^*}{d\pi} < 0$. ■

Proof of Result 1: Differentiating with respect to π yields

$$\frac{dA(\tilde{x}^*)}{d\pi} = \tau + (1-\tau)(G(\tilde{x}^*; 0) - G(\tilde{x}; 1)) - (1-\tau)\frac{d\tilde{x}^*}{d\pi}\Big(\pi g(\tilde{x}^*; 1) + (1-\pi)g(\tilde{x}^*; 0)\Big) > 0,$$

where $G(\tilde{x}^*; 0) \geq G(\tilde{x}; 1)$ follows because the monotone likelihood ratio property implies first-order stochastic dominance. ■

Corollary A.2 *The equilibrium signal cutoff $\tilde{x}^*$ is increasing in β.*

Proof of Corollary A.2: By the implicit function theorem,

$$\frac{d\tilde{x}^*}{d\beta} = -\frac{\partial I(\tilde{x})/\partial \beta}{\partial I(\tilde{x})\ \partial \tilde{x}}.$$

Partially differentiating with respect to β yields

$$\frac{\partial I(\tilde{x})}{\partial \beta} = -\eta(\tilde{x})\Big(\Delta(1; \tilde{x}) - \Delta(0; \tilde{x})\Big) + (1 - \eta(\tilde{x}) + \beta\eta(\tilde{x}))\frac{\partial \Delta(0; \tilde{x})}{\partial \beta}.$$

Now, $\frac{\partial \mu^*(1,0;\tilde{x})}{\partial \beta} = -\frac{\tau\pi(1-\tau)(1-\pi)(1-G(\tilde{x};0))}{(\tau\pi+\beta(1-\pi)(1-\tau)(1-G(\tilde{x};0))+\pi(1-\tau)(1-G(\tilde{x};1)))^2} < 0$ and $\frac{\partial \mu^*(0,0;\tilde{x})}{\partial \beta} = \frac{\tau\pi(1-\pi)(1-\tau)G(\tilde{x};1)}{(\beta(1-\pi)(\tau+(1-\tau)G(\tilde{x};0)+\pi(1-\tau)G(\tilde{x};1))^2} > 0$. Therefore $\frac{\partial \Delta(0)}{\partial \beta} < 0$. Hence $\frac{\partial I(\tilde{x})}{\partial \beta} < 0$ so by the implicit function theorem, $\frac{d\tilde{x}^*}{d\beta} > 0$. ■

Proof of Result 2: Differentiating with respect to β yields

$$\frac{dA(\tilde{x}^*)}{d\beta} = -(1-\tau)\pi g(\tilde{x}^*;1)\frac{d\tilde{x}^*}{d\beta} - (1-\tau)(1-\pi)g(\tilde{x}^*;0)\frac{d\tilde{x}^*}{d\beta} < 0.$$

■

Proof of Lemma 1: The special interest group's objective function is

$$\max_{\beta\in[0,1]} \ 1-\tau\pi-(1-\tau)\pi(1-G(\tilde{x}^*(\beta);1))-(1-\tau)(1-\pi)(1-G(\tilde{x}^*(\beta);0))-c(\beta).$$

Differentiating with respect to β yields the first-order condition

$$(1-\tau)\pi g(\tilde{x}^*(\beta);1)\frac{d\tilde{x}^*}{d\beta} + (1-\tau)(1-\pi)g(\tilde{x}^*(\beta);0)\frac{d\tilde{x}^*}{d\beta} - c'(\beta) = 0.$$

Since the objective function is continuous and β is maximized along a compact interval, it must have both a maximum and a minimum. It is clear that the first-order condition must have at least one solution, as rearranging gives

$$(1-\tau)\frac{d\tilde{x}^*}{d\beta}\Big(\pi g(\tilde{x}^*;1) + (1-\pi)g(\tilde{x}^*;0)\Big) = c'(\beta),$$

but this solution may characterize either a maximum or a minimum. A maximum is characterized whenever the second-order condition is negative at the solution to the above first-order condition. The second order condition is

$$\begin{aligned} SOC &= (1-\tau)\pi g(\tilde{x}^*;1)\frac{d^2\tilde{x}^*}{d\beta^2} + (1-\tau)\pi g'(\tilde{x}^*;1)(\frac{d\tilde{x}^*}{d\beta})^2 + (1-\tau)(1-\pi)g(\tilde{x}^*;0)\frac{d^2\tilde{x}^*}{d\beta^2} \\ &\quad + (1-\tau)(1-\pi)g'(\tilde{x}^*;0)(\frac{d\tilde{x}^*}{d\beta})^2 - c''(\beta). \\ &= (1-\tau)(\frac{d\tilde{x}^*}{d\beta})^2(\pi g'(\tilde{x}^*;1) + (1-\pi)g'(\tilde{x}^*;0)) + \frac{d^2\tilde{x}^*}{d\beta^2}(\frac{d\tilde{x}^*}{d\beta})^{-1}c'(\beta) - c''(\beta). \end{aligned}$$

The second-order condition is not readily globally concave: the sign of the first term depends on the value of $\tilde{x}^*$ by log-concavity of $g(\cdot)$, the second term depends on the sign of $\frac{d^2\tilde{x}^*}{d\beta^2}$, and the third term is negative.

But note that if the second-order condition fails at the critical point, the maximum of the objective function must be on the corner. Further, from the first-order condition, observe that if $c'(\beta) \to 0$, the LHS is strictly positive and so the optimal solution is a corner solution at $\beta^* = 1$. If $c'(\beta)$ is relatively large, the LHS is strictly negative and the optimal solution is a corner solution at $\beta^* = 0$. ■

Proof of Result 3: Define the function $I_\beta(\beta)$ as

$$I_\beta(\beta) := (1-\tau)\pi g(\tilde{x}^*(\beta);1)\frac{d\tilde{x}^*}{d\beta} + (1-\tau)(1-\pi)g(\tilde{x}^*(\beta);0)\frac{d\tilde{x}^*}{d\beta} - c'(\beta) = 0.$$

Observe that at $\pi = 0$ and $\pi = 1$, $I_\beta = 0$ so it is optimal for the special interest group to be truthful, $\beta^* = 0$. Further by Rolle's theorem there must be a $\hat{\pi} \in (0,1)$ where $\frac{\partial I_\beta(\beta)}{\partial \pi} = 0$, meaning that β^* is nonmonotonic in π.

Partially differentiating yields

$$\begin{aligned}
\frac{\partial I_\beta(\beta)}{\partial \pi} &= (1-\tau)\Big[g(\tilde{x}^*;1)\frac{d\tilde{x}^*}{d\beta} + \pi g'(\tilde{x}^*;1)\frac{d\tilde{x}^*}{d\pi}\frac{d\tilde{x}^*}{d\beta} + \pi g(\tilde{x}^*;1)\frac{d^2\tilde{x}^*}{d\beta d\pi} \\
&\quad - g(\tilde{x}^*;0)\frac{d\tilde{x}^*}{d\beta} + (1-\pi)g'(\tilde{x}^*;0)\frac{d\tilde{x}^*}{d\pi}\frac{d\tilde{x}^*}{d\beta} + (1-\pi)g(\tilde{x}^*;0)\frac{d^2\tilde{x}^*}{d\beta d\pi}\Big]. \\
\Leftrightarrow \frac{\partial I_\beta(\beta)}{\partial \pi} &= (1-\tau)\Bigg[\Big(g(\tilde{x}^*;1) - g(\tilde{x}^*;0)\Big)\frac{d\tilde{x}^*}{d\beta} + \Big(\pi g'(\tilde{x}^*;1) + (1-\pi)g'(\tilde{x}^*;0)\Big)\frac{d\tilde{x}^*}{d\pi}\frac{d\tilde{x}^*}{d\beta} \\
&\quad + \Big(\pi g(\tilde{x}^*;1) + (1-\pi)g(\tilde{x}^*;0)\Big)\frac{d^2\tilde{x}^*}{d\beta d\pi}\Bigg].
\end{aligned}$$

Observe that at $\pi = 0$ and $\pi = 1$, $\frac{\partial I_\beta(\beta)}{\partial \pi} = 0$, implying that such points are extrema, and we know that $\beta^* = 0$ in these cases. But because $\beta \in [0,1]$, these must be minima. Then the point $\hat{\pi}$ which is defined by Rolle's theorem must be an interior maximum such that β^* is increasing when $\pi < \hat{\pi}$ and decreasing when $\pi > \hat{\pi}$. Such a $\hat{\pi}$ is characterized by

$$\Big(g(\tilde{x}^*(\hat{\pi});1) - g(\tilde{x}^*(\hat{\pi});0)\Big)\frac{d\tilde{x}^*}{d\beta}|_{\pi=\hat{\pi}} + \Big(\hat{\pi}g'(\tilde{x}^*(\hat{\pi});1) + (1-\hat{\pi})g'(\tilde{x}^*(\hat{\pi});0)\Big)\frac{d\tilde{x}^*}{d\pi}|_{\pi=\hat{\pi}}\frac{d\tilde{x}^*}{d\beta}|_{\pi=\hat{\pi}} + \Big(\hat{\pi}g(\tilde{x}^*(\hat{\pi});1) + (1-\hat{\pi})g(\tilde{x}^*(\hat{\pi});0)\Big)\frac{d^2\tilde{x}^*}{d\beta d\pi}|_{\pi=\hat{\pi}} = 0.$$

■

Extension: Pro-Climate Interest Group

Suppose that instead of a special interest group biased against climate action, the group that disseminates information to the voter is in favor of ambitious climate policies. Specifically, the group designs a signal

$s \in \{0,1\}$ according to the experiment

$$\mathcal{E}(s=0,\omega=0) = 1-\gamma. \;\; \mathcal{E}(s=1,\omega=0) = \gamma.$$
$$\mathcal{E}(s=0,\omega=1) = 0. \;\; \mathcal{E}(s=1,\omega=1) = 1.$$

The interest group therefore chooses the parameter $\gamma \in [0,1]$. All of the analysis remains as before. I characterize the equilibrium of the climate policy subgame and show that the special interest's optimal choice of γ exists, as in the main text for an anti-climate interest group.

Proposition A.1 *A unique cutoff $\tilde{x}^*$ exists, admitting a unique perfect Bayesian equilibrium to the climate policy subgame with a pro-climate interest group. A politician of type θ chooses policy $a=1$ upon observing signal x^θ with probability $\sigma^*(\theta, x^\theta) \in [0,1]$. These probabilities are*

$$\sigma^*(1, x^1) = x^1 = \omega.$$
$$\sigma^*(0, x^0) = 1 - G(\tilde{x}^*;\omega).$$

Upon observing policy a and signal s, the voter reelects the politician with probability $F(\mu^*(a,s;\tilde{x}^*))$.

Proof of Proposition A.1: The voter observes (a,s) and retains the politician when $\mu(a,s) \geq \varepsilon$, occurring with probability $F(\mu(a,s))$.

The competent politician always follows her signal. If $x^1 = 1$, playing $a=1$ is optimal:

$$1 + F(\mu(1,1)) \geq F(\mu(0,1)) \;\Leftrightarrow\; 1 \geq -\Delta(1).$$

Similarly, if $x^1 = 0$, the competent politician chooses $a=0$:

$$\gamma F(\mu(1,1)) + (1-\gamma)F(\mu(1,0)) \leq 1 + \gamma F(\mu(0,1)) + (1-\gamma)F(\mu(0,0)) \;\Leftrightarrow\; \gamma\Delta(1) + (1-\gamma)\Delta(0) \leq 1.$$

Given the signal $x^0 = x$, the incompetent type chooses $a=1$ iff

$$\begin{aligned}\eta(x) + &\gamma(1-\eta(x))F(\mu(1,1)) + (1-\gamma)(1-\eta(x))F(\mu(1,0)) + \eta(x)F(\mu(1,1) \geq \\ &(1-\eta(x)) + \gamma(1-\eta(x))F(\mu(0,1)) + (1-\gamma)(1-\eta(x))F(\mu(0,0)) + \eta(x)F(\mu(0,1)) \\ \Leftrightarrow\;\; &2\eta(x) - 1 + (\gamma - \gamma\eta(x) + \eta(x))\Delta(1) + (1-\gamma)(1-\eta(x))\Delta(0) \geq 0.\end{aligned}$$

Let $\tilde{x}$ be the value of x that solves this at equality. The posterior beliefs induced by these strategies are

$$\mu(1,0) = 0.$$

$$\mu(1,1) = \frac{\tau\pi\frac{\gamma}{1-\gamma}}{\pi\frac{\gamma}{1-\gamma}(\tau + (1-\tau)(1-G(\tilde{x};1))) + (1-\pi)(1-G(\tilde{x};0))}.$$

$$\mu(0,0) = \frac{\tau}{\tau + (1-\tau)G(\tilde{x};0)}.$$

$$\mu(0,1) = \frac{\tau(1-\pi)}{(1-\pi)(\tau + (1-\tau)G(\tilde{x};0)) + (1-\tau)\pi\frac{\gamma}{1-\gamma}G(\tilde{x};1)}.$$

Differentiating the incompetent type's constraint with respect to x yields

$$2 - \frac{\partial\eta(x)}{\partial x}(1-\gamma)(\Delta(1)+\Delta(0)) + (\gamma(1-\eta(x))+\eta(x))\frac{\partial\Delta(1)}{\partial x} + (1-\eta(x))(1-\gamma)\frac{\partial\Delta(0)}{\partial x}.$$

Since $\mu(0,0)$ is decreasing in $\tilde{x}$, $\Delta(0)$ is increasing in $\tilde{x}$. Similarly, $\mu(1,1)$ is increasing in $\tilde{x}$ and $\mu(0,1)$ is decreasing in $\tilde{x}$. Hence by the intermediate value theorem there is a $\tilde{x}^*$ such that the incompetent type plays $a = 1$ iff $x^0 \geq \tilde{x}^*$. ■

Corollary A.3 *The equilibrium signal cutoff $\tilde{x}$ is decreasing in γ in the model with a pro-climate interest group.*

Proof of Corollary A.3: Define the function

$$I_\gamma(\tilde{x}) := 2\eta(\tilde{x}) - 1 + (\gamma - \gamma\eta(\tilde{x}) + \eta(\tilde{x}))\Delta(1;\tilde{x}) + (1-\gamma)(1-\eta(\tilde{x}))\Delta(0;\tilde{x}).$$

Clearly, $I_\gamma(\tilde{x})$ is increasing in $\tilde{x}$ and the point $\tilde{x}^*$ is defined by $I_\gamma(\tilde{x}^*) = 0$. By the implicit function theorem,

$$\frac{d\tilde{x}^*}{d\gamma} = -\frac{\partial I_\gamma(\tilde{x})/\partial\gamma}{\partial I_\gamma(\tilde{x})/\partial\tilde{x}}.$$

Differentiating with respect to γ yields

$$\frac{\partial I_\gamma(\tilde{x})}{\partial\gamma} = (1-\eta(\tilde{x}))(\Delta(1;\tilde{x}) - \Delta(0;\tilde{x})) + (\gamma - \gamma\eta(\tilde{x}) + \eta(\tilde{x}))\frac{\partial\Delta(1;\tilde{x})}{\partial\gamma}.$$

Now, $\mu(1,1)$ is increasing in γ and $\mu(1,0)$ is decreasing in γ so $\frac{\partial\Delta(1;\tilde{x})}{\partial\gamma} > 0$. Hence $\frac{\partial I_\gamma(\tilde{x})}{\partial\gamma} > 0$ so by the implicit function theorem $\frac{d\tilde{x}^*}{d\gamma} < 0$. ■

Lemma A.1 *Given equilibrium behavior in the climate policy subgame with a pro-climate interest group, there exists an optimal* $\gamma^* \in [0, 1]$.

Proof of Lemma A.1: The special interest then chooses γ to maximize the probability of climate action, given by the objective function

$$\max_{\gamma \in [0,1]} \tau\pi + (1-\tau)\pi(1 - G(\tilde{x}^*(\gamma); 1)) + (1-\tau)(1-\pi)(1 - G(\tilde{x}^*(\gamma); 0)) - c(\gamma).$$

Differentiating with respect to γ yields the (rearranged) first-order condition

$$-(1-\tau)\pi g(\tilde{x}^*; 1)\frac{d\tilde{x}^*}{d\gamma} - (1-\tau)(1-\pi)g(\tilde{x}^*; 0)\frac{d\tilde{x}^*}{d\gamma} = c'(\gamma)$$

and second-order condition

$$-(1-\tau)\frac{d^2\tilde{x}^*}{d\gamma^2}\Big(\pi g(\tilde{x}^*; 1) + (1-\pi)g(\tilde{x}^*; 0)\Big) - (1-\tau)(\frac{d\tilde{x}^*}{d\gamma})^2\Big(\pi g'(\tilde{x}^*; 1) + (1-\pi)g'(\tilde{x}^*; 0)\Big) - c''(\gamma),$$

with characterization analogous to the proof in Lemma 1. ■

Extension: Office-Motivated Politician

The payoff from reelection in the main model is normalized to 1. Instead consider the case where the politician earns benefit $\Psi > 1$ from reelection.

Proposition A.2 *A unique cutoff* $\tilde{x}^*$ *exists, admitting a unique perfect Bayesian equilibrium to the climate policy subgame with an office-motivated politician. There are two cases:*

1. *If* $\Psi \leq \frac{1}{F(\tau)-F(0)}$, *a politician of type* θ *chooses policy* $a = 1$ *upon observing signal* x^θ *with probability* $\sigma^*(\theta, x^\theta) \in [0, 1]$. *These probabilities are*

$$\sigma^*(1, x^1) = x^1 = \omega.$$
$$\sigma^*(0, x^0) = 1 - G(\tilde{x}^*; \omega).$$

   Upon observing policy a *and signal* s, *the voter reelects the politician with probability* $F(\mu^*(a, s; \tilde{x}^*))$.

2. *If* $\Psi > \frac{1}{F(\tau)-F(0)}$, *both politicians play* $a = 1$ *with probability 1. Upon observing policy* $a = 1$ *and signal* s, *the voter reelects the probability with probability* $F(\tau)$. *Off the equilibrium path,* $\mu^*(0, s) = 0$.

Proof of Proposition A.2: As before, the competent politician chooses $a = 1$ when $x^1 = 1$:

$$1+\beta\Psi F(\mu(1,0))+(1-\beta)\Psi F(\mu(1,1)) \geq \beta\Psi F(\mu(0,0))+(1-\beta)\Psi F(\mu(0,1)) \;\Leftrightarrow\; 1 \geq -\Psi\beta\Delta(0)-\Psi(1-\beta)\Delta(1).$$

She chooses $a = 0$ following signal $x^1 = 0$ only if Ψ is sufficiently small:

$$\Psi F(\mu(1,0)) \leq 1 + \Psi F(\mu(0,0)) \;\Leftrightarrow\; \Psi\Delta(0) \leq 1.$$

First consider the parameter space on Ψ such that $\Psi \leq \frac{1}{\Delta(0)}$ so that the voter believes that the competent politician always follows her signal. Then given $x^0 = x$, the incompetent politician chooses $a = 1$ iff

$$2\eta(x) - 1 + (1-\beta)\Psi\eta(x)\Delta(1;x) + \Psi(1-\eta(x)+\beta\eta(x))\Delta(0;x) \geq 0.$$

As before (see details of Proposition 1), there is a cutoff $\tilde{x}^*$ such that the incompetent politician plays $a = 1$ iff $x^0 \geq \tilde{x}^*$.

Now suppose that $\Psi > \frac{1}{\Delta(0)}$. Then the competent politician always plays $a = 1$. This means that any deviation must come from the incompetent politician, or $\mu^*(0, s) = 0$. Then, $\Delta(1) = F(\mu(1,1)) - F(0)$ and $\Delta(0) = F(\mu(1,0)) - F(0)$. The incompetent politician with signal $x^0 = x$ prefers to play $a = 1$ iff

$$2\eta(x) - 1 + (1-\beta)\Psi\eta(x)(F(\mu(1,1)) - F(\mu(1,0))) + \Psi(F(\mu(1,0)) - F(0)) \geq 0.$$

Now observe that $\mu(1,1) = \mu(1,0) = \tau$ so the constraint is always satisfied, hence it is always optimal for the incompetent politician to play $a = 1$. Then, the competent politician's constraint simplifies to $\Psi \leq \frac{1}{\Delta(0)} = \frac{1}{F(\tau)-F(0)}$. ∎

Corollary A.4 *Suppose $\Psi \leq \frac{1}{F(\tau)-F(0)}$. The equilibrium signal cutoff $\tilde{x}^*$ is decreasing in Ψ in the model with an office-motivated politician.*

Proof of Corollary A.4: Define the function $I(\tilde{x})$ as

$$I(\tilde{x}) := 2\eta(\tilde{x}) - 1 + (1-\beta)\Psi\eta(\tilde{x})\Delta(1;\tilde{x}) + \Psi(1-\eta(\tilde{x})+\beta\eta(\tilde{x}))\Delta(0;\tilde{x}).$$

Partially differentiating with respect to Ψ yields

$$\frac{\partial I(\tilde{x})}{\partial \Psi} = (1-\beta)\eta(\tilde{x})\Big(\Delta(1;\tilde{x}) - \Delta(0;\tilde{x})\Big) + \Delta(0;\tilde{x}) > 0.$$

Therefore by the implicit function theorem $\frac{d\tilde{x}^*}{d\Psi} < 0$. ■

This implies that the probability of climate action is increasing in Ψ. Moreover, in any equilibrium in which all politicians choose $a = 1$, i.e., when $\Psi > \frac{1}{F(\tau)-F(0)}$, the special interest chooses $\beta = 0$.

Robustness: Politician and Interest Group Signal

In the main model, the politician is unable to condition her strategy on the signal s sent by the interest group. I now relax that assumption. This means that the politician's strategy is now a function of her type θ, her private signal x^θ, as well as the public signal s.

It is straightforward to observe that the interest group's signal has no effect on the competent type: since she knows ω perfectly already, there is no incentive to deviate from her equilibrium strategy as posited in the main text. Hence, $\sigma^*(1, x^1, s) = x^1 = \omega$.

Now consider the incompetent type. Define $\rho(x^0, s; \beta) = P(\omega = 1|x^0, s; \beta)$ to be the incompetent type's posterior belief that $\omega = 1$ given her private signal x^0 and the realization of the interest group's message s given β. Since $s = 1$ is a truthful message, $\rho(x^0, 1) = 1$ for any value of x^0. Hence in the subgame following $s = 1$, the incompetent type chooses $a = 1$ iff

$$1 + F(\mu(1,1)) \geq F(\mu(0,1)),$$

which is always satisfied, so $\sigma^*(0, x^0, 1) = 1$. Hence following $s = 1$, there is a pooling equilibrium on $a = 1$. Off path, $\mu(0,1) = 0$ as it is the incompetent type who would possibly deviate.

Following $s = 0$, the incompetent type does not know if the special interest is truthful reporting $\omega = 0$ or if with some probability β it misreported. Then the incompetent type's problem is to choose $a = 1$ whenever

$$\rho(x^0, 0; \beta) + F(\mu(1,0)) \geq (1 - \rho(x^0, 0; \beta)) + F(\mu(0,0)) \;\Leftrightarrow\; 2\rho(x^0, 0; \beta) - 1 + \Delta(0) \geq 0.$$

It is clear that $\mu(1,0) = 0$ but $\mu(0,0)$ is decreasing in the probability that the incompetent type takes action (see proof of Proposition 1). Then, analogous to the proof of Proposition 1, there is a cutoff $\tilde{x}^*$ such that the incompetent type plays $a = 1$ iff $x^0 \geq \tilde{x}^*$. Hence $\sigma^*(0, x^0, 0) = 1 - G(\tilde{x}^*; \omega)$.

Proofs of International Cooperation Model

Recall that $\hat{\sigma}_i(\theta_i, \omega)$ is voter i's belief about the probability that politician i chooses $a_i = 1$ when she is of type θ and the state of the world is ω. Define $B(\theta_i, a_i, s_i, a_j)$ as proportional to the *ex ante* probability that a politician i of type θ chooses action a_i and signal s_i is realized by the special interest group in country i and politician j chooses action a_j.

$$B(\theta_i, 1, s_i, a_j) = P(\theta_i)\Big(\pi\hat{\sigma}_i(\theta_i, 1)P(a_j|\omega = 1) + (1-\pi)\hat{\sigma}_i(\theta_i, 0)\frac{P(s_i|s_i \neq \omega)}{P(s_i|s_i = \omega)}P(a_j|\omega = 0)\Big).$$
$$B(\theta_i, 0, s_i, a_j) = P(\theta_i)\Big(\pi(1-\hat{\sigma}_i(\theta_i, 1))P(a_j|\omega = 1) + (1-\pi)(1-\hat{\sigma}_i(\theta_i, 0))\frac{P(s_i|s_i \neq \omega)}{P(s_i|s_i = \omega)}P(a_j|\omega = 0)\Big).$$

Upon observing politician i's policy a_i, the special interest's signal in country i s_i, and politician j's policy a_j, voter i has a posterior belief about politician i's competence $\mu_i(a_i, s_i, a_j) = P(\theta_i = 1|a_i, s_i, a_j)$,

$$\mu_i(a_i, s_i, a_j) = \frac{P(a_i, s_i, a_j|\theta_i = 1)P(\theta_i = 1)}{P(a_i, s_i, a_j|\theta_i = 1)P(\theta_i = 1) + P(a_i, s_i, a_j|\theta_i = 0)P(\theta_i = 0)} = \frac{B(1, a_i, s_i, a_j)}{B(1, a_i, s_i, a_j) + B(0, a_i, s_i, a_j)}.$$

Lemma A.2 *The following statements are true regarding the ordering of voter i's posterior beliefs:*

- $\mu_i(1, 1, a_j) \geq \mu_i(0, 1, a_j) \;\Leftrightarrow\; \hat{\sigma}_i(1, 1) \geq \hat{\sigma}_i(0, 1)$.
- $\mu_i(1, 0, 1) \geq \mu_i(0, 0, 1) \;\Leftrightarrow\; \frac{\beta_i}{1-\beta_i}\frac{\pi}{1-\pi} \geq \frac{\tau_j\hat{\sigma}_j(1,1)+(1-\tau_j)\hat{\sigma}_j(0,1)}{\tau_j\hat{\sigma}_j(1,0)+(1-\tau_j)\hat{\sigma}_j(0,0)}\frac{\hat{\sigma}_i(0,1)-\hat{\sigma}_i(1,1)}{\hat{\sigma}_i(1,0)-\hat{\sigma}_i(0,0)}$.
- $\mu_i(1, 0, 0) \geq \mu_i(0, 0, 0) \;\Leftrightarrow\; \frac{\beta_i}{1-\beta_i}\frac{\pi}{1-\pi} \geq \frac{\tau_j(1-\hat{\sigma}_j(1,1))+(1-\tau_j)(1-\hat{\sigma}_j(0,1))}{\tau_j(1-\hat{\sigma}_j(1,0))+(1-\tau_j)(1-\hat{\sigma}_j(0,0))}\frac{\hat{\sigma}_i(0,1)-\hat{\sigma}_i(1,1)}{\hat{\sigma}_i(1,0)-\hat{\sigma}_i(0,0)}$.
- $\mu_i(1, 0, 1) \geq \mu_i(1, 0, 0) \;\Leftrightarrow\; \frac{\hat{\sigma}_i(1,1)}{\hat{\sigma}_i(0,1)} \geq \frac{\hat{\sigma}_i(1,0)}{\hat{\sigma}_i(0,0)}$.
- $\mu_i(1, 1, a_j) \geq \mu_i(1, 0, a_j) \;\Leftrightarrow\; \frac{\hat{\sigma}_i(1,1)}{\hat{\sigma}_i(0,1)} \geq \frac{\hat{\sigma}_i(1,0)}{\hat{\sigma}_i(0,0)}$.
- $\mu_i(0, 1, a_j) \geq \mu_i(0, 0, a_j) \;\Leftrightarrow\; \frac{1-\hat{\sigma}_i(1,1)}{1-\hat{\sigma}_i(0,1)} \geq \frac{1-\hat{\sigma}_i(1,0)}{1-\hat{\sigma}_i(0,0)}$.
- $\mu_i(0, 1, 1) \geq \mu_i(0, 1, 0) \;\Leftrightarrow\; \frac{\hat{\sigma}_i(1,1)}{\hat{\sigma}_i(0,1)} \geq \frac{\hat{\sigma}_i(1,0)}{\hat{\sigma}_i(0,0)}$.
- $\mu_i(0, 0, 1) \geq \mu_i(0, 0, 0) \;\Leftrightarrow\; \frac{1-\hat{\sigma}_i(1,1)}{1-\hat{\sigma}_i(0,1)} \geq \frac{1-\hat{\sigma}_i(1,0)}{1-\hat{\sigma}_i(0,0)}$.
- $\mu_i(a_i, 1, 1) = \mu_i(a_i, 1, 0)$.

Proof of Lemma A.2: Straightforward from definition of posterior beliefs. ■

Write $\Delta_i(s_i, a_j) = F(\mu_i(1, s_i, a_j)) - F(\mu_i(0, s_i, a_j))$ as the difference in politician i's reelection probabilities from playing $a_i = 1$ and $a_i = 0$ when interest group i generates signal s_i and politician j plays a_j.

Corollary A.5 *Suppose competent politicians follow their signal, $\hat{\sigma}_i(1,1) = 1$ and $\hat{\sigma}_i(1,0) = 0$. The following statements are true:*

- $\Delta_i(1, a_j) \geq 0$.
- $\Delta_i(1, a_j) \geq \Delta_i(0, a_j)$.
- $\Delta_i(s_i, 1) \geq \Delta_i(s_i, 0)$.

Proof of Corollary A.5: Immediate from Lemma A.2 and the definition of $\Delta_i(s_i, a_j)$. ■

To prove equilibrium existence (Proposition 2), I proceed in several steps. First I assume that competent types are willing to follow their signal, $a_i = x_i^1$ to prove that incompetent types have equilibrium strategies that are cutoffs: incompetent types play a_i iff their signal x_i^0 exceeds some cutoff k_i, holding fixed the behavior in country j and the beliefs of voter i (Lemma A.3). I then characterize the conditions needed for competent types to follow their signal in equilibrium, namely when τ_i is greater than some threshold $\overline{\tau}_i$ (Lemma A.4). I make this assumption for the rest of the analysis (Assumption A.1). I then endogenize the behavior of politician j into incompetent politician i's cutoff to show that there are cutoffs that are mutual best responses (Lemma A.5). Finally, I endogenize voter i's posterior beliefs as a function of the cutoff strategies (Lemma A.6).

Define the set of domestic fundamentals, which is the set of country-specific electoral returns in the climate policy subgame, as $\Lambda_i = \Big(\Delta_i(1,1),\ \Delta_i(1,0),\ \Delta_i(0,1),\ \Delta_i(0,0)\Big)$.

Lemma A.3 *Fix Λ_i and assume that competent politicians follow their signal. Politician i's best response is in cutoff strategies: there exists a cutoff k_i such that the incompetent politician chooses $a_i = 1$ iff $x_i^0 \geq k_i$.*

Proof of Lemma A.3: Let $y_j = P(a_j = 1|x_i)$ be the probability that politician j chooses $a_j = 1$ given what politician i knows about the state of the world from her realized signal $x_i^0 = x_i$. Then, $y_j = \tau_j\eta(x_i) + (1-\tau_j)\eta(x_i)\hat{\sigma}_j(0,1) + (1-\tau_j)(1-\eta(x_i))\hat{\sigma}_j(0,0)$. Observe that y_j is increasing in $\eta(x_i)$ (and hence in x_i by the monotone likelihood ratio property): $\frac{\partial y_j}{\partial \eta(x_i)} = \tau_j + (1-\tau_j)(\hat{\sigma}_j(0,1) - \hat{\sigma}_j(0,0)) \geq 0$, which follows from monotonicity of strategies in the state of the world.

Given Λ_i, the incompetent politician plays $a_i = 1$ following signal x_i iff

$$\eta(x_i)\Bigg[y_j\Big[1 + \beta_i F(\mu_i(1,0,1)) + (1-\beta_i)F(\mu_i(1,1,1)\Big] + (1-y_j)\Big[\beta_i F(\mu_i(1,0,0)) + (1-\beta_i)F(\mu_i(1,1,0))\Big]\Bigg]$$

$$+(1-\eta(x_i))\Big[y_j\Big[1+F(\mu_i(1,0,1))\Big]+(1-y_j)F(\mu_i(1,0,0))\Big] \geq$$

$$\eta(x_i)\Big[y_j\Big[\beta_i F(\mu_i(0,0,1))+(1-\beta_i)F(\mu_i(0,1,1))\Big]+(1-y_j)\Big[1+\beta_i F(\mu_i(0,0,0))+(1-\beta_i)F(\mu_i(0,1,0))\Big]\Big]$$

$$+(1-\eta(x_i))\Big[y_j F(\mu_i(0,0,1))+(1-y_j)\Big[1+F(\mu_i(0,0,0))\Big]\Big].$$

$$\Leftrightarrow \; 2y_j-1+(1-\eta(x_i)+\eta(x_i)\beta_i)\Big(y_j\Delta_i(0,1)+(1-y_j)\Delta(0,0)\Big)+\eta(x_i)(1-\beta_i)\Big(y_j\Delta_i(1,1)+(1-y_j)\Delta_i(1,0)\Big) \geq 0. \tag{2}$$

Differentiating with respect to $\eta(x_i)$ yields

$$2\frac{\partial y_j}{\partial \eta(x_i)}+(1-\beta_i)\Big(y_j\Delta_i(1,1)-y_j\Delta_i(0,1)+(1-y_j)\Delta_i(1,0)-(1-y_j)\Delta_i(0,0)\Big)+(1-\eta(x_i)+\eta(x_i)\beta_i)\frac{\partial y_j}{\partial \eta(x_i)}\Big(\Delta_i(0,1)-\Delta_i(0,0)\Big)>0.$$

Hence, incompetent politician i's net gain from playing $a_i=1$ is increasing in x_i such that by the intermediate value theorem she adopts a cutoff strategy and plays $a_i=1$ iff $x_i^0 \geq k_i$. ■

Lemma A.4 *Assume $\tau_j \geq \overline{\tau}_j$. The competent politician i always follows her signal.*

Proof of Lemma A.4: Proof is analogous for politician j. Let $y_{j\omega}=P(a_j=1|\omega)$ be the competent politician's updated beliefs about politician j's behavior given that she knows the state of the world perfectly.

Suppose a competent politician i observes $x_i=1$. She plays $a_i=1$ iff

$$y_{j1}\Big[1+\beta_i F(\mu_i(1,0,1))+(1-\beta_i)F(\mu_i(1,1,1))\Big]+(1-y_{j1})\Big[\beta_i F(\mu_i(1,0,0))+(1-\beta_i)F(\mu_i(1,1,0))\Big] \geq$$

$$y_{j1}\Big[\beta_i F(\mu_i(0,0,1))+(1-\beta_i)F(\mu_i(0,1,1))]+(1-y_{j1})\Big[\beta_i F(\mu_i(0,0,0))+(1-\beta_i)F(\mu_i(0,1,0))\Big].$$

$$\Leftrightarrow \; y_{j1}+\beta_i\Big(y_{j1}\Delta_i(0,1)+(1-y_{j1})\Delta_i(0,0)\Big)+(1-\beta_i)\Big(y_{j1}\Delta_i(1,1)+(1-y_{j1})\Delta_i(1,0)\Big) \geq 0.$$

By following her signal, $\Delta_i(1,1)=\Delta_i(1,0)$ and $\Delta_i(0,1) \geq \Delta_i(0,0)$ by Corollary A.5; the inequality holds.

Similarly, suppose a competent politician i observes $x_i=0$. She plays $a_i=0$ iff

$$y_{j0}F(\mu_i(0,0,1))+(1-y_{j0})\Big[1+F(\mu_i(0,0,0))\Big] \geq y_{j0}F(\mu_i(1,0,1))+(1-y_{j0})F(\mu_i(1,0,0))$$

$$\Leftrightarrow \; (1-y_{j0})(1-\Delta_i(0,0))-y_{j0}\Delta_i(0,1) \geq 0.$$

This inequality need not hold; by way of contradiction, suppose it doesn't hold. Then this means that the competent type plays $a_i=1$ regardless of her signal. Therefore, $\mu_i(0,s_i,a_j)=0$ because any $a_i=0$

must be played by the incompetent type.

Consider the incentives for the incompetent type. Suppose the incompetent type receives signal $x_i^0 = x_i$ and has beliefs $y_j = P(a_j = 1|x_i)$. The incompetent type plays $a_i = 1$ iff Equation 2 is satisfied, which in this case reduces to

$$2y_j-1-F(0)+(\eta(x_i)\beta_i y_j+(1-\eta(x_i))y_j)F(\mu_i(1,0,1))+\eta(x_i)(1-\beta_i)F(\mu_i(1,1,1))+(\eta(x_i)\beta_i(1-y_j)+(1-\eta(x_i))(1-y_j))F(\mu_i(1,0,0)) \geq 0,$$

where the simplification comes from the fact that $\mu_i(0, s_i, a_j) = 0$ and that by Lemma A.2, $\mu_i(1, 1, 1) = \mu_i(1, 1, 0)$. In a pooling equilibrium, it would also be true that $\mu_i(1, s_i, a_j) = \tau_i$, meaning the voter would learn nothing about the competent politician's type from $a_i = 1$. Substituting this into the incompetent politician's incentive constraint yields

$$2y_j - 1 - F(0) + F(\tau_i) \geq 0,$$

however, by the intermediate value theorem, there are some values of x_i where this constraint holds and some where it does not (because y_j is increasing in x_i). Hence pooling on $a_i = 1$ is not always optimal: there exists a cutoff $\hat{x}_i$ such that the incompetent politician plays $a_i = 1$ iff $x_i \geq \hat{x}_i$ and $a_i = 0$ otherwise. Then we know that in such an equilibrium, $\sigma(1, 1) = \sigma(1, 0) = 1$, $\sigma(0, 1) = 1 - G(\hat{x}_i; 1)$, and $\sigma(0, 0) = 1 - G(\hat{x}_i; 0)$. Further, by first-order stochastic dominance, $G(\hat{x}_i; 0) \geq G(\hat{x}_i; 1) \implies \sigma(0, 1) \geq \sigma(0, 0)$ so by Lemma A.2 we have $\mu_i(1, 0, 0; \hat{x}_i) \geq \mu_i(1, 0, 1; \hat{x}_i)$.

Returning the competent politician's constraint, recall that she plays $a_i = 1$ following $x_i^1 = 0$ iff

$$(1 - y_{j0})(1 - F(\mu_i(1, 0, 0; \hat{x}_i))) - y_{j0}F(\mu_i(1, 0, 1; \hat{x}_i)) + F(0) \leq 0.$$

Note that if $x_i \geq \hat{x}_i$, then the incompetent politician is pooling, so $\mu_i(1, 0, 0; \hat{x}_i) = \mu_i(1, 0, 1; \hat{x}_i) = \tau_i$. But if $x_i \leq \hat{x}_i$, there is separation between the competent and the incompetent types, so posterior beliefs are bounded below by τ_i, $\mu_i(1, 0, 0; \hat{x}_i) \geq \mu_i(1, 0, 1; \hat{x}_i) \geq \tau_i$. Clearly this is hardest to satisfy at the lower bound, yielding

$$1 - y_{j0} - F(\tau_i) + F(0) \leq 0.$$

Since the LHS is increasing in τ_j and the RHS is constant, there is a value $\overline{\tau}_j$ such that when $\tau_j \leq \overline{\tau}_j$ the constraint is satisfied, but that contradicts the hypothesis that $\tau_j \geq \overline{\tau}_j$. ■

To continue with the analysis, maintain the following assumption such that Lemma A.4 holds.

Assumption A.1 *Both politicians are sufficiently likely to be competent:* $\tau_i \geq \overline{\tau}_i$ *and* $\tau_j \geq \overline{\tau}_j$*.*

Now we endogenize the behavior of politician j into politician i's best response (and vice versa).

Lemma A.5 *Fix* Λ_i*. There exist cutoffs* $(\tilde{x}_i, \tilde{x}_j)$ *that are mutual best responses.*

Proof of Lemma A.5: By Lemma A.3, the incompetent politician in both countries has a well-defined cutoff k_i such that i plays $a_i = 1$ iff $x_i^0 \geq k_i$ holding fixed the strategy of politician j. Since politician j is playing a cutoff strategy, we know that $y_j = \tau_j \eta(x_i) + (1-\tau_j)\eta(x_i)(1-G(k_j;1)) + (1-\tau_j)(1-\eta(x_i))(1-G(k_j;0))$ given that $x_i^0 = x_i$. Observe that $\frac{\partial y_j}{\partial k_j} = -(1-\tau_j)\Big(\eta(x_i)g(k_j;1) + (1-\eta(x_i))g(k_j;0)\Big) < 0$.

Define $\hat{I}(k_i, k_j; \Lambda_i)$ as the incompetent politician i's indifference condition between playing $a_i = 1$ and $a_i = 0$ that endogenizes the cutoff of the incompetent politician j:

$$\begin{aligned}\hat{I}(k_i, k_j; \Lambda_i) :=\; & 2y_j(k_i, k_j) - 1 + (1 - \eta(k_i) + \eta(k_i)\beta_i)\Big(y_j(k_i, k_j)\Delta_i(0,1) + (1 - y_j(k_i, k_j))\Delta_i(0,0)\Big) \\ & + \eta(k_i)(1-\beta_i)\Big(y_j(k_i, k_j)\Delta_i(1,1) + (1 - y_j(k_i, k_j))\Delta_i(1,0)\Big).\end{aligned}$$

Hence, the cutoffs $(\tilde{x}_i, \tilde{x}_j)$ therefore solve the system

$$\hat{I}(\tilde{x}_i, \tilde{x}_j; \Lambda_i) = 0 \quad \text{and} \quad \hat{I}(\tilde{x}_j, \tilde{x}_i; \Lambda_j) = 0.$$

To show the system has a unique solution, I use the implicit function theorem. The Jacobian matrix is

$$\mathbf{J} = \begin{bmatrix} \frac{\partial \hat{I}(k_i, k_j; \Lambda_i)}{\partial k_i} & \frac{\partial \hat{I}(k_i, k_j; \Lambda_i)}{\partial k_j} \\ \frac{\partial \hat{I}(k_j, k_i; \Lambda_j)}{\partial k_i} & \frac{\partial \hat{I}(k_j, k_i; \Lambda_j)}{\partial k_j} \end{bmatrix}.$$

Differentiating $\hat{I}(k_i, k_j; \Lambda_i)$ with respect to k_j yields

$$\frac{\partial \hat{I}(k_i, k_j; \Lambda_i)}{\partial k_j} = 2\frac{\partial y_j}{\partial k_j} + (1-\eta(k_i)+\eta(k_i)\beta_i)\frac{\partial y_j}{\partial k_j}\Big(\Delta_i(0,1)-\Delta_i(0,0)\Big) + \eta(k_i)(1-\beta_i)\frac{\partial y_j}{\partial k_j}\Big(\Delta_i(1,1)-\Delta_i(1,0)\Big) < 0.$$

Since the determinant $|\mathbf{J}| = \frac{\partial \hat{I}(k_i, k_j; \Lambda_i)}{\partial k_i}\frac{\partial \hat{I}(k_j, k_i; \Lambda_j)}{\partial k_j} - \frac{\partial \hat{I}(k_i, k_j; \Lambda_i)}{\partial k_j}\frac{\partial \hat{I}(k_j, k_i; \Lambda_j)}{\partial k_i} > 0$, the system has a unique solution at the cutoffs $(\tilde{x}_i, \tilde{x}_j)$ are well-defined. ■

Now we need to endogenize voter i's beliefs by writing $\Delta_i(s_i, a_j)$ as a function of equilibrium strategies. By Lemma A.5, there exists a pair of cutoffs $(\tilde{x}_i, \tilde{x}_j)$ such that incompetent politician i plays $a_i = 1$ iff $x_i^0 \geq \tilde{x}_i$

(same for incompetent politician j), and that competent politicians always follow their signals. Moreover, given $\tilde{x}_j$, we can write $\tilde{y}_{j1} = P(a_j = 1|\omega = 1, \tilde{x}_j) = \tau_j + (1-\tau_j)(1 - G(\tilde{x}_j; 1))$ and $\tilde{y}_{j0} = P(a_j = 1|\omega = 0, \tilde{x}_j) = (1-\tau_j)(1 - G(\tilde{x}_j; 0))$. This induces the following posterior beliefs for voter i:

$$\mu_i(1,0,1;\tilde{x}_i,\tilde{x}_j) = \frac{\tau_i \pi \tilde{y}_{j1}}{\pi \tilde{y}_{j1}(\tau_i + (1-\tau_i)(1-G(\tilde{x}_i;1))) + (1-\tau_i)(1-\pi)\frac{\beta_i}{1-\beta_i}(1-G(\tilde{x}_i;0))\tilde{y}_{j0}}.$$

$$\mu_i(1,1,1;\tilde{x}_i,\tilde{x}_j) = \frac{\tau_i}{\tau_i + (1-\tau_i)(1-G(\tilde{x}_i;1))}.$$

$$\mu_i(1,0,0;\tilde{x}_i,\tilde{x}_j) = \frac{\tau_i \pi (1-\tilde{y}_{j1})}{\pi(1-\tilde{y}_{j1})(\tau_i + (1-\tau_i)(1-G(\tilde{x}_i;1))) + (1-\tau_i)(1-\pi)\frac{\beta_i}{1-\beta_i}(1-G(\tilde{x}_i;0))(1-\tilde{y}_{j0})}.$$

$$\mu_i(1,1,0;\tilde{x}_i,\tilde{x}_j) = \frac{\tau_i}{\tau_i + (1-\tau_i)(1-G(\tilde{x}_i;1))}.$$

$$\mu_i(0,0,1;\tilde{x}_i,\tilde{x}_j) = \frac{\tau_i(1-\pi)\frac{\beta_i}{1-\beta_i}\tilde{y}_{j0}}{(1-\pi)\frac{\beta_i}{1-\beta_i}\tilde{y}_{j0}(\tau_i + (1-\tau_i)G(\tilde{x}_i;0)) + (1-\tau_i)\pi G(\tilde{x}_i;1)\tilde{y}_{j1}}.$$

$$\mu_i(0,1,1;\tilde{x}_i,\tilde{x}_j) = 0.$$

$$\mu_i(0,0,0;\tilde{x}_i,\tilde{x}_j) = \frac{\tau_i(1-\pi)\frac{\beta_i}{1-\beta_i}(1-\tilde{y}_{j0})}{(1-\pi)\frac{\beta_i}{1-\beta_i}(1-\tilde{y}_{j0})(\tau_i + (1-\tau_i)G(\tilde{x}_i;0)) + (1-\tau_i)\pi G(\tilde{x}_i;1)(1-\tilde{y}_{j1})}.$$

$$\mu_i(0,1,0;\tilde{x}_i,\tilde{x}_j) = 0.$$

The following table summarizes the sign of the derivative of voter i's posterior beliefs with respect to the cutoffs $\tilde{x}_i$ and $\tilde{x}_j$.

$\mu_i(a_i, s_i, a_j; \tilde{x}_i, \tilde{x}_j)$	$\frac{\partial \mu_i(a_i,s_i,a_j;\tilde{x}_i,\tilde{x}_j)}{\partial \tilde{x}_i}$	$\frac{\partial \mu_i(a_i,s_i,a_j;\tilde{x}_i,\tilde{x}_j)}{\partial \tilde{x}_j}$
$\mu_i(1,1,1)$	+	0
$\mu_i(1,1,0)$	+	0
$\mu_i(1,0,1)$	+	+
$\mu_i(1,0,0)$	+	-
$\mu_i(0,1,1)$	0	0
$\mu_i(0,1,0)$	0	0
$\mu_i(0,0,1)$	-	+
$\mu_i(0,0,0)$	-	-

Table A.1

Signing derivatives with respect to $\tilde{x}_i$ follow analogously from the proof of Proposition 1. Derivatives with respect to $\tilde{x}_j$ can be signed because the monotone likelihood ratio property implies hazard rate ordering. From Table A.1, it is evident that all $\Delta(s_i, a_j)$ are increasing in $\tilde{x}_i$.

Lemma A.6 *There exist cutoffs $(\tilde{x}_i^*, \tilde{x}_j^*)$ that are mutual best responses.*

Proof of Lemma A.6: Define $\hat{I}^*(\tilde{x}_i, \tilde{x}_j, \Lambda_i)$ as the incompetent politician i's indifference condition that endogenizes both the cutoff of the incompetent politician j $\tilde{x}_j$ and the electoral returns in country i Λ_i given equilibrium strategies defined by such cutoffs:

$$\hat{I}^*(\tilde{x}_i, \tilde{x}_j, \Lambda_i) = 2y(\tilde{x}_i, \tilde{x}_j) - 1 + (1 - \eta(\tilde{x}_i) + \eta(\tilde{x}_i)\beta_i)\Big(y(\tilde{x}_i, \tilde{x}_j)\Delta_i(0, 1; \tilde{x}_i, \tilde{x}_j) + (1 - y(\tilde{x}_i, \tilde{x}_j))\Delta_i(0, 0; \tilde{x}_i, \tilde{x}_j)\Big) + \eta(\tilde{x}_i)(1 - \beta_i)\Delta_i(1, 0; \tilde{x}_i, \tilde{x}_j). \tag{3}$$

Differentiating with respect to $\tilde{x}_i$ yields

$$\frac{\partial \hat{I}^*(\tilde{x}_i, \tilde{x}_j, \Lambda_i)}{\partial \tilde{x}_i} = \frac{\partial \hat{I}(\tilde{x}_i; \tilde{x}_j, \Lambda_i)}{\partial \tilde{x}_i} + (1 - \eta(\tilde{x}_i) - \eta(\tilde{x}_i)\beta_i)(y(\tilde{x}_i, \tilde{x}_j)\frac{\partial \Delta_i(0, 1)}{\partial \tilde{x}_i} + (1 - y(\tilde{x}_i, \tilde{x}_j))\frac{\partial \Delta_i(0, 0)}{\partial \tilde{x}_i}) + \eta(\tilde{x}_i)(1 - \beta_i)\frac{\partial \Delta_i(1, 0)}{\partial \tilde{x}_i} > 0.$$

Hence endogenizing voter i's beliefs preserves optimality of the cutoff strategy for incompetent politician i.

Finally, differentiating with respect to $\tilde{x}_j$ yields

$$\frac{\partial \hat{I}^*(\tilde{x}_i, \tilde{x}_j, \Lambda_i)}{\partial \tilde{x}_j} = \frac{\partial \hat{I}(\tilde{x}_i, \tilde{x}_j; \Lambda_i)}{\partial \tilde{x}_j} + (1 - \eta(\tilde{x}_i) - \eta(\tilde{x}_i)\beta_i)(y(\tilde{x}_i, \tilde{x}_j)\frac{\partial \Delta_i(0, 1)}{\partial \tilde{x}_j} + (1 - y(\tilde{x}_i, \tilde{x}_j))\frac{\partial \Delta_i(0, 0)}{\partial \tilde{x}_j}) < 0.$$

Therefore, there exist cutoffs $(\tilde{x}_i^*, \tilde{x}_j^*)$ solving the system

$$\hat{I}^*(\tilde{x}_i^*, \tilde{x}_j^* \Lambda_i(\tilde{x}_i^*, \tilde{x}_j^*)) = 0 \quad \text{and} \quad \hat{I}^*(\tilde{x}_j^*, \tilde{x}_i^*, \Lambda_j(\tilde{x}_j^*, \tilde{x}_i^*)) = 0.$$

Analogous to Lemma A.5, the solution to the system is unique by the implicit function theorem by constructing the Jacobian matrix $\mathbf{J}$ and demonstrating that $|\mathbf{J}| > 0$. ■

Proof Proposition 2: Following any history in which politician i chooses policy a_i, voter i observes signal s_i, and politician j chooses policy a_j, the voter has posterior belief $P(\theta_i = 1|a_i, s_i, a_j) = \mu(a_i, s_i, a_j)$ as defined above, and reelects politician i iff $\mu(a_i, s_i, a_j) \geq \varepsilon_i$, which occurs with probability $F(\mu(a_i, s_i, a_j))$.

By Lemma A.4, the competent politician always follows her signal. By Lemma A.6, the incompetent politician plays a cutoff strategy such that she plays $a_i = 1$ iff $x_i^0 \geq \tilde{x}_i^*$, where $\tilde{x}_i^*$ exists and is a best response to both politician j's behavior and voter i's posterior beliefs. ■

Proof of Result 4: Immediate from Lemma A.6 and the implicit function theorem,

$$\frac{d\tilde{x}_i^*}{dk_j} = -\frac{\partial \hat{I}^*(k_i, k_j, \Lambda_i)/\partial k_j}{\partial \hat{I}^*(k_i; k_j, \Lambda_i)/\partial k_i} > 0.$$

■

Corollary A.6 *Politician i's cutoff $\tilde{x}_i^*$ is increasing in β_i.*

Proof of Corollary A.6: By the implicit function theorem,

$$\frac{d\tilde{x}_i^*}{d\beta_i} = -\frac{\begin{bmatrix} \frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial \beta_i} & \frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial k_j} \\ \frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial \beta_i} & \frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial k_j} \end{bmatrix}}{|\mathbf{J}|}.$$

It is clear that $\frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial \beta_i} = 0$. Now differentiate $\hat{I}^*(\tilde{x}_i, \tilde{x}_j, \Lambda_i)$ with respect to β_i to get

$$\frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial \beta_i} = \eta(\tilde{x}_i)(y\Delta_i(0,1)+(1-y)\Delta_i(0,0)-\Delta_i(1,0))+(1-\eta(\tilde{x}_i)+\eta(\tilde{x}_i)\beta_i)(y\frac{\partial \Delta_i(0,1)}{\partial \beta_i}+(1-y)\frac{\partial \Delta_i(0,0)}{\partial \beta_i}).$$

Now, $\mu_i(1,0,1;\tilde{x}_i,\tilde{x}_j)$ is decreasing in β_i and $\mu_i(0,0,1;\tilde{x}_i,\tilde{x}_j)$ is increasing in β_i so $\Delta_i(0,1)$ is decreasing in β_i. Similarly, $\mu_i(1,0,0;\tilde{x}_i,\tilde{x}_j)$ is decreasing in β_i and $\mu_i(0,0,0;\tilde{x}_i,\tilde{x}_j)$ is increasing in β_i so $\Delta_i(0,0)$ is also decreasing in β_i. Hence $\frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial \beta_i} < 0$ so the determinant of the matrix in the numerator is negative; by the implicit function theorem, $\frac{d\tilde{x}_i^*}{d\beta_i} > 0$. ■

Proof of Result 5: By the implicit function theorem,

$$\frac{d\tilde{x}_j^*}{d\beta_i} = -\frac{\begin{bmatrix} \frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial k_i} & \frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial \beta_i} \\ \frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial k_i} & \frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial \beta_i} \end{bmatrix}}{|\mathbf{J}|}.$$

It is clear that $\frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial \beta_i} = 0$. From Corollary A.6, $\frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial \beta_i} < 0$ so the determinant of the matrix in the numerator is negative (as $\frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial k_i} < 0$). Then $\frac{d\tilde{x}_j^*}{d\beta_i} > 0$. ■

Corollary A.7 *Politician i's cutoff $\tilde{x}_i^*$ is decreasing in π.*

Proof of Corollary A.7:

$$\frac{d\tilde{x}_i^*}{d\pi} = -\frac{\begin{bmatrix} \frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial \pi} & \frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial k_j} \\ \frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial \pi} & \frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial k_j} \end{bmatrix}}{|\mathbf{J}|}.$$

Partially differentiating with respect to π yields

$$\begin{aligned}\frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial \pi} &= 2\frac{\partial y_j}{\partial \eta(\tilde{x}_i^*)}\frac{\partial \eta(\tilde{x}_i^*)}{\partial \pi} + (1-\beta_i)\frac{\partial \eta(\tilde{x}_i^*)}{\partial \pi}\Big(\Delta_i(1,0) - y_j\Delta_i(0,1) - (1-y_j)\Delta_i(0,0)\Big) \\ &+ (1-\eta(\tilde{x}_i^*) + \eta(\tilde{x}_i^*)\beta_i)\Big(\frac{\partial y_j}{\partial \eta(\tilde{x}_i^*)}\frac{\partial \eta(\tilde{x}_i^*)}{\partial \pi}(\Delta_i(0,1) - \Delta_i(0,0)) + y_j\frac{\partial \Delta_i(0,1)}{\partial \pi} + (1-y_j)\frac{\partial \Delta_i(0,0)}{\partial \pi}\Big).\end{aligned}$$

Now, $\mu_i(1,0,1;\tilde{x}_i^*,\tilde{x}_j^*)$ is increasing in π and $\mu_i(0,0,1;\tilde{x}_i^*,\tilde{x}_j^*)$ is decreasing in π, hence $\frac{\Delta_i(0,1)}{\partial \pi} > 0$. Similarly, $\mu_i(1,0,0;\tilde{x}_i^*,\tilde{x}_j^*)$ is increasing in π and $\mu_i(0,0,0;\tilde{x}_i^*,\tilde{x}_j^*)$ is decreasing in π, hence $\frac{\partial \Delta_i(0,0)}{\partial \pi} > 0$. Therefore $\frac{\partial \hat{I}^*(\tilde{x}_i,\tilde{x}_j,\Lambda_i)}{\partial \pi} > 0$, and by symmetry, $\frac{\partial \hat{I}^*(\tilde{x}_j,\tilde{x}_i,\Lambda_j)}{\partial \pi}$. Therefore the determinant of the matrix in the numerator is positive and by the implicit function theorem $\frac{d\tilde{x}_i^*}{d\pi} < 0$. ■

Proof of Result 6: The *ex ante* probability of climate action for country i (analogous for country j) is defined as

$$A_i(\tilde{x}_i^*) = \tau_i\pi + (1-\tau_i)\pi(1-G(\tilde{x}_i^*;1)) + (1-\tau_i)(1-\pi)(1-G(\tilde{x}_i^*;0)).$$

Differentiating with respect to β_i yields

$$\begin{aligned}\frac{dA_i}{d\beta_i} &= -(1-\tau_i)\frac{d\tilde{x}_i^*}{d\beta_i}\Big(\pi g(\tilde{x}_i^*;1) + (1-\pi)g(\tilde{x}_i^*;0)\Big) < 0. \\ \frac{dA_j}{d\beta_i} &= -(1-\tau_j)\frac{d\tilde{x}_j^*}{d\beta_i}\Big(\pi g(\tilde{x}_j^*;1) + (1-\pi)g(\tilde{x}_j^*;0)\Big) < 0.\end{aligned}$$

Then, using the definitions of coordinated climate action, unilateral climate action, and coordinated climate inaction from the text, differentiating with respect to β_i yields

$$\begin{aligned}\text{coordinated climate action:} &\quad A_i\frac{dA_j}{d\beta_i} + \frac{dA_i}{d\beta_i}A_j < 0. \\ \text{unilateral climate action:} &\quad \frac{dA_i}{d\beta_i}(1-2A_j) + \frac{dA_j}{d\beta_i}(1-2A_i). \\ \text{coordinated climate inaction:} &\quad -(1-A_i)\frac{dA_j}{d\beta_i} - \frac{dA_i}{d\beta_i}(1-A_j) > 0.\end{aligned}$$

Clearly, coordinated climate action is decreasing in β_i and coordinated climate inaction is increasing in β_i. A sufficient condition that unilateral climate action is increasing in β_i is thus if $A_i > \frac{1}{2}$ and $A_j > \frac{1}{2}$. ■

Lemma A.7 *Fix β_j. Given equilibrium behavior in the international coordination game, special interest i's best response $\hat{\beta}_i(\beta_j) \in [0,1]$ exists.*

Proof of Lemma A.7: Fix β_j (the proof is analogous for special interest j fixing β_i). Since β_j is a parameter, this proof is identical to Lemma 1 albeit that the incompetent politician's cutoff is $\tilde{x}_i^*$ and not $\tilde{x}^*$ (although these cutoffs have the same relevant properties).

Special interest i has the objective function

$$\max_{\beta_i \in [0,1]} 1 - A_i\Big(\tilde{x}_i^*(\beta_i, \beta_j)\Big) - c(\beta_i).$$

Differentiating with respect to β_i yields the first-order condition

$$-\frac{dA_i}{d\beta_i} - c'(\beta_i) = 0,$$

and second-order condition

$$SOC = -\frac{d^2 A_i}{d\beta_i^2} - c''(\beta_i),$$

where $\frac{d^2 A_i}{d\beta_i^2} = -(1-\tau_i)\frac{d^2 \tilde{x}_i^*}{d\beta_i^2}\Big(\pi g(\tilde{x}_i^*(\beta_i, \beta_j); 1) + (1-\pi) g(\tilde{x}_i^*(\beta_i, \beta_j); 0)\Big) - (1-\tau_i)(\frac{d\tilde{x}_i^*}{d\beta_i})^2\Big(\pi g'(\tilde{x}_i^*(\beta_i, \beta_j); 1) + (1-\pi) g'(\tilde{x}_i^*(\beta_i, \beta_j); 0)\Big)$. Similar to the argument made in the proof of Lemma 1, a solution $\hat{\beta}_i(\beta_j)$ exists, either as the solution to the first-order condition or on the corner. ■

Proof of Lemma 2: Since each interest group's best response is well-defined as shown in Lemma A.7, we now endogenize the behavior of the other interest group. Define the function $Z(\beta_i, \beta_j)$ as (analogous for group j):

$$Z(\beta_i, \beta_j) := (1-\tau_i)\frac{d\tilde{x}_i^*}{d\beta_i}\Big(\pi g(\tilde{x}_i^*(\beta_i, \beta_j); 1) + (1-\pi) g(\tilde{x}_i^*(\beta_i, \beta_j); 0)\Big) - c'(\beta_i),$$

where $\hat{\beta}_i(\beta_j)$ is the solution to $Z(\hat{\beta}_i, \beta_j) = 0$ for a fixed β_j, and $\frac{\partial Z(\hat{\beta}_i, \beta_j)}{\partial \beta_i} < 0$, by definition of $\hat{\beta}_i(\beta_j)$ being utility maximizing. The equilibrium levels of misreporting (β_i^*, β_j^*) are defined as the solution to the system

$$Z(\beta_i^*, \beta_j^*) = 0 \;\text{ and }\; Z(\beta_j^*, \beta_i^*) = 0.$$

To show that this system has a unique solution, define the Jacobian matrix as

$$\mathbf{J} = \begin{bmatrix} \frac{\partial Z(\beta_i^*, \beta_j^*)}{\partial \beta_i} & \frac{\partial Z(\beta_i^*, \beta_j^*)}{\partial \beta_j} \\ \frac{\partial Z(\beta_j^*, \beta_i^*)}{\partial \beta_i} & \frac{\partial Z(\beta_j^*, \beta_i^*)}{\partial \beta_j} \end{bmatrix}.$$

We know that $\frac{\partial Z(\beta_i^*,\beta_j^*)}{\partial\beta_i} < 0$ and $\frac{\partial Z(\beta_j^*,\beta_i^*)}{\partial\beta_j} < 0$. Differentiating with respect to β_j yields

$$\begin{aligned}\frac{\partial Z(\beta_i,\beta_j)}{\partial\beta_j} &= (1-\tau_i)\frac{d^2\tilde{x}_i^*}{d\beta_i d\beta_j}\Big(\pi g(\tilde{x}_i^*(\beta_i,\beta_j);1) + (1-\pi)g(\tilde{x}_i^*(\beta_i,\beta_j);0)\Big)\\ &\quad + (1-\tau_i)\frac{d\tilde{x}_i^*}{d\beta_i}\frac{d\tilde{x}_i^*}{d\beta_j}\Big(\pi g'(\tilde{x}_i^*(\beta_i,\beta_j);1) + (1-\pi)g'(\tilde{x}_i^*(\beta_i,\beta_j);0)\Big).\end{aligned}$$

While $\frac{\partial Z(\beta_i,\beta_j)}{\partial\beta_j}$ is not readily signed, observe that by symmetry, $sgn\frac{\partial Z(\beta_i,\beta_j)}{\partial\beta_j} = sgn\frac{\partial Z(\beta_j,\beta_i)}{\partial\beta_i}$. Then it is apparent that $|\mathbf{J}| \neq 0$, and hence nonsingular, so a solution to the system exists. ■

Proof of Result 8: By the implicit function theorem,

$$\frac{d\hat{\beta}_i}{d\beta_j} = -\frac{\partial I_i/\partial\beta_j}{\partial I_i/\partial\beta_i}.$$

Partially differentiating with respect to β_j yields

$$\begin{aligned}\frac{\partial Z(\beta_i,\beta_j)}{\partial\beta_j} &= (1-\tau_i)\frac{d^2\tilde{x}_i^*}{d\beta_i d\beta_j}\Big(\pi g(\tilde{x}_i^*(\beta_i,\beta_j);1) + (1-\pi)g(\tilde{x}_i^*(\beta_i,\beta_j);0)\Big)\\ &\quad + (1-\tau_i)\frac{d\tilde{x}_i^*}{d\beta_i}\frac{d\tilde{x}_i^*}{d\beta_j}\Big(\pi g'(\tilde{x}_i^*(\beta_i,\beta_j);1) + (1-\pi)g'(\tilde{x}_i^*(\beta_i,\beta_j);0)\Big).\end{aligned}$$

The sign of the first term depends on the sign of $\frac{d^2\tilde{x}_i^*}{d\beta_i d\beta_j}$ and the sign of the second term depends on the sign of $\pi g'(\tilde{x}_i^*(\beta_i,\beta_j);1) + (1-\pi)g'(\tilde{x}_i^*(\beta_i,\beta_j);0)$. Note that since $g(\cdot,\omega)$ is a log-concave density, it is single peaked. Then for any $x \geq 1$, $\pi g'(x;1) + (1-\pi)g'(x;0) < 0$ and for any $x \leq 0$, $\pi g'(x;1) + (1-\pi)g'(x;0) > 0$. But for $x \in (0,1)$, $g'(x;1) > 0$ and $g'(x;0) < 0$.

Now, as $\pi \to 0$, $\tilde{x}_i^* \to \infty$, so the first term goes to zero, and the second term is $(1-\tau_i)\frac{d\tilde{x}_i^*}{d\beta_i}\frac{d\tilde{x}_i^*}{d\beta_j}g'(\tilde{x}_i^*(\beta_i,\beta_j);0) \leq 0$. Hence $\frac{\partial Z(\beta_i,\beta_j)}{\partial\beta_j} \leq 0$ so $\frac{d\hat{\beta}_i}{d\beta_j} \leq 0$. As $\pi \to 1$, $\tilde{x}_i^* \to -\infty$, so the first term goes to zero, and the second term is $(1-\tau_i)\frac{d\tilde{x}_i^*}{d\beta_i}\frac{d\tilde{x}_i^*}{d\beta_j}g'(\tilde{x}_i^*(\beta_i,\beta_j);1) \geq 0$. Hence $\frac{\partial Z(\beta_i,\beta_j)}{\partial\beta_j} \geq 0$ so $\frac{d\hat{\beta}_i}{d\beta_j} \geq 0$. ■

Proof of Result 7: Given the definitions of $A_i(\tilde{x}_i^*)$ from the main text of $R_i(\tilde{x}_i^*)$:

$$R_i(\tilde{x}_i^*) - A_i(\tilde{x}_i^*) = \tau_i(1-\pi) + (1-\tau_i)(1-\pi)(2G(\tilde{x}_i^*;0) - 1).$$

Differentiating with respect to β_i and β_j yields

$$\frac{d(R_i(\tilde{x}_i^*) - A_i(\tilde{x}_i^*))}{d\beta_i} = 2(1-\tau_i)(1-\pi)g(\tilde{x}_i^*;0)\frac{d\tilde{x}_i^*}{d\beta_i} > 0.$$
$$\frac{d(R_i(\tilde{x}_i^*) - A_i(\tilde{x}_i^*))}{d\beta_j} = 2(1-\tau_i)(1-\pi)g(\tilde{x}_i^*;0)\frac{d\tilde{x}_i^*}{d\tilde{x}_j^*}\frac{d\tilde{x}_j^*}{d\beta_i} > 0.$$

■

Extension: No Domestic Politics

Proposition A.3 *Let $F'(\varepsilon_i) \to 0$ so politicians are insensitive to reelection concerns. A unique cutoff $\tilde{x}_i^*$ exists, admitting a unique Bayesian Nash equilibrium to the international coordination game. A politician of type θ chooses policy $a = 1$ upon observing signal x^θ with probability $\sigma^*(\theta, x^\theta) \in [0,1]$. These probabilities are*

$$\sigma^*(1, x^1) = x^1 = \omega.$$
$$\sigma^*(0, x^0) = 1 - G(\tilde{x}^*;\omega).$$

Proof of Proposition A.3: Define $y_{j\omega} = P(a_j = 1|\omega)$ as the probability that politician j takes climate action given competent politician i's knowledge of the state ω. Then a competent politician i observing $\omega = 1$ plays $a_i = 1$ iff $y_{j1} \geq 0$. Similarly, a competent politician i observing $\omega = 0$ plays $a_i = 0$ iff $y_{j0} \leq 1$. Clearly there is no incentive for a competent politician to deviate from her signal. So by this argument $\hat{\sigma}_i(1,1) = \hat{\sigma}_j(1,1) = 1$ and $\hat{\sigma}_i(1,0) = \hat{\sigma}_j(1,0) = 0$.

Now consider the behavior of the incompetent politician. Let $y_j = P(a_j = 1|x_i)$ be the probability that politician takes climate action when the incompetent politician i has received signal $x_i^0 = x_i$. Since competent politicians always follow their signals, $y_j = \tau_j + (1-\tau_j)\eta(x_i)\hat{\sigma}_j(0,1) + (1-\tau_j)(1-\eta(x_i))\hat{\sigma}_j(0,0)$. Then a competent politician plays $a_i = 1$ iff $y_j \geq 1 - y_j \Leftrightarrow y_j \geq \frac{1}{2}$. Since y_j is increasing in x_i (by the monotone likelihood ratio property), there is a unique signal $\tilde{x}_i^*$ inducing $y_j(\tilde{x}_i^*) = \frac{1}{2}$ such that the incompetent politician plays $a_i = 1$ iff $x_i \geq \tilde{x}_i^*$. ■

Additional Figures

Figure A.1 demonstrates that the lion's share of these laws are related to climate mitigation. The growth of mitigation laws over time is notable, especially as nearly all NDCs under the Paris framework include mitigation measures. Moreover, as mitigation is nationally costly but provides global benefits, theories of collective action would predict a stagnation or underprovision of mitigation laws. Other laws aim to address adaptation, disaster risk management, and loss and damages. These policies, while much more difficult to measure, are also increasing in frequency as climate change's effects become more pronounced, especially in the Global South.

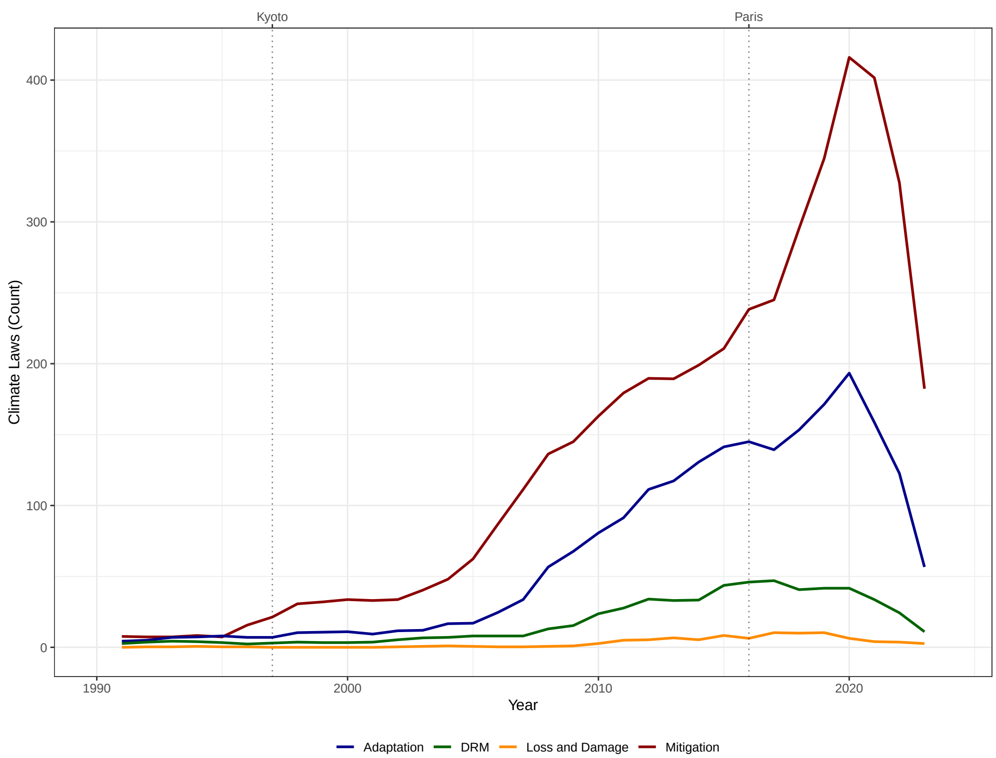


Figure A.1: Climate Laws by Type

Unsurprisingly, many of the laws enacted address reforms to the energy industry, as shown in Figure A.2 where laws are graphed by sector. The passage of these laws demonstrate how fossil fuel companies or other firms with "climate-forcing assets" (Colgan, Green and Hale 2021) have become increasingly at risk over time. While energy laws are consistently the most commonly passed climate law, there has been a spike in economy-wide initiatives in the 2020s; these laws intend to cut across sectors, representing large-scale societal investments like the Inflation Reduction Act in the United States or the European Union's European Green Deal.

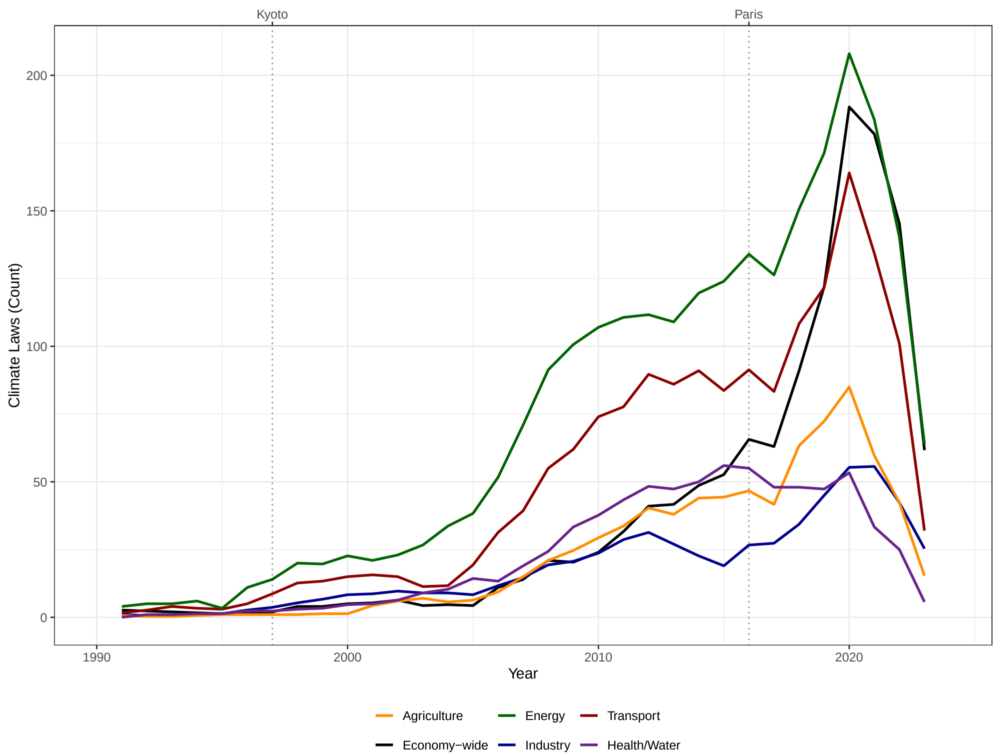


Figure A.2: Climate Laws by Sector

Figure A.3 of the figure examines the evolution of policy instruments used to address climate change. While initial efforts predominantly relied on command-and-control regulations, the early 2010s marked a shift toward the adoption of subsidies and incentives as central tools. Subsidies, in particular, play a pivotal role in fostering domestic industries to accelerate the green transition. Their increasing use is noteworthy, especially in light of the temptations to free-ride, as predicted by collective action theories, as these policy instruments aim to lessen the burden of costly abatement or adjustment. Also notable is the steady growth in laws that provided for climate change research, contributing to the accumulation of knowledge about the severity of global warming. These investments and the subsequent accumulation of knowledge have contributed to the scientific understanding which ultimately facilitates more climate policymaking and pushes back on the ability for special interests to misreport, as will be detailed in the theoretical argument.

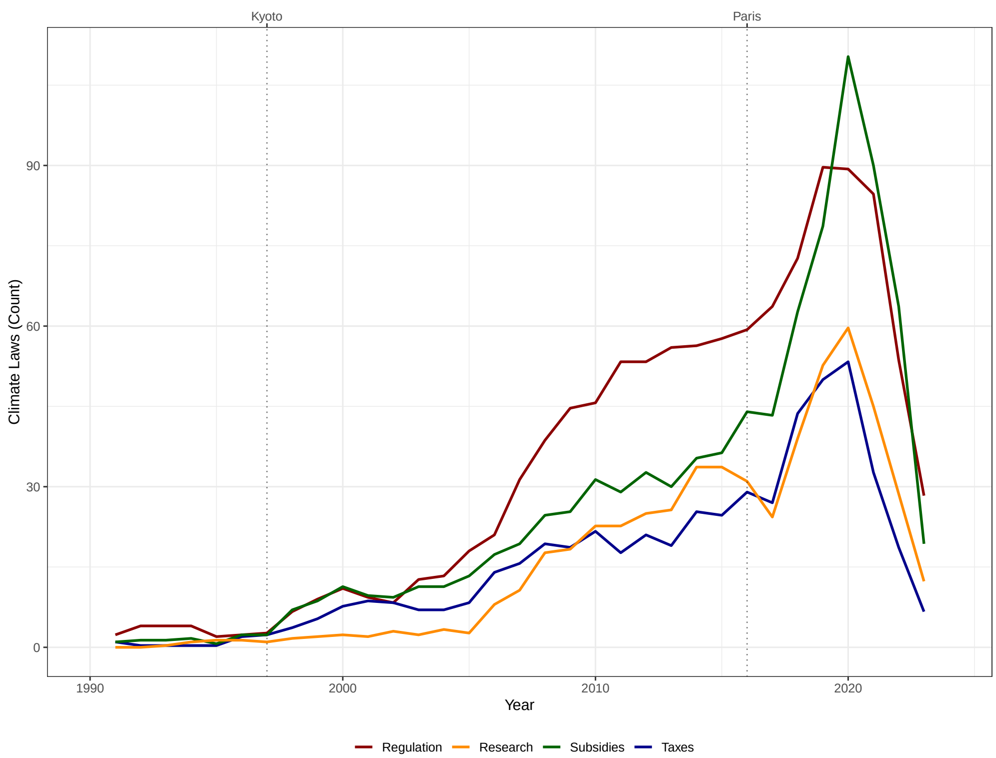


Figure A.3: Climate Laws by Policy Instrument

Figure A.4 displays the number of climate laws normalized by the number of adopting countries in each year. The increasing trend in law adoption over time is robust to this normalization.

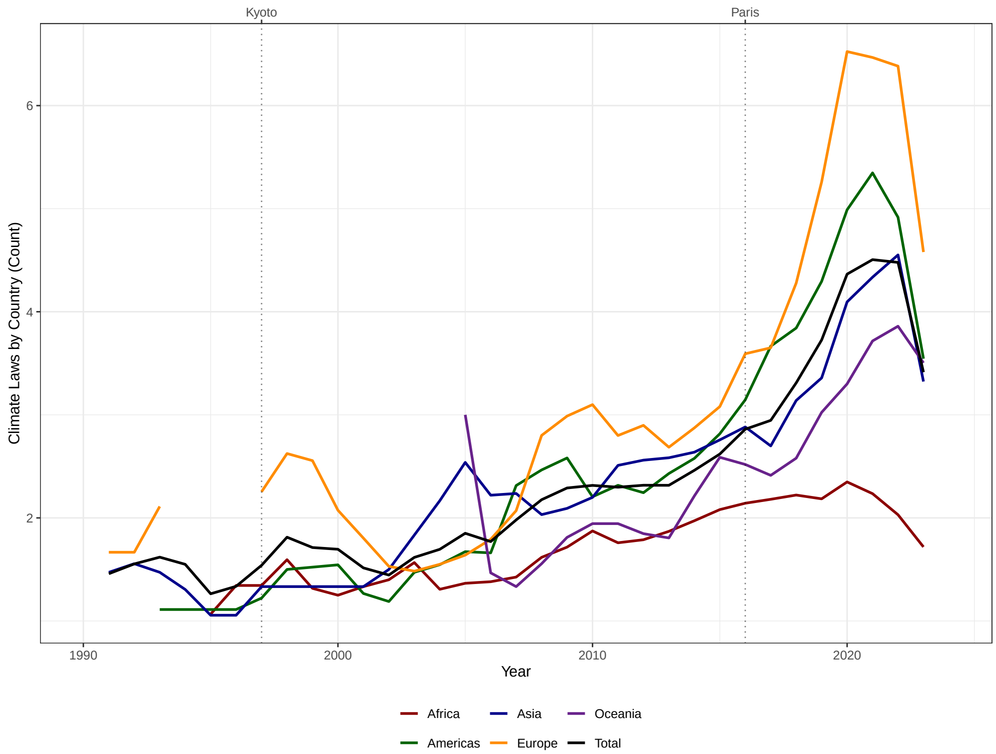


Figure A.4: Climate Laws Normalized by Country

Figure A.5 shows the correlation in the OECD Environmental Policy Stringency Index across countries. The figure shows that all cross-country correlations of environmental policy stringency are positive, and almost all of the are statistically distinguishable from zero (those that are not are in red). These positive correlations are meaningful because they suggest that increases in climate ambitions across countries are complementary, not substitutable, as theories based in free-riding would predict.

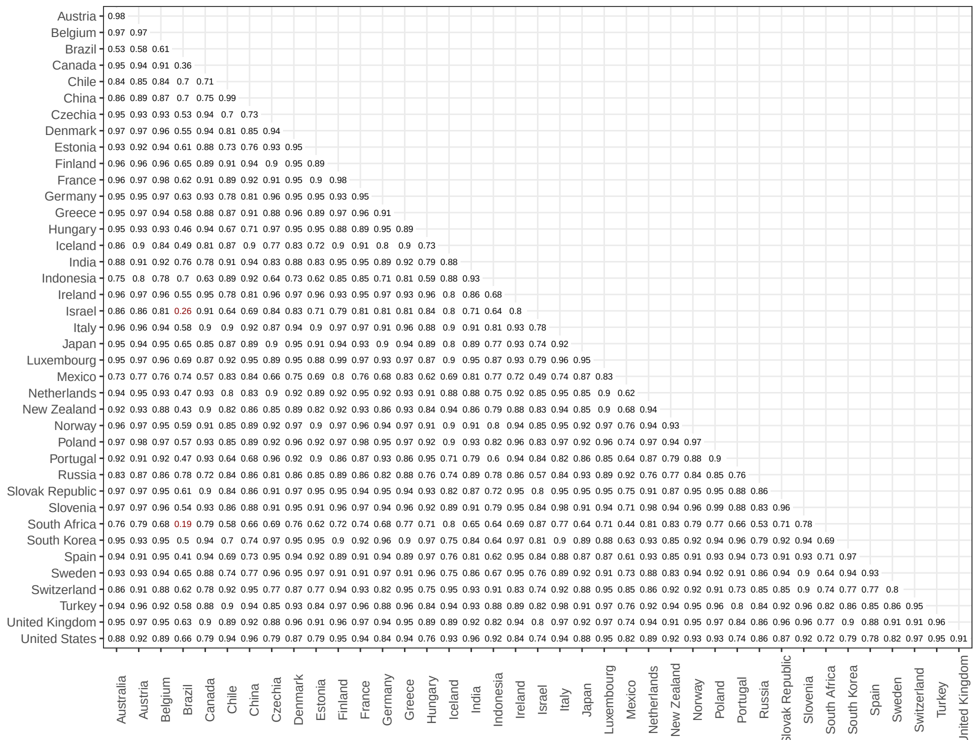


Figure A.5: Correlation Between Countries' Environmental Policy Stringency, 1990-2020

The Climate Actions and Policies Measurement Framework (CAPMF) by Nachtigall et al. (2024) presents an alternative approach to measuring policy stringency than the OECD's EPS. It is constructed similarly to the EPS, but relies on more policy instruments and also factors in international policy commitments. Rather than aggregate to a single index, the CAPMF aggregates up to the levels of sectoral policies, cross-sectoral policies, and international policies. Figure A.6 thus illustrates these measures for 49 countries between 1990 and 2022. Similar to the EPS in Figure 2, countries' policy stringencies are increasing over time.

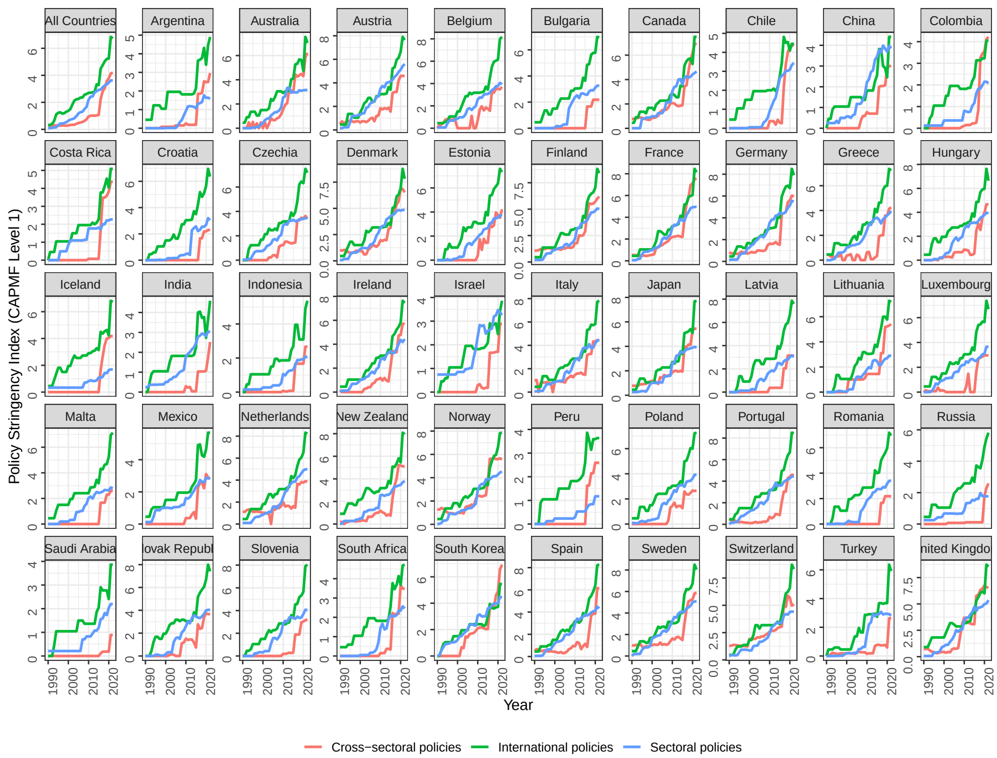


Figure A.6: Environmental Policy Stringency over Time using CAPMF

The evolution of climate policymaking in the United States comports with the status of the informational environment as fostered by firms like Exxon. Figure A.7 illustrates the near absence of climate policy in the United States during the 1990s and early 2000s, a period coinciding with Exxon's public campaigns denying climate change. Notably, following Exxon's reduction in funding for climate denial efforts around 2007, the implementation of climate policies began to gain traction. Furthermore, Exxon's eventual acknowledgment of climate change's severity marks the onset of a new phase in U.S. climate policymaking. Although some climate legislation was enacted during the Trump administration, the Biden administration oversaw the most significant expansion of climate policy, culminating in the passage of the Inflation Reduction Act, the largest clean energy investment in history.

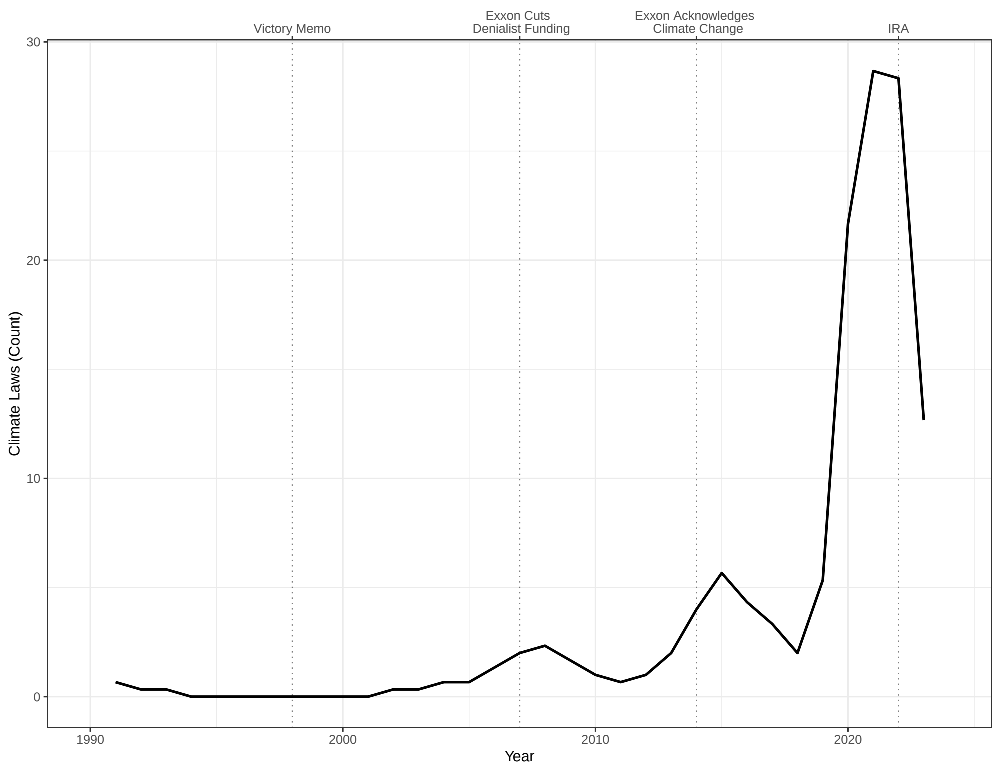


Figure A.7: Variation in U.S. Climate Policy over Time

Exxon scientist James Black's 1978 memo notes the scientific consensus that the climate is affected by fossil fuels. Notably, he writes that "present thinking holds that man has a time window of five to ten years before the need for hard decisions regarding changes in energy strategies might become critical." The summary section of the memo is presented in Figure A.8. The entire document is available at https://climateintegrity.org/uploads/deception/1978-Exxon-BlackMemo.pdf.

THE GREENHOUSE EFFECT

J. F. Black, Products Research Division
Exxon Research and Engineering Co.

SUMMARY

The earth's atmosphere presently contains about 330 ppm of CO_2. This gas does not absorb an appreciable amount of the incoming solar energy but it can absorb and return part of the infrared radiation which the earth radiates toward space. CO_2, therefore, contributes to warming the lower atmosphere by what has been called the "Greenhouse Effect."

The CO_2 content of the atmosphere has been monitored since 1957 at two locations, the Mauna Loa Observatory, Hawaii and the South Pole. These and other shorter studies show that CO_2 is increasing. If the increase is attributed to the combustion of fossil fuels, it can be calculated that the CO_2 content of the atmosphere has already been raised by about 10 to 15% and that slightly more than half of the CO_2 released by fossil fuel combustion is remaining in the atmosphere. Assuming that the percentage of the CO_2 remaining in the atmosphere will stay at 53% as fossil fuel consumption increases, one recent study predicts that in 2075 A.D., CO_2 concentration will peak at a level about twice what could be considered normal. This prediction assumes that fossil fuel consumption will grow at a rate of 2% per year until 2025 A.D. after which it will follow a symetrical decrease. This growth curve is close to that predicted by Exxon's Corporate Planning Department.

Mathematical models for predicting the climatic effect of a CO_2 increase have not progressed to the point at which all the feedback interactions which can be important to the outcome can be included. What is considered the best presently available climate model for treating the Greenhouse Effect predicts that a doubling of the CO_2 concentration in the atmosphere would produce a mean temperature increase of about 2°C to 3°C over most of the earth. The model also predicts that the temperature increase near the poles may be two to three times this value.

The CO_2 increase measured to date is not capable of producing an effect large enough to be distinguished from normal climate variations. As an example of normal variations, studies of meteorological and historical records in England indicate that the mean temperature has varied over a range of about ±0.7°C in the past 1000 years. A study of past climates suggests that if the earth does become warmer, more rainfall should result. But an increase as large as 2°C would probably also affect the distribution of the rainfall. A possible result might be a shift of both the desert and the fertile areas of the globe toward higher latitudes. Some countries would benefit but others could have their agricultural output reduced or destroyed. The picture is too unclear to predict which countries might be affected favorably or unfavorably.

- 2 -

It seems likely that any general temperature increase would be accentuated in the polar regions, possibly as much as two- or three-fold as mentioned above. Any large temperature increase at high latitudes would be associated with a reduction in snow cover and a melting of the floating ice-pack. Present thinking suggests that there would be little or no melting of the polar ice-caps in response to warmer temperatures on a time scale over which the Greenhouse Effect is predicted to apply.

A number of assumptions and uncertainties are involved in the predictions of the Greenhouse Effect. The first is the assumption that the observed CO_2 increase can be attributed entirely to fossil fuel combustion. At present, meteorologists have no direct evidence that the incremental CO_2 in the atmosphere comes from fossil carbon. The increase could be at least partly due to changes in the natural balance. There is considerable uncertainty regarding what controls the exchange of atmospheric CO_2 with the oceans and with carbonaceous materials on the continents.

Models which predict the climatic effects of a CO_2 increase are in a primitive stage of development. The atmosphere is a very complicated system, particularly on a global scale. In existing models, important interactions are neglected, either because they are not completely understood or because their proper mathematical treatment is too cumbersome. Substantial efforts are being expended to improve existing models. But there is no guarantee that better knowledge will lessen rather than augment the severity of the predictions.

The Greenhouse Effect has been the subject of a number of international scientific conferences during the past two years. These meetings have identified the information needed to definitely establish the source and ultimate significance of the CO_2 increase in the atmosphere. Present thinking holds that man has a time window of five to ten years before the need for hard decisions regarding changes in energy strategies might become critical. The DOE is presently seeking Congressional support for a research program which will produce the necessary information in the required time. This program is described.

Figure A.8: James Black's Memo to Exxon Executives, 1978

Exxon scientist Roger Cohen's 1982 memo summarizes findings about Exxon's internal climate modeling. It documents the projected relationship between increased carbon dioxide in the atmosphere and changes in the Earth's climate. It further discusses the scientific consensus around this result. The first two pages of the memo are displayed in Figure A.9. The entire document is available at https://www.climatefiles.com/exxonmobil/1982-exxon-memo-summarizing-climate-modeling-and-co2-greenhouse-effect-research/.

0757-L-RWC

EXXON RESEARCH AND ENGINEERING COMPANY

CORPORATE RESEARCH
SCIENCE LABORATORIES

P. O. Box 45, Linden, N. J. 07036

DUANE G. LEVINE, Director

ROGER W.COHEN, Director
Theoretical and Mathematical Sciences Laboratory

September 2, 1982

H. N. WEINBERG
SEP 2 1982

Mr. A. M. Natkin
Office of Science and Technology
Exxon Corporation
1251 Avenue of the Americas
New York, New York 10020

Dear Al:

I would like to summarize the findings of our research in climate modeling and place our results in the context of the existing body of knowledge of the CO_2 greenhouse effect.

Although the increase of atmospheric CO_2 is well documented, it has not yet resulted in a measurable change in the earth's climate. The concerns surrounding the possible effects of increased CO_2 have been based on the predictions of models which simulate the earth's climate. These models vary widely in the level of detail in which climate processes are treated and in the approximations used to describe the complexities of these processes. Consequently the quantitative predictions derived from the various models show considerable variation. However, over the past several years a clear scientific consensus has emerged regarding the expected climatic effects of increased atmospheric CO_2. The consensus[+] is that a doubling of atmospheric CO_2 from its pre-industrial revolution value would result in an average global temperature rise of $(3.0 \pm 1.5)^{\circ}C$. The uncertainty in this figure is a result of the inability of even the most elaborate models to simulate climate in a totally realistic manner. The temperature rise is predicted to be distributed nonuniformly over the earth, with above-average temperature elevations in the polar regions and relatively small increases near the equator. There is unanimous agreement in the scientific community that a temperature increase of this magnitude would bring about significant changes in the earth's climate, including rainfall distribution and alterations in the biosphere. The time

[+] National Research Council Panel Report, Carbon Dioxide and Climate: A Second Assessment, National Academy Press, Washington, D.C., 1982.

Mr. A. M. Natkin - 2 - August 25, 1982

required for doubling of atmospheric CO_2 depends on future world consumption of fossil fuels. Current projections indicate that doubling will occur sometime in the latter half of the 21st century. The models predict that CO_2-induced climate changes should be observable well before doubling. It is generally believed that the first unambiguous CO_2-induced temperature increase will not be observable until around the year 2000.

It should be emphasized that the consensus prediction of global warming is not unanimous. Several scientists have taken positions that openly question the validity of the predictions of the models, and a few have proposed mechanisms which could mitigate a CO_2 warming. One of the most serious of these proposals has been made by Professor Reginald Newell of MIT. Newell noted that geological evidence points to a relative constancy of the temperature of the equatorial waters over hundreds of millions of years. This constancy is remarkable in view of major climatic changes in other regions of the earth during this period. Newell ascribed this anchoring of the temperature of the equatorial waters to an evaporative buffering mechanism. In this mechanism, when heating increases at the equator, most of the extra energy induces greater rates of evaporation rather than raising temperatures. Newell proposed that this effect might greatly reduce the global warming effect of increased atmospheric CO_2.

In our climate research we have explored the global effects of Newell's evaporative buffering mechanism using a simple mathematical climate model. Our findings indicate that Newell's effect is indeed an important factor in the earth's climate system. As Newell predicted, evaporative buffering does limit CO_2-induced temperature changes in the equatorial regions. However, we find a compensatingly larger temperature increase in the polar regions, giving a global averaged temperature increase that falls well within the range of the scientific consensus. Our results are consistent with the published predictions of more complex climate models. They are also in agreement with estimates of the global temperature distribution during a certain prehistoric period when the earth was much warmer than today.

In summary, the results of our research are in accord with the scientific consensus on the effect of increased atmospheric CO_2 on climate. Our research appears to reconcile Newell's observations and proposed mechanism with the consensus opinion.

We are now ready to present our research to the scientific community through the usual mechanisms of conference presentations and publications in appropriate journals. I have enclosed a detailed plan for presenting our results.

Figure A.9: Roger Cohen's Memo on Exxon Climate Science, 1982

In 1996 and 1998, Exxon released pamphlets to the masses that sought to inject doubt into the public discourse about the validity of climate science and the subsequent need for policy action. Figure A.10 displays the introductory letter from Exxon Chairman Lee Raymond to the document "Global climate change: everyone's debate." The full document is available at https://www.climatefiles.com/exxonmobil/1998-exxon-pamphlet-global-climate-change-everyones-debate/. The pamphlet "Global warming: who's right?" admonishes readers not to "ignore the facts" about climate change and is available at https://climateintegrity.org/uploads/deception/1996-Exxon-Global-Warming-Whos-Right.pdf.

Exxon shares with people around the world the goal of protecting Earth's environment. We take seriously our responsibility to conduct our operations in an environmentally sound way. For that reason, for many years, we've carefully studied and worked to increase understanding of the issue of global climate change — often referred to as "global warming." It's one of the knottiest and most contentious scientific subjects. Essentially, the question is whether the use of fossil fuels — oil, natural gas and coal — is causing Earth's temperature to rise beyond normal variation.

Our analysis indicates that the current state of climate science is too uncertain to provide clear answers to many key questions about global climate change. Even if global warming were a proven threat — which it is not — targets agreed on in Kyoto, Japan, fail to provide a fair, practical or cost-effective solution.

Because fossil fuels account for about 90 percent of the energy people use in the world today and form the basis for economic growth, everybody has a stake in the debate. Clearly, Exxon employees, shareholders and customers are especially affected.

This booklet will help inform you about the science, economics and other aspects of the issue. It will tell you about the many steps Exxon and others are taking — from research to reforestation.

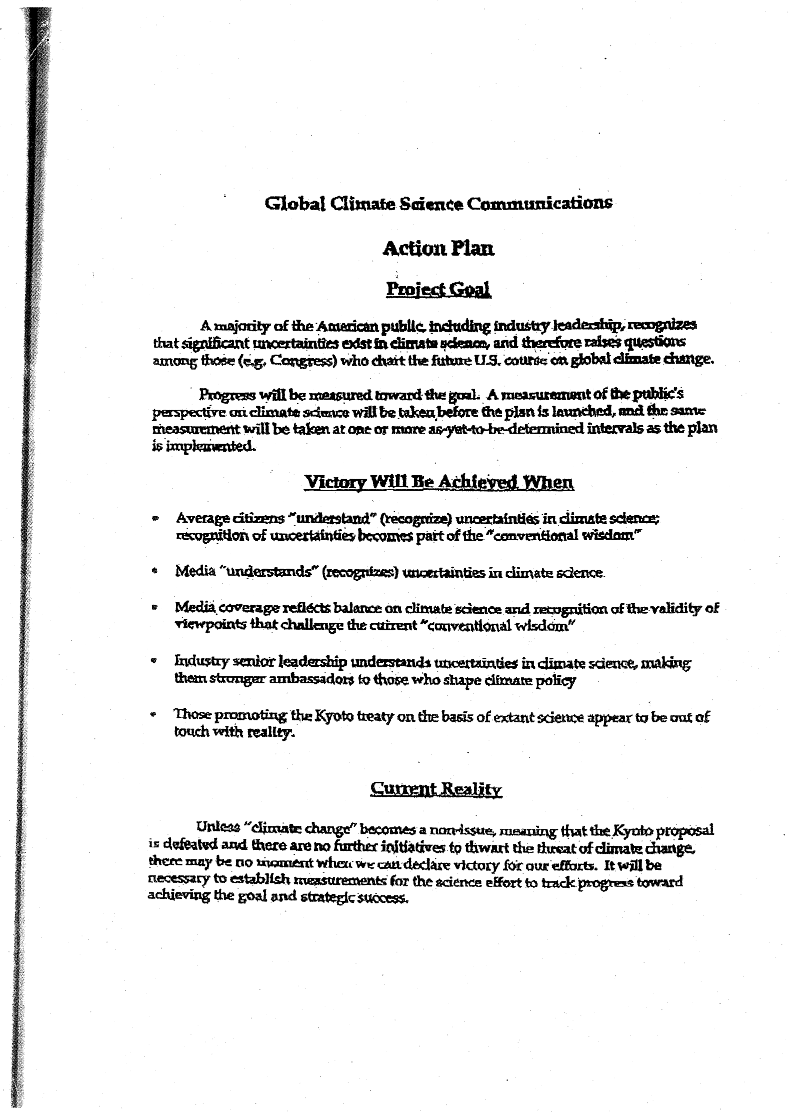
We hope to gain your interest in this matter, and we encourage you to join the important debate about global climate change.

Lee R Raymond

Lee R. Raymond
Chairman

Figure A.10: "Global climate change: everyone's debate," 1996

The "Victory Memo" of 1998 makes the goal to inject uncertainty into the public sphere clear: "victory will be achieved when average citizens 'understand' (recognize) uncertainties in climate science," and "recognition of uncertainty becomes part of the 'conventional wisdom."' Figure A.11 provides an excerpt of the memo describing the goals of the public informational campaign, the entire memo can be found at https://www.climatefiles.com/trade-group/american-petroleum-institute/1998-global-climate-science-communications-team-action-plan/.



Global Climate Science Communications

Action Plan

Project Goal

A majority of the American public, including industry leadership, recognizes that significant uncertainties exist in climate science, and therefore raises questions among those (e.g. Congress) who chart the future U.S. course on global climate change.

Progress will be measured toward the goal. A measurement of the public's perspective on climate science will be taken before the plan is launched, and the same measurement will be taken at one or more as-yet-to-be-determined intervals as the plan is implemented.

Victory Will Be Achieved When

- Average citizens "understand" (recognize) uncertainties in climate science; recognition of uncertainties becomes part of the "conventional wisdom"
- Media "understands" (recognizes) uncertainties in climate science.
- Media coverage reflects balance on climate science and recognition of the validity of viewpoints that challenge the current "conventional wisdom"
- Industry senior leadership understands uncertainties in climate science, making them stronger ambassadors to those who shape climate policy
- Those promoting the Kyoto treaty on the basis of extant science appear to be out of touch with reality.

Current Reality

Unless "climate change" becomes a non-issue, meaning that the Kyoto proposal is defeated and there are no further initiatives to thwart the threat of climate change, there may be no moment when we can declare victory for our efforts. It will be necessary to establish measurements for the science effort to track progress toward achieving the goal and strategic success.

Figure A.11: Victory Memo, 1998

"The Greenhouse Effect" is a report published by a working group of Shell scientists in 1988 documents potential climate impacts, including rising sea levels, ocean acidification, and human migration, from continued fossil fuel production. The document's summary is shown in Figure A.12; the full document is available at https://www.documentcloud.org/documents/4411090-Document3.html.

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SUMMARY

Man-made carbon dioxide, released into and accumulated in the atmosphere, is believed to warm the earth through the so-called greenhouse effect. The gas acts like the transparent walls of a greenhouse and traps heat in the atmosphere that would normally be radiated back into space. Mainly due to fossil fuel burning and deforestation, the atmospheric CO2 concentration has increased some 15% in the present century to a level of about 340 ppm. If this trend continues, the concentration will be doubled by the third quarter of the next century. The most sophisticated geophysical computer models predict that such a doubling could increase the global mean temperature by 1.3-3.3°C. The release of other (trace) gases, notably chlorofluorocarbons, methane, ozone and nitrous oxide, which have the same effect, may amplify the warming by predicted factors ranging from 1.5 to 3.5°C.

Mathematical models of the earth's climate indicate that if this warming occurs then it could create significant changes in sea level, ocean currents, precipitation patterns, regional temperature and weather. These changes could be larger than any that have occurred over the last 12,000 years. Such relatively fast and dramatic changes would impact on the human environment, future living standards and food supplies, and could have major social, economic and political consequences.

There is reasonable scientific agreement that increased levels of greenhouse gases would cause a global warming. However, there is no consensus about the degree of warming and no very good understanding what the specific effects of warming might be. But as long as man continues to release greenhouse gases into the atmosphere, participation in such a global "experiment" is guaranteed. Many scientists believe that a real increase in the global temperature will be detectable towards the end of this century or early next century. In the meanwhile, greater sophistication both in modelling and monitoring will improve the understanding and likely outcomes. However, by the time the global warming becomes detectable it could be too late to take effective countermeasures to reduce the effects or even to stabilise the situation.

The likely time scale of possible change does not necessitate immediate remedial action. However, the potential impacts are sufficiently serious for research to be directed more to the analysis of policy and energy options than to studies of what we will be facing exactly. Anticipation of climatic change is new, preventing undue change is a challenge which requires international cooperation.

With fossil fuel combustion being the major source of CO2 in the atmosphere, a forward looking approach by the energy industry is clearly desirable, seeking to play its part with governments and others in the development of appropriate measures to tackle the problem.

Figure A.12: "The Greenhouse Effect," 1988

The Global Climate Coalition was a lobbying group of several large oil and gas companies that operated between 1989 an 2001. Its primary function was to coordinate messaging against global climate action like the ratification of the Kyoto Protocol. In 1995, the GCC internally circulated *Predicting Future Climate Change: A Primer*, which summarized the state of climate science. Notably, it reads, "The scientific basis for the Greenhouse Effect and the potential impact of human emissions of greenhouse gases such as CO2 on climate is well established and cannot be denied." Figure A.13 displays the introduction to the primer. The full document is available at https://www.ucsusa.org/sites/default/files/attach/2015/07/Climate-Deception-Dossier-7_GCC-Climate-Primer.pdf

APPROVAL DRAFT

Predicting Future Climate Change: A Primer

In its recently approved Summary for Policymakers for its contribution to the IPCC's Second Assessment Report, Working Group I stated:

> ...the balance of evidence suggests that there is a discernable human influence on global climate.

The Global Climate Coalition's Science and Technical Advisory Committee believes that the IPCC statement goes beyond what can be justified by current scientific knowledge.

This paper presents an assessment of those issues in the science of climate change which relate to the ability to predict whether human emissions of greenhouse gases have had an effect on current climate or will have a significant impact on future climate. It is a primer on these issues, not an exhaustive analysis. Complex issues have been simplified, hopefully without any loss of accuracy. Also, since it is a primer, it uses the terminology which has become popular in the climate change debate, even in those cases where the popular terminology is not technically accurate.

Introduction and Summary

Since the beginning of the industrial revolution, human activities have increased the atmospheric concentration of CO_2 by more than 25%. Atmospheric concentrations of other greenhouse gases have also risen. Over the past 120 years, global average temperature has risen by 0.3 - 0.6°C. Since the Greenhouse Effect can be used to relate atmospheric concentration of greenhouse gases to global average temperature, claims have been made that at least part of the temperature rise experienced to date is due to human activities, and that the projected future increases in atmospheric concentrations of greenhouse gases (as the result of human activities) will lead to even larger increases in future temperature. Additionally, it is claimed that these increases in temperature will lead to an array of climate changes (rainfall patterns, storm frequency and intensity, etc.) that could have severe environmental and economic impacts.

This primer addresses the following questions concerning climate change:

1) Can human activities affect climate?

   The scientific basis for the Greenhouse Effect and the potential impact of human emissions of greenhouse gases such as CO_2 on climate is well established and cannot be denied.

2) Can future climate be accurately predicted?

   The climate models which are being used to predict the increases in temperature which might occur with increased atmospheric concentrations of greenhouse gases are limited at present both by incomplete scientific understanding of the factors which affect climate and

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APPROVAL DRAFT

   by inadequate computational power. Improvements in both are likely, and in the next decade it may be possible to make fairly accurate statements about the impact that increased greenhouse gas concentrations could have on climate. However, these improvements may still not translate into an ability to predict future climate for at least two reasons:

   - limited understanding of the natural variability of climate, and
   - inability to predict future atmospheric concentrations of greenhouse gases.

   The smaller the geographic area considered, the poorer the quality of climate prediction. This is a critical limitation in our ability to predict the impacts of climate change, most of which would result from changes in a local or regional area.

3) Have human activities over the last 120 years affected climate, i.e. has the change been greater than natural variability?

   Given the limitations of climate models and other information on this question, current claims that a human impact on climate has already been detected, are unjustified. However, assessment of whether human activities have already affected climate may be possible when improved climate models are available. Alternatively, a large, short term change in climate consistent with model predictions could be taken as proof of a human component of climate change.

4) Are there alternate explanations for the climate change which has occurred over the last 120 years?

   Explanations based on solar variability, anomalies in the temperature record, etc. are valid to the extent they are used to argue against a conclusion that we understand current climate or can detect a human component in the change in climate that has occurred over the past 120 years. However, these alternative hypotheses do not address what would happen if atmospheric concentrations of greenhouse gases continue to rise at projected rates.

Can Human Activities Affect Climate?

The Sun warms the Earth and is the source of energy for the climate system. However, as shown in Figure 1, the process by which this occurs is complicated. Only about half of the incoming radiation from the Sun is absorbed by the Earth's surface. About a quarter is absorbed by the atmosphere, and the remainder is reflected back into space by clouds, dust and other particulates without being absorbed, either by the surface or atmosphere.

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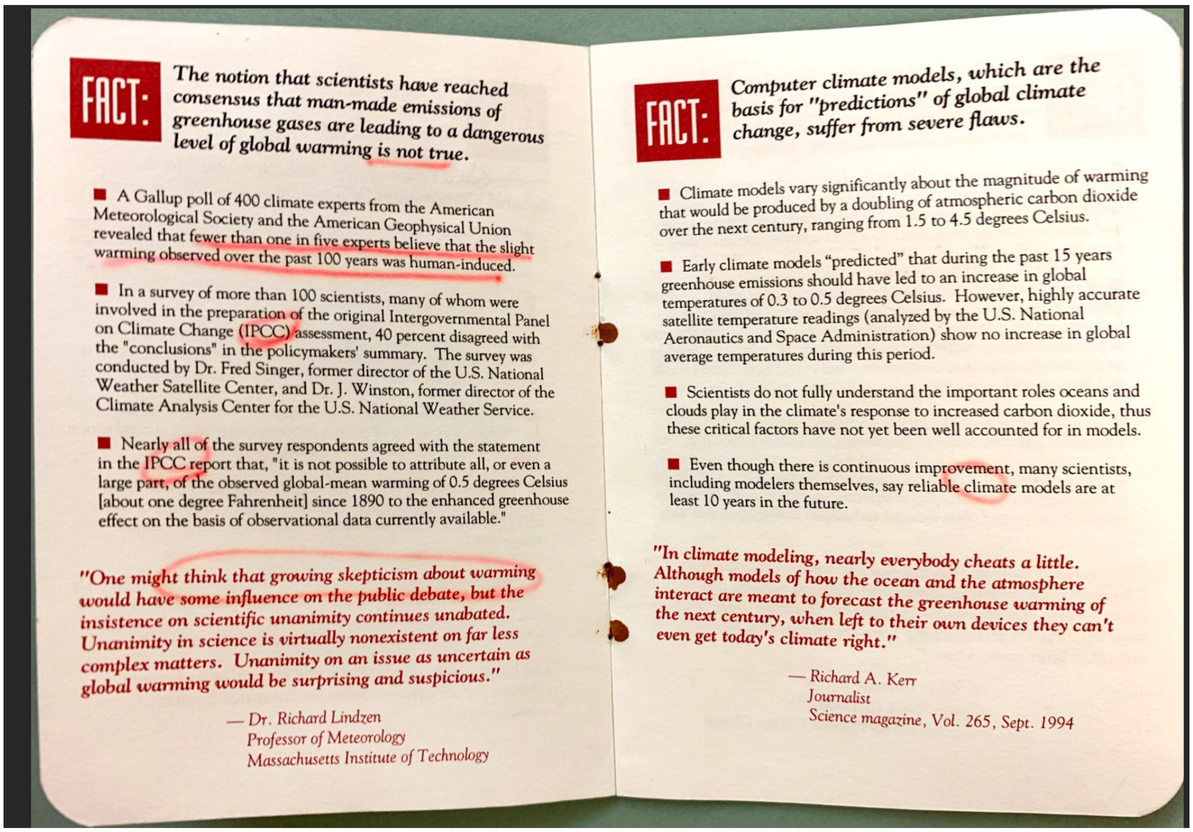
Figure A.13: *Predicting Future Climate Change: A Primer*, 1995

While the GCC internally circulated *Predicting Future Climate Change: A Primer*, its public-facing publications of the time were very different. In 1995, it also published "Climate Change: Your Passport To The Facts," a booklet allegedly intended to introduce readers to essential facts about climate change. Facts include that "the notion that scientists have reached consensus that man-made emissions of greenhouse gases are leading to a dangerous level of global warming is not true" and "computer climate models, which are the basis for "predictions" of global climate change, suffer from severe flaws." Figure A.14 shows an excerpt of the booklet, with the full document available at https://www.worthingtoncaron.com/documents/1995-CLIMATE-CHANGE-YOUR-PASSPORT.pdf



FACT: *The notion that scientists have reached consensus that man-made emissions of greenhouse gases are leading to a dangerous level of global warming is not true.*

■ A Gallup poll of 400 climate experts from the American Meteorological Society and the American Geophysical Union revealed that fewer than one in five experts believe that the slight warming observed over the past 100 years was human-induced.

■ In a survey of more than 100 scientists, many of whom were involved in the preparation of the original Intergovernmental Panel on Climate Change (IPCC) assessment, 40 percent disagreed with the "conclusions" in the policymakers' summary. The survey was conducted by Dr. Fred Singer, former director of the U.S. National Weather Satellite Center, and Dr. J. Winston, former director of the Climate Analysis Center for the U.S. National Weather Service.

■ Nearly all of the survey respondents agreed with the statement in the IPCC report that, "it is not possible to attribute all, or even a large part, of the observed global-mean warming of 0.5 degrees Celsius [about one degree Fahrenheit] since 1890 to the enhanced greenhouse effect on the basis of observational data currently available."

"One might think that growing skepticism about warming would have some influence on the public debate, but the insistence on scientific unanimity continues unabated. Unanimity in science is virtually nonexistent on far less complex matters. Unanimity on an issue as uncertain as global warming would be surprising and suspicious."

— Dr. Richard Lindzen
Professor of Meteorology
Massachusetts Institute of Technology

FACT: *Computer climate models, which are the basis for "predictions" of global climate change, suffer from severe flaws.*

■ Climate models vary significantly about the magnitude of warming that would be produced by a doubling of atmospheric carbon dioxide over the next century, ranging from 1.5 to 4.5 degrees Celsius.

■ Early climate models "predicted" that during the past 15 years greenhouse emissions should have led to an increase in global temperatures of 0.3 to 0.5 degrees Celsius. However, highly accurate satellite temperature readings (analyzed by the U.S. National Aeronautics and Space Administration) show no increase in global average temperatures during this period.

■ Scientists do not fully understand the important roles oceans and clouds play in the climate's response to increased carbon dioxide, thus these critical factors have not yet been well accounted for in models.

■ Even though there is continuous improvement, many scientists, including modelers themselves, say reliable climate models are at least 10 years in the future.

"In climate modeling, nearly everybody cheats a little. Although models of how the ocean and the atmosphere interact are meant to forecast the greenhouse warming of the next century, when left to their own devices they can't even get today's climate right."

— Richard A. Kerr
Journalist
Science magazine, Vol. 265, Sept. 1994

Figure A.14: "Climate Change: Your Passport To The Facts," 1995

ExxonMobil published a series of newspaper ads in order to sow doubt into the public about climate science. In the spring of 2000, ExxonMobil rad the ad "Unsettled Science" in major news outlets (e.g., the *New York Times*), displayed in Figure A.15. These ads also tried to discredit climate scientists. Scientists like Lloyd Keigwin later responded in the *Wall Street Journal* complaining that ExxonMobil had distorted his work by suggesting it supported the notion that global warming was just a natural cycle.[1]

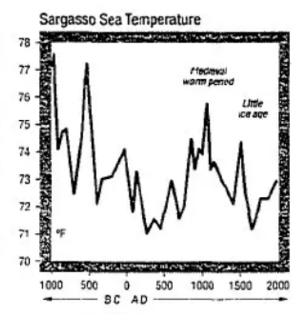
Unsettled Science

Knowing that weather forecasts are reliable for a few days at best, we should recognize the enormous challenge facing scientists seeking to predict climate change and its impact over the next century. In spite of everyone's desire for clear answers, it is not surprising that fundamental gaps in knowledge leave scientists unable to make reliable predictions about future changes.

A recent report from the National Research Council (NRC) raises important issues, including these still-unanswered questions: (1) Has human activity already begun to change temperature and the climate, and (2) How significant will future change be?

The NRC report confirms that Earth's surface temperature has risen by about 1 degree Fahrenheit over the past 150 years. Some use this result to claim that humans are causing global warming, and they point to storms or floods to say that dangerous impacts are already under way. Yet scientists remain unable to confirm either contention.

Geological evidence indicates that climate and greenhouse gas levels experience significant natural variability for reasons having nothing to do with human activity. Historical records and current scientific evidence show that Europe and North America experienced a *medieval warm period* one thousand years ago, followed centuries later by a *little ice age*. The geological record shows even larger changes throughout Earth's history. Against this backdrop of large, poorly understood natural variability, it is impossible for scientists to attribute the recent small surface temperature increase to human causes.



Moreover, computer models relied upon by climate scientists predict that lower atmospheric temperatures will rise as fast as or faster than temperatures at the surface. However, only within the last 20 years have reliable global measurements of temperatures in the lower atmosphere been available through the use of satellite technology. These measurements show little if any warming.

Even less is known about the potential positive or negative impacts of climate change. In fact, many academic studies and field experiments have demonstrated that increased levels of carbon dioxide can promote crop and forest growth.

So, while some argue that the science debate is settled and governments should focus only on near-term policies—that is empty rhetoric. Inevitably, future scientific research will help us understand how human actions and natural climate change may affect the world and will help determine what actions may be desirable to address the long-term.

Science has given us enough information to know that climate changes may pose long-term risks. Natural variability and human activity may lead to climate change that could be significant and perhaps both positive and negative. Consequently, people, companies and governments should take responsible actions now to address the issue.

One essential step is to encourage development of lower-emission technologies to meet our future needs for energy. We'll next look at the promise of technology and what is being done today.

ExxonMobil

Figure A.15: "Unsettled Science," 2000

[1] https://insideclimatenews.org/news/22102015/exxon-sowed-doubt-about-climate-science-for-decades-by-stressing-uncertainty/