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Encouraging politicians to act on climate: A field experiment with local officials in six countries

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Abstract
Local governments play an important role in addressing the climate crisis. However, despite public support for climate action, local policy responses have been limited. We argue that (1) biased beliefs about voter preferences, (2) the time horizon for credit claiming, and (3) source credibility are barriers for legislators to learn and adopt new environmental policies. We test these arguments in a real policy-learning context. Representatives from six Western countries received customized invitations to a webinar on climate solutions for local governments. We find that constituency opinion on climate issues made local office-holders more responsive to public preferences. Invitations sent by a climate scientist and emphasizing shorter term policy effects increased interest in the webinar, but did not boost the likelihood of policy commitments. Only US officials responded negatively to climate scientists. The results reveal concrete steps to induce climate action and contribute to scholarship on policy learning.

Climate change is the largest humanitarian threat of the twenty-first century. According to the Intergovernmental Panel on Climate Change (IPCC), carbon emissions must be reduced and balanced to net zero by 2050 to avoid the most drastic consequences of global warming (Masson-Delmotte et al., 2018). Addressing this crisis will require large-scale individual and collective action at all levels of government (Van Der Linden et al., 2021).

While national governments and international organizations coordinate the global response to the climate crisis, local governments also play an important role. Cities and towns account for more that 70% of global greenhouse gas emissions and have the ability to tackle at least part of this large footprint.[1] A combination of energy, mobility, and planning policy solutions

under the control of local governments can effectively reduce emissions and increase resilience (Amundsen et al., 2018; Deangelo & Harvey, 1998). However, with a few exceptions, the policy response from local governments has been limited. In 2017, local climate resilience plans covered only 16.9% of the global population (UNEP, 2018). In this project, we explore how local politicians can be mobilized to learn and pursue new policy solutions to address the climate crisis.

We identify three potential obstacles to climate action by local governments.[2] First, politicians may *underestimate constituency support for climate action*. Environmental concerns have only become a salient issue for the general population in recent years, as the consequences of global warming became more visible (Andrews et al., 2018; Hoffmann et al., 2022), and office-holders often hold outdated beliefs about public

[1] "Cities, 'a cause of and a solution to' climate change," United Nations (UN), September 18, 2019.

[2] We define *climate action* broadly as the process of seeking information on climate change policies, learning about these measures, making public commitments to reduce carbon emissions, introducing new measures, or voting in favor of them.

preferences (Butler & Nickerson, 2011; Hager & Hilbig, 2020). Prior studies have found that elected officials may underestimate the extent of their constituents' proclimate positions (Mildenberger & Tingley, 2019). The belief that voters do not support climate action may create incentives for time-constrained legislators to prioritize other issues. Second, the *time horizon required to implement environmental reforms* can be an obstacle to reelection-seeking politicians, who tend to prioritize policies with shorter term benefits (Sheffer et al., 2018). The payoffs of most climate change interventions are often beyond the political careers of individual representatives, making it a less desirable domain for credit claiming and political action. Third, the *credibility of the actors disseminating new climate solutions* can influence legislators' willingness to learn and adopt new policies. Information from credible sources is more persuasive and more likely to induce ambivalent subjects to seek out information (Druckman, 2001; Pornpitakpan, 2004). In different areas, policy experts are a credible source of information to public officials (Lee, 2022). However, climate science has become increasingly politicized, particularly in the United States (Bolsen & Druckman, 2018; Chinn et al., 2020; Hornsey et al., 2018). Hence, we expect that information provided by climate scientists or other actors external to the legislative process may be less persuasive than information from peer politicians.

We test these arguments in a preregistered field experiment carried out in partnership with Oxford Net Zero (ONZ), a research and engagement program at the University of Oxford that promotes science-based policy solutions to achieve climate neutrality. In Spring 2021, ONZ organized a webinar for local elected officials on strategies to achieve net zero emissions in local governments. The event included presentations from policy experts, politicians with prior experience adopting similar policies, and representatives of international nongovernmental organizations (NGOs) that promote sustainable development in local governments. To study local politicians' motivations to act on climate, we embedded an experiment in the webinar invitations that ONZ sent to local officials. The organization invited politicians from 1651 local governments in six Western countries: France, Germany, Italy, Switzerland, the UK, and the US ($N = 5298$ individuals). The invitations varied along three dimensions that track with the obstacles to climate action described above: (1) whether they included local-level public opinion data on climate, (2) whether they highlighted the long- or short-term policy effects of the policies, and (3) whether they were sent on behalf of a climate scientist or peer legislator. We test the marginal effects of each light-touch intervention on legislators' interest in the webinar and willingness to commit to reduce carbon emissions after the event.

Overall, we found no evidence that receiving constituency-level data on climate attitudes, on average, increased interest in the event. This result is not consistent with our first argument that underestimating public opinion is an obstacle to climate action among local elected officials. However, the treatment did make US officials more responsive to constituency preferences: Legislators who received public opinion information expressed more interest in the webinar and were more willing to make policy commitments as local support for climate action increased. The same is not true for officials who did not receive public opinion information. In turn, we only find suggestive evidence that the time horizon of climate action deters local officials from engaging on the issue. Invitations highlighting the longer term effects of reducing emissions generated less engagement with the webinar invitation, as expected, but the effects were small, not robust to different outcomes, and did not translate into policy commitments. Finally, contrary to our predictions, we find that invitations sent by a climate scientist generated *more* interest in the event than those sent by a peer legislator. The exception to this pattern is the United States, where local officials were less likely to respond to the climate expert than to the legislator. This pattern is driven disproportionately by Republican officials and is consistent with the growing politicization of climate science in the United States.

Our empirical strategy offers generalizable evidence on mechanisms to mobilize politicians for climate action in advanced democracies. While we focus on local officials, our findings apply to different levels of government. However, we interpret the evidence as preliminary. Given the nature of the interventions, embedded in a cold email in a noisy information environment, we should not expect large effects resulting in sustained policy change. Ethical considerations led us to focus on light-touch interventions that preserve realism while minimizing the researchers' role in influencing policy. Still, our findings are relevant and highlight NGOs' important role in filling gaps in local climate governance.

The study contributes to scholarship on elite behavior, environmental politics, and the role of expertise in policy learning. Our findings reveal the importance of understanding how resource-constrained legislators learn about policy. The results of the public opinion intervention are easily scalable and suggest that a large-scale information campaign to update perceptions of public support for climate action among office-holders can have meaningful policy consequences, especially in the United States. The role of constituency preferences that we identify is consistent with a distributive model of climate politics (Aklin & Mildenberger, 2020). The findings also reveal that,

despite the increasing politicization of climate science (Druckman, 2017), climate scientists remain a more reliable source of information than peer legislators in Europe. However, policy experts' ability to inform public policy cannot be taken for granted, as the US results suggest. Finally, our experimental design introduces a new avenue for the study of policy learning and diffusion, which allows researchers to unobtrusively observe how legislators acquire and respond to information.

POLITICAL OBSTACLES TO LOCAL CLIMATE ACTION

The obstacles to a local policy response to climate change come in many forms: decision makers' ideological considerations, political resources (real or perceived), and competing policy priorities (Measham et al., 2011). We focus here on three political obstacles that may influence local elected officials' willingness to learn and pursue new policy solutions to reduce carbon emissions: (1) misperceptions of public support for climate action, (2) the time horizon of environmental reforms, and (2) the credibility of the actors advocating new climate policies. We do not argue that these factors are the best predictors of environmental policy learning. However, we believe they are important and underappreciated mechanisms that are potentially malleable. We discuss each mechanism in turn.

Misperceptions of public opinion

Office-seeking politicians have incentives to be informed about voter preferences (Downs, 1957). Responsive incumbents are more likely to be reelected (Bechtel & Hainmueller, 2011). Consistent with this view, prior empirical studies have demonstrated that politicians change their behavior in response to public opinion information (Butler & Nickerson, 2011; Chu & Recchia, 2022; Hager & Hilbig, 2020; but see Kalla & Porter, 2021). However, gauging public opinion is challenging and legislators often misperceive voter preferences, even on salient issues (Pereira, 2021). For instance, Broockman and Skovron (2018) show that state legislators in the United States systematically misperceived public opinion on abortion or gun control.

Politicians may misperceive support for climate policies in their constituencies for three main reasons. First, public support for climate action has shifted meaningfully in the last decade as the consequences of global warming have become more visible (Hoffmann et al., 2022; Lee et al., 2015). Recent opinion polls in Europe and the United States consistently show ample support for policies to tackle climate change (Ansolabehere & Konisky, 2009; Ballew et al., 2019; Lewis et al., 2019; Stokes et al., 2015). Citizens deem environmental issues increasingly salient and no longer conditional on other considerations such as economic conditions (Andrews et al., 2018; Mildenberger & Leiserowitz, 2017). For example, the share of Germans reporting that environmental protection is a very important challenge facing the country increased from 53% in 2016 to 68% in 2019 (Rubik et al., 2019). A similar dynamic is observed in the United States, where the share of citizens worried about global warming increased from 56% in 2016 to 65% in 2021 (YCOM, 2022). Few other policy areas have experienced similar shifts in public opinion in the last decade. Second, there are important asymmetries in mobilization between a supportive but quiet majority in favor of more ambitious climate action and a vocal minority of opponents supported by resourceful interest groups (Meckling & Nahm, 2022; Stokes, 2016). Mass movements such as the School Strikes for Climate sparked by Greta Thunberg have had some success in mitigating this imbalance in political voice (Sabherwal et al., 2021). Finally, the valence character of the issue may contribute to misperceptions (Spoon et al., 2014; Stokes, 1963). While voters generally support protecting the environment, the political battle is over the means of achieving this goal. This dual nature of the issue might make it harder for politicians to gauge the true level of support for concrete climate policies in their constituency.

For these three reasons—recent shifts in public opinion, asymmetries in mobilization, and the valence nature of the issue—we posit that local officials underestimate support for climate action in their constituencies.[3] By supplying public opinion data to correct these misperceptions, we predict that reelection–seeking officials will display more interest in acting on climate change (H1a), particularly in constituencies where voters are more supportive of environmental reforms (H1b).[4]

The time horizon of climate policy reforms

Legislators face intertemporal trade-offs between supporting policies that maximize welfare in the present and investing in the future. In representative democracies, this trade-off poses a political dilemma whenever the benefits of a policy are not visible before the next election (Finnegan, 2022; Jacobs, 2016). Because

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[3] We did not design our study to test this prediction. Our prediction builds on existing evidence from public officials and voters in different countries (Broockman & Skovron, 2018; Hertel-Fernandez et al., 2019; Mildenberger & Tingley, 2019).

[4] All the hypotheses reported in the text are preregistered. Only the final hypothesis (H4) is not tested here since it is part of a separate project.

legislators' ability to remain in office and continue shaping policy is conditional on their performance in the next election, representatives tend to prioritize shorter term benefits (Sheffer et al., 2018). Legislators recognize the challenge of reconciling political concerns with long-term policy goals. As a report from the UK House of Commons explained, "[g]overning for the future is [...] difficult because it rubs up against the short-termism that is inherent in the politics of the electoral cycle" (House of Commons, 2007).

The temporal dimension of policymaking is particularly salient in the area of climate action. On the one hand, many policy solutions to address climate change are expected to produce short-term benefits in areas such as employment (Garrett-Peltier, 2017), innovation (Ambec et al., 2020), or public health (Marshall & Ferenchak, 2019; Shaw et al., 2014). On the other hand, climate change is inherently a long-term phenomenon. According to the most optimistic predictions, it will take decades for the policy response to the crisis to balance the concentration of greenhouse gas emissions in the atmosphere at levels that stabilize the climate system. Moreover, some of the mitigation reforms may impose costs long before their benefits will be observed (Moran et al., 2013).

Hence, we expect that the time horizon of structural environmental reforms can be a deterrent to reelection-seeking officials. We hypothesize that local officials may show more interest in pursuing new environmental policies once they are primed to consider the more short-term benefits of acting on climate (H2).

The effects of time horizon may be less discernible in party-centric systems. These institutional settings can facilitate long-term commitments by obfuscating accountability mechanisms and increasing the electoral safety of decision makers (Finnegan, 2022; Jacobs, 2016). Key policy decisions in party-centric systems depend more heavily on the positions of party leaders, who may feel their positions less threatened than legislators in marginal seats. Still, existing research shows similar levels of temporal discounting among Members of Parliament from political systems with more and less party discipline (Sheffer et al., 2018).

Source credibility

Finally, we posit that source credibility helps explain legislators' willingness to pursue new climate policy solutions. Information from more credible sources is more persuasive and more likely to induce ambivalent subjects to learn (Druckman, 2001; Pornpitakpan, 2004). A large literature in political communication documents that source credibility is an essential determinant of whether new information is incorporated

(Hovland & Weiss, 1951; Metzger & Flanagin, 2015). Lupia (2002) specifies two important dimensions of source credibility: knowledge and trustworthiness.

What constitutes a credible source to legislators in the context of climate politics is less clear. While in some domains politicians are willing to listen to policy experts (Lee, 2022), which should score high on the knowledge dimension of source credibility, there is evidence that public officials are biased in favor of information provided by ideologically proximate peers and copartisans (Butler et al., 2017; Pereira, 2022). The politicization of climate science can also jeopardize the credibility of policy experts by reducing public trust (Bolsen & Druckman, 2018; Druckman & McGrath, 2019). This dynamic is particularly acute in the United States, where conservatives are significantly more likely to reject climate science than conservatives elsewhere (Hornsey et al., 2018). In addition, research shows that when individuals are aware of the persuasive intent of a source, the message is deemed as less credible (Metzger et al., 2010). Given that policy experts almost unanimously agree that climate change is a major problem that needs action (IPCC, 2022), this could also limit the credibility of messages sent from the climate scientist.

On the other hand, professional relationships and communication are a central aspect of the policy-making process. Legislators often take cues from their peers, and these cues can be as effective at influencing behavior as direct policy information (Box-Steffensmeier et al., 2015; Zelizer, 2019). The high value of the information, the frequent interactions as well as the familiarity with this kind of information should make peers a highly trusted and thus credible source

In sum, we hypothesize that peer legislators are more effective than nonpolitical policy experts at motivating public officials to act on climate change (H3a). Finally, given the role of homophily in policy learning (Halberstam & Knight, 2016; Lee & Van de Meene, 2012), we expect conational legislators to be more persuasive than peer legislators from a different country (H3b).

EMPIRICAL STRATEGY

We test our predictions in a real-life, policy-learning setting. In April 2021, ONZ organized a webinar for local elected officials on policy solutions to achieve net zero climate emissions. NGOs commonly use webinars to share policy expertise with decision makers. The event speakers included policy experts, representatives from the world's largest organizations of local governments promoting sustainable development, and legislators with prior experience adopting net zero policies. The webinar had two central goals: (1)
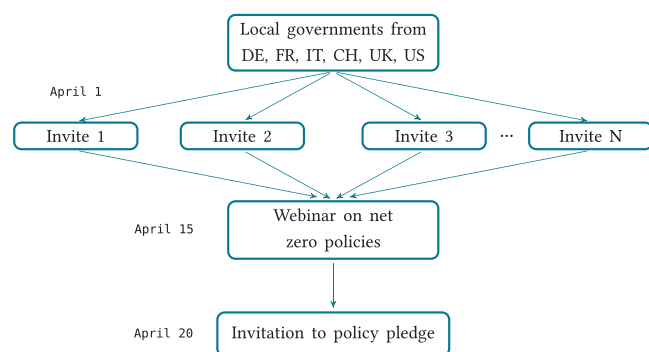
FIGURE 1 Design and time frame of the field experiment.
Note: We randomly assigned local officials to different versions of the webinar invitation and measured the effects on engagement with the invitation and with the policy pledge email.

FIGURE 2 Public opinion intervention: US local officials.
Note: Element of the webinar invitation to US local officials.

to highlight specific strategies for local governments to reduce carbon emissions and (2) to promote the Race to Zero Cities, a global campaign sponsored by the UN to promote carbon neutrality in subnational governments.[5] At the webinar, participants and speakers discussed different measures available to local governments, including the implementation of zero-emissions zones, requirements for new housing to be certified as net zero buildings, or the establishment of ambitious science-based clean energy targets.

The environmental group invited local elected officials from six countries: the United States, the United Kingdom, Switzerland, Italy, Germany, and France. All the presentations in the webinar were made in English, but a team of interpreters provided simultaneous translations into French, German, and Italian.[6] To study public officials' motivations to act on climate issues, we partnered with ONZ and randomly assigned different versions of the invitation. Figure 1 illustrates the experimental design. The invitations were sent to mayors and council members 2 weeks before the event, and a reminder was sent 7 days after the original invitation. Five days after the event, a follow-up email included a link to register a policy pledge in the UN Race to Zero Cities campaign.

Our empirical strategy offers three main advantages. First, the experimental component allows us to avoid endogeneity concerns that often make the study of policy learning and diffusion challenging. Second, the harmonized, multisite design increases our confidence in the generalizability of the findings to other established democracies. Finally, partnering with ONZ and embedding the study in a webinar with policy experts allowed us to unobtru-

sively observe the behavior of legislators in a common policy-learning context.

Treatments in the webinar invitation

We rely on a factorial experiment to randomly assign three features of the invitation. The core structure of the email remained constant, including the subject and the email address of the sender.

First, we randomly assigned local officials to receive information about public attitudes on climate policy *in their constituency*. For data availability reasons, this intervention was implemented only in the United States and the United Kingdom. In the United States, we relied on county-level public opinion estimates from the Yale Climate Opinion Maps (YCOM) 2020 (Howe et al., 2015). These estimates were derived from statistical models using multilevel regression with poststratification (MRP). In the United Kingdom, we replicated the same estimation strategy based on data from the European Values Survey.[7]

Figure 2 provides the wording of the public opinion intervention included in the invitation to local officials in the United States.[8] Both statements referenced in the intervention are supported by an ample majority of Americans. According to YCOM, 71% of Americans nationwide agree that global warming will harm future generations, and 75% support CO_2 regulation (county-level estimates from 53% to 82%, and from 65% to 85%, respectively). We expect legislators who have the opportunity to update their beliefs about constituency support for climate action to be more likely to express interest in the webinar, particularly in communities where support for climate action is higher.

[5] See https://unfccc.int/climate-action/race-to-zero-campaign for more information.
[6] The webinar materials, including the invitations, flyers, and communications, were also translated and disseminated in the native languages from each country.

[7] Appendix C in the Supporting Information (SI; pp. 5–13) describes the estimation strategy and sensitivity analyses performed to validate the MRP estimates used in the United Kingdom. US and UK local officials are elected in majoritarian electoral systems. Hence, we believe that the electorate as a whole represents the reference constituency to these legislators (Rehfeld, 2005). However, we note that officials in more proportional electoral systems officials may care more about the preferences of their own party voters or of different subconstituencies.
[8] See Appendix A in the SI (p. 1) for the equivalent vignette in the United Kingdom.

The public opinion intervention could violate the excludability assumption if the politicians' response to the prompt was activated *not* by the public opinion estimates but simply by the reference to their constituency; previous research has found that email personalization increases engagement (Sahni et al., 2018). To overcome this risk, we held the level of personalization constant across groups by including a reference to the officials' constituency in the core segment of the invitation.[9]

Second, we randomly assigned legislators to receive invitations that highlighted either long- or short-term arguments to respond to the climate crisis.[10] The short-term prompt emphasized the ability of net zero strategies to provide an economic edge in the recovery from the COVID-19 pandemic by attracting labor-intensive industries. The prompt also highlighted the symbolic relevance of the UN Climate Change Conference held later that year, the largest and most ambitious meeting of national and subnational policymakers since the Paris Climate Agreements in 2015. The long-term prompt emphasized the importance of moving toward a sustainable future in the coming decades, including the ability to secure employment in more resilient sectors. By priming one set of arguments in the intervention, these arguments may receive greater weight in officials' decisions despite preexisting information (Chong & Druckman, 2007). Both vignettes focus on economic arguments to avoid conflating the time horizon with other dimensions of climate policy. To support the arguments conveyed in the vignette while guaranteeing the symmetry of the intervention, both versions included a link to the same academic article that reports shorter and longer term economic predictions of the transition to green energy (Garrett-Peltier, 2017). Appendix A in the SI (p. 1) reproduces the English version of the vignettes.

Third, to assess the effect of source credibility, the invitation was sent by either a climate scientist or a local elected official. The climate scientist was a professor at a leading academic institution and a coauthor of the IPCC's 2018 Special Report on Global Warming. The local representative was a councilor from a midsize city in the same country as the climate scientist.[11] The invitations included links to the personal websites of the senders to further validate their identity. We held the sender's email address constant to avoid the risk of differential open rates by treatment group. The identity of the sender is disclosed in the

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On behalf of [Professor/Councillor] [names redacted]

Dear [title, last name of local official]
I write you as a [climate scientist/fellow local
representative] with an invitation to a webinar on
setting and achieving net zero climate emissions at
the local level.
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FIGURE 3 Source credibility intervention. *Note*: English version of the email introduction.

first two sentences of the invitation, as described in Figure 3, and in the email signature.[12] To minimize the risk of any confounding factor besides the difference between politician and policy expert to influence our results, both partners have the same gender, the same ethnicity, come from the same country, and belong to a similar age group.

All three factors are fully crossed, producing a 2(1) × 2(3) × 2 factorial design summarized in Table A1 (Appendix in the SI, p. 2). Depending on the specific variations adopted in each country, the design produced four to eight versions of the invitation. However, as further described below, the analyses are performed along the margins to isolate the causal effects of each individual factor.

All interventions provide some form of information to officials. Individual responses may vary according to prior beliefs or preexisting information. Given the nature of the study, we do not have access to this information. Instead, we focus on uncovering the average response to each treatment, above and beyond other sources of individual heterogeneity.

Sampling and randomization

The partnering organization invited city- and county-level elected officials with publicly available email addresses in the six countries included in the study. The sample of representatives comprised mayors, vice-mayors, other elected members of the executive, and council members. We describe the specific sampling strategy adopted in each country in Appendix B in the SI (p. 4). The starting sample included valid email addresses from 21,932 local officials.

Table 1 reports the number of emails delivered and opened by country. The overall open rate was 24.0%. There are no significant differences in open rates across conditions (Appendix Table B1 in the SI, p. 5). The analyses reported below are based on local officials who were exposed to the treatments by opening

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[9] Regardless of the exact level at which public opinion was measured (e.g., city or county), the vignette mentioned the officials' constituency.

[10] We did not specifically mention a potential electoral connection or the possibility to claim credit from these policies, which might limit the conclusion we can draw from this intervention. Future work would benefit from making a more explicit reference to the credit claiming potential of short-term benefits.

[11] Both individuals regularly collaborate with ONZ activities and agreed to participate.

[12] In Germany, a third group was randomly assigned to invitations sent by a German local official.

TABLE 1 Webinar invitations sent and opened, by country.

	Individual invitations			Local governments
	Sent	Opened	Open rate	
United States	7719	1953	25.3	559
United Kingdom	5510	700	12.7	160
Switzerland	2589	817	31.6	354
Italy	893	163	18.3	130
Germany	3796	1513	39.9	296
France	1425	152	10.7	152
Total	21,932	5298	24.2	1651

Note: Columns 1-3 are the number of emails sent and opened by local officials in each country (columns 1-3). Column 4 lists the number of unique local governments where at least one elected official opened the invitation.

the email ($N = 5298$; 1651 local governments). Restricting the sample to those who were exposed to the invitation allows us to directly estimate the treatment effects.[13]

We clustered random assignment at the local government level to minimize the risk of interference (Zelizer, 2019). Randomization was performed with multivariate continuous blocking within country to maximize balance on population size, vote share of the largest party, constituency public opinion (UK and US), and local council size. Block randomization improves precision by minimizing the variance in factors other than the experimental conditions (Duflo et al., 2007). Appendix Table B2 in the SI (p. 6) reports covariate balance tests.

The subjects treated in the study are the officials' email addresses (not the representatives themselves). This practice is common in audit studies and requires assuming that staffers who open the email acted on behalf of the elected official (Butler & Crabtree, 2021). This assumption is unlikely to have meaningful consequences for our study since the vast majority of local offices have no resources available to support staffers.

Outcomes

To examine local representatives' motivations to act on climate change, we measured how subjects engaged with the webinar invitation and the follow-up email sent out after the event. We used email marketing tools to track clicks on the links provided in the emails. We used this unobtrusive method to produce three main behavioral outcomes that capture the officials'

interest in learning about net zero policies and their willingness to make policy commitments in this area.

Policy Interest is a binary measure that takes a value of 1 if a subject clicked on any of the links provided in the webinar invitation, and 0 otherwise. In the email, officials could register for the event by clicking on a hyperlink with the statement "Learn more about the webinar and register." The message also included links to the webinar host's website and the personal website of the email sender. To better capture different levels of engagement with the invitation, we use a second outcome, **Policy Engagement**, which indicates the number of links clicked in the invitation. Of the subjects who clicked on any of the links provided, 77% clicked on more than one. Hence, while both outcomes capture interest in learning about net zero policies, they measure different forms of engagement. These measures capture a relevant component of climate action. The active search for more information is a first and important step in attitude change (Kinder, 2003; Zaller et al., 1992), and information that has been actively searched for is more likely to be retained in the memory and to subsequently influence behavior (Vössing & Weber, 2019).

Finally, we measure local officials' willingness to set net zero-emissions targets in their municipality by tracking clicks on the follow-up email sent after the webinar (see Figure 1). **Policy Commitments** takes a value of 1 if officials clicked on the hyperlinked statement: "Click here to join the Race to Zero." The link led to the Cities Race to Zero website, a global campaign backed by the UN Framework Convention on Climate Change that encourages local governments to make policy commitments to achieve net zero emissions but also allowed them to learn about concrete initiatives of how to save CO_2. The follow-up message did not include any experimental manipulations. By analyzing responses to the follow-up message, we also test the effects of the different treatments embedded in the webinar invitation sent 19 days earlier, which thus represents a medium-term assessment of the intervention.

In the preanalysis plan, we registered three additional outcomes that we were unable to measure (webinar registrations, webinar attendances, and policy commitments by municipalities) for two reasons. First, we could not match webinar registrations and attendance with the email list used for the invitations because the vast majority of officials who registered for the event used different email accounts or delegated the task to a staff member. Second, the organization that managed the policy pledge platform did not provide the necessary information to identify the date of individual policy commitments. In the concluding section, we discuss how these constraints shape the scope of the findings, and what we can learn from them.

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[13] Appendix Table B3 in the SI (p. 7) compares the demographics of municipalities where local officials opened or did not open the email. Municipalities in the study are slightly larger and more likely to elect women to local office (5 percentage points). However, we find no discernible differences in climate attitudes and voting behavior.

Estimation

We estimate the Average Marginal Component Effect (AMCE) of each of the three features randomly assigned in the invitation. This quantity corresponds to the marginal effect of each factor, averaged over the joint distribution of all factors.[14] We derive estimates of the AMCE from ordinary least squares (OLS) regressions with covariate adjustment. We test all main predictions in country-specific models and pooled models with country fixed effects.[15] The unit of analysis in the models reported in the main text is the local government, the level of random assignment. According to Athey and Imbens (2017), cluster-level analyses are "more transparent and more directly linked to the randomization framework" (p. 113).[16] We aggregate the outcomes up to the local government level by taking the mean of each outcome at the individual level.

Ethical considerations

This experiment was approved by the human subjects committees at the University of Southern California and the University of Geneva. Our study shares similarities with government audits that are increasingly common in political science (Butler & Crabtree, 2021). We discuss three main ethical concerns associated with this type of experimental research, and how we addressed them: deception, wasting public resources, and potential influence on policy outcomes.

We avoided deception by collaborating with an NGO that regularly promotes initiatives like the one analyzed in this study. The webinar had been planned in advance by the partnering organization as part of a year-long campaign to raise awareness of net zero policies. Continued consultation during the research design process ensured that the interventions resonated well with the organization's approach and followed their normal routine of contacting policy makers. This close collaboration allowed us to observe politicians in a real policy-learning environment, while avoiding exposing decision makers to policy information they would not have been exposed to otherwise.

Additionally, we sought to minimize the cost to public officials involved in the study in two ways. First, we conducted power analyses to identify the smallest sample sizes that would allow us to have a sufficiently powered study. Based on these analyses, we reduced the starting sample of local officials by randomly selecting a subset of legislators in larger local councils. However, two features of the study required a relatively large baseline sample: the clustered design and uncertainty about the opening rates that would ultimately determine the study sample. Second, the interventions add a residual cost to local officials. Any subject who opened the invitation but was not interested in the webinar could simply disregard the email. Alternative ways of administering the treatment—through individual meetings for instance—could increase treatment dosage but would also impose additional costs on local representatives.

The light-touch nature of the intervention, a cold email sent by a relatively small and new organization, had one additional goal: to reduce the study's ability to influence policy outcomes. Observing how officials interacted with different versions of the invitation provides a valid instrument to study the motivations of legislators to learn and adopt new policies while at the same time adhering to the principle of field experiments to be unobstrusive. At the same time, it minimizes the chances that the interventions would lead to the adoption of policies that would not have been pursued in the absence of the study (see Zelizer, 2021, for a similar approach).

RESULTS

We report the results for each intervention separately. The effects of providing information on constituency preferences to local officials in the United States and the United Kingdom are analyzed separately since the measures of public opinion used in each country are not directly comparable. For the remaining interventions, we report the results of country-specific and pooled models.

Public opinion and policy action

We randomly assigned public officials to receive information about constituency preferences on climate change. We predicted that legislators who received this information would be more likely to show interest in the webinar on net zero policies, especially in communities where there is more support for climate action. Table 2 reports the main effects of the public opinion intervention in the United States. Models 1, 3, and 5 provide estimates for the average causal effect of receiving an invitation containing public opinion data

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[14] The estimates should be interpreted as a composite treatment effect that includes a weighted-average of the intervention across different levels of the other factors (Muralidharan et al., 2019).

[15] Following the preanalysis plan, the models adjust for local vote share of the largest party in the most recent general election (only country-specific models), population size, constituency opinion on climate (UK and US), cluster size, and gender composition of the local government. Unadjusted models reported in Appendix Figures E2–E3 in the SI (pp. 19–20) provide substantively indistinguishable results.

[16] Appendix Figures E4–E5 in the SI (pp. 21–22) replicate the main findings at the individual level with clustered standard errors.

TABLE 2 The effects of receiving public opinion information on local support for climate action among US legislators.

	Policy interest		Policy engagement		Policy commitments	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	−0.037	−1.486*	−0.233	−5.688*	−0.036	−1.128
	(0.032)	(0.598)	(0.120)	(2.264)	(0.031)	(0.596)
Local support	−0.011	−0.022*	−0.030	−0.072	−0.007	−0.015
	(0.009)	(0.010)	(0.036)	(0.040)	(0.009)	(0.010)
Treatment × Local support	—	0.020*	—	0.075*	—	0.015
		(0.008)		(0.031)		(0.008)
Preregistered covariates	Yes	Yes	Yes	Yes	Yes	Yes
Observations	559	559	559	559	559	559
Adjusted R^2	0.176	0.183	0.182	0.189	0.164	0.167

Note: Entries are coefficient estimates from linear models on the effects of receiving public opinion information on climate attitudes (*Treatment*) on policy interest (1-2), policy engagement (3-4) and policy commitments (5-6). Models 2, 4, and 6 report treatment effects conditional on support for climate action in the constituency.

*$p < 0.05$; **$p < 0.01$.

on climate attitudes (relative to the same email without public opinion data). Models 2, 4, and 6 estimate treatment effects conditional on the levels of local support for climate action in the constituency.

The results provide mixed support for our predictions. There is no evidence that public opinion information, per se, made politicians more likely to devote time to learn and adopt new climate solutions. The causal estimates are negative and not precisely estimated, so we cannot rule out smaller effects that the study was unable to capture.[17] Still, no clear directional pattern is discernible across the three outcomes. One possible explanation for this result is that elite perceptions of public opinion on climate became less biased over the last decade (Broockman & Skovron, 2018; Hertel-Fernandez et al., 2019). In the last few years, a growing number of collective action efforts have raised awareness of the threats of climate change, and these initiatives may have allowed public officials to update their beliefs about constituency preferences (Gause, 2022). Recent scholarship shows that politicians tend to have more accurate perceptions of public preferences on more salient issues (Varone & Helfer, 2022). It is also possible that the treatment was not deemed credible by legislators, or that concentrated opposition matters more than diffuse support for climate policies (Stokes, 2016). However, the effects conditional on public opinion reported below are not consistent with these explanations.

In turn, we find evidence that providing public opinion data made officials more responsive to constituency preferences, consistent with H1b. The interaction term in Models 2, 4, and 6 describes the difference in responses between officials in the treatment and control groups at different levels of local support for climate action. The positive coefficient in Model 2, for instance, means that officials who received public opinion information expressed more interest in the webinar as constituency support increased. The same is not true for officials in the control group. Hence, providing public opinion data on climate attitudes made officials behave more in line with the preferences of their constituents. The effect sizes are meaningful. A 5 percentage point increase in constituency support for regulating CO_2 emissions is associated with a 10.0 percentage point increase in the probability of clicking on a link in the webinar invitation, relative to officials in the control group who received no public opinion information.[18] This effect is sustained for over 2 weeks. In the follow-up email, officials representing higher support constituencies who received public opinion information in the original webinar invitation were more likely to click on the link to register a net zero commitment in their municipality (0.015; s.e. = 0.008; *p*-value = .067). The effect size is smaller but remains meaningful: a 5-point increase in support is associated with a 6.8-point change in the probability of clicking on the link to register a policy commitment.[19]

Finally, we find no evidence that local officials in the United Kingdom responded to public opinion (Appendix Table D1 in the SI, p. 14). One possible explanation for this result is that the estimates of public opinion in the United Kingdom were aggregated at the NUTS 3 level for data availability reasons. In the United Kingdom, these units aggregate counties and

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[17] For one of the three outcomes (policy engagement), there is suggestive evidence of a negative average effect of receiving public opinion data (−0.233; s.e. = 0.120). This result is consistent with a mechanism where officials overestimated public support for climate action and updated their perceptions negatively. However, the lack of consistency across outcomes and the relatively high levels of public support for the statements render this explanation unlikely. Still, the results suggest that providing public opinion is unlikely to induce climate action on the average US local official.

[18] Calculation based on the estimates in Model 2: $5 \times 0.020 = 0.10$.
[19] While local support for climate action is not exogenous, we note that these effects capture more than differences in partisanship at the local level since the US models account for Democratic vote share in the municipality.

districts in ways that may have made the estimates less informative.[20] It is also possible that UK legislators care less about diffuse policy support and more about the views of copartisans or subconstituencies directly affected by climate policy (Mildenberger et al., 2022; Stokes, 2016).

Time horizon and policy action

Legislators who opened the webinar invitation were exposed to a set of either longer or shorter term arguments for local governments to pursue carbon neutrality. We predicted that local politicians would show more interest in pursuing new climate policies after learning about the more immediate benefits of these policies. Figure 4 displays the main results of this test. Each panel corresponds to a different outcome and includes the main results from country-specific (green) and pooled (purple) models. The estimates correspond to the causal effect of being exposed to an invitation that emphasized longer term (rather than shorter term) arguments to act on climate change.

The results provide only marginal support for our prediction. The pooled effect of the long-term frame on policy interest (panel a) is negative, as predicted, but the effect is small and indistinguishable from zero (-0.015; s.e. $= -0.013$). The same pattern emerges more clearly when considering the levels of engagement with the invitation (panel b). The pooled effect from all six countries is negative and distinguishable from zero (-0.092; s.e. $= 0.048$; p-value $= .059$). The coefficient suggests that local officials who received the long-term frame on average clicked on 0.09 fewer links than their peers who were exposed to the short-term frame. The effect size is small, represents 8.6% of the standard deviation of the outcome, and is mainly driven by US officials. The coefficient for the pooled model excluding the United States provides a precisely estimated null result (-0.005; s.e. $= 0.038$). Finally, we find no evidence that the effects of the intervention are sustained over time. The long-term frame did not meaningfully impact legislators' willingness to register policy commitments in the Race to Zero platform 19 days later (panel c).

Given the simplicity of the intervention, with the long-/short-term arguments occupying a secondary role in the webinar invitation, we interpret these results as preliminary but promising. The evidence suggests that the longer time horizon commonly associated with climate policies may discourage office-

seeking local officials from engaging on the issue. However, only an alternative implementation strategy that increases the treatment dosage can provide a more definitive answer to this question. We discuss some of these alternative strategies in the concluding section.

The effects of source credibility

Finally, we report the effects of source credibility on local officials' willingness to act on climate. We predicted that peer effects could make legislators more responsive to information received from another local representative. Figure 5 presents the main findings. The estimates reported in each panel correspond to the causal effects of receiving an invitation from a climate scientist rather than a peer politician.

Overall, the results contradict our prediction. With the exception of US legislators, officials in the study responded more positively to the invitation sent by a climate scientist than the one initiated by a peer legislator. European local officials were 2.3 percentage points more likely to click on at least one link in the invitation when sent by a climate scientist (p-value $= .03$). The average differences by country range from 0.9 percentage points (Switzerland) to 5 percentage points (Italy). Yet, the probability that US local officials express interest in the net zero webinar decreased by 4.2 points when the invitation came from a climate scientist instead of another local official. However, the coefficient is not precisely estimated (s.e. $= 0.03$; p-value $= .17$). The same pattern is discernible in the models with the number of clicks as the outcome (panel b). Local officials from European municipalities, on average, were more likely to engage with the invitation to register for the webinar when the message was sent by the climate scientist partnering with ONZ (0.11; s.e. $= 0.04$). Only officials from US municipalities, on average, engaged less with the invitations sent by the policy expert.

Increased politicization of scientific knowledge in the United States may explain the different responses of US and European officials. Exploratory analyses with the subset of US officials running on partisan ballots are consistent with this mechanism (Appendix Figure E6 in the SI, p. 23). Republicans were 14.7 points less likely to express interest in the webinar when the invitation was sent from the climate scientist than when it came from a peer (p-value $= .04$). The coefficient for Democrats is half the magnitude and indistinguishable from zero (-0.07; p-value $= .39$).[21]

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[20] We tried to minimize this concern by providing a link to a website with a map of the United Kingdom and regional estimates of public opinion. Local officials could easily find their constituency on the map and see the corresponding estimates of public opinion. Still, in Appendix Tables E1 and E2 in the SI (p. 24), we find suggestive evidence consistent with this prediction.

[21] Backlash against European-based experts could also explain this result. While French, German, Italian, and Swiss officials also received invitations from foreign subjects, and German officials respond similarly to an invitation from a German or UK peer, as described below, we cannot rule the possibility of differential nationalistic biases in the United States.
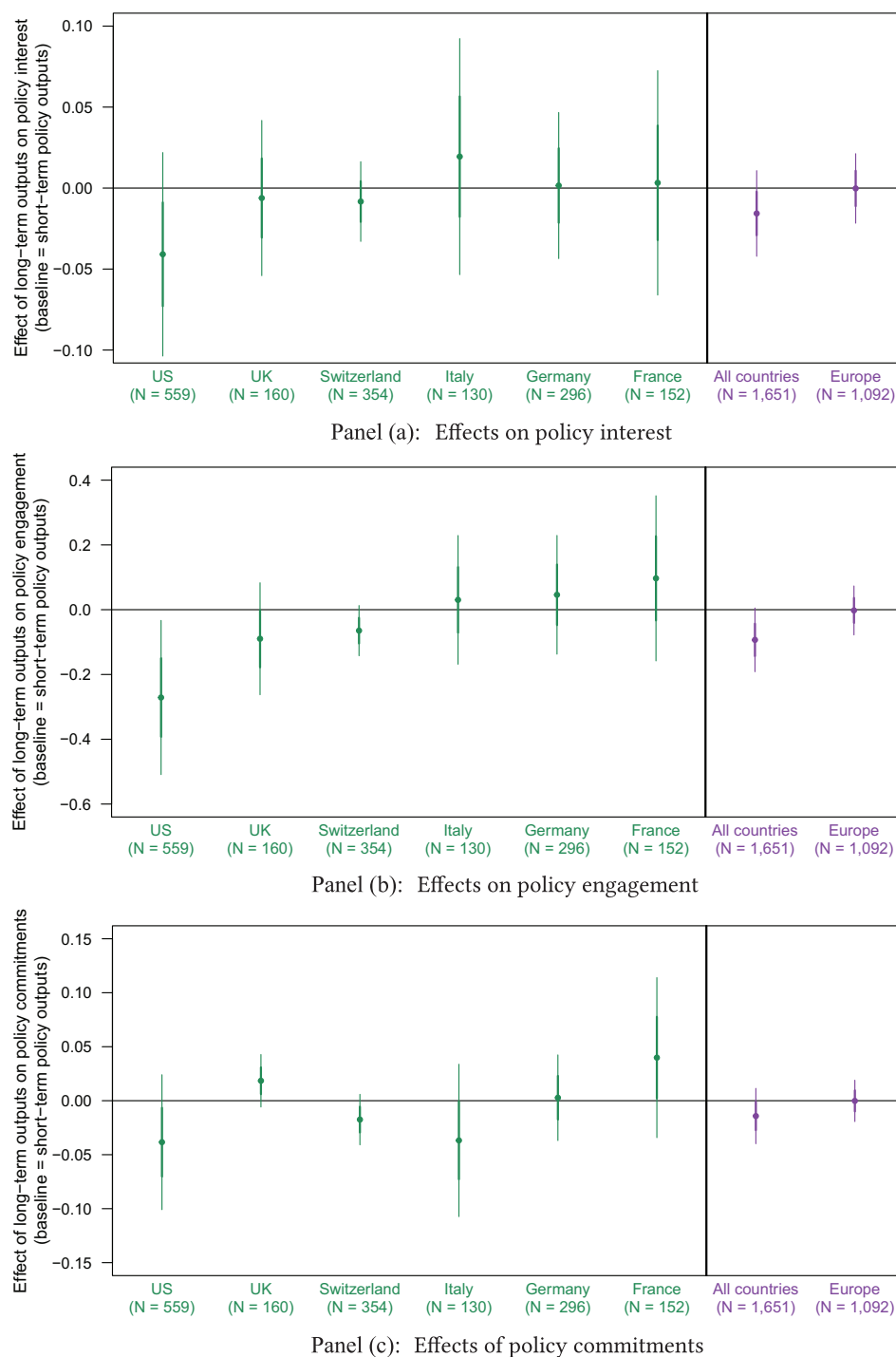
FIGURE 4 The effects of receiving a webinar invitation emphasizing long-term (vs. short-term) arguments to act on climate, by country and pooled. *Note*: Points are estimates of the causal effect of priming long-term policy goals in the invitation to the webinar on policy interest (panel a), policy engagement (panel b), and policy commitments (panel c); 95% confidence intervals surround point estimates; thicker lines represent one standard error. Full model results in Appendix Tables D2–D4 in the SI (pp. 15–17).

We do not find the same gap among European officials from left- or right-leaning parties (Appendix Figure E7 in the SI, p. 23).

Additionally, we find no evidence that source credibility in the invitation to the webinar affected officials' willingness to make policy commitments 19 days later

(panel c). The pooled estimate across all six countries is small and unreliable (−0.01; s.e. = 0.01). Overall, the results suggest that the information conveyed by the policy expert generated more immediate interest, with the exception of US officials. However, this effect was not sustained 3 weeks later when representatives
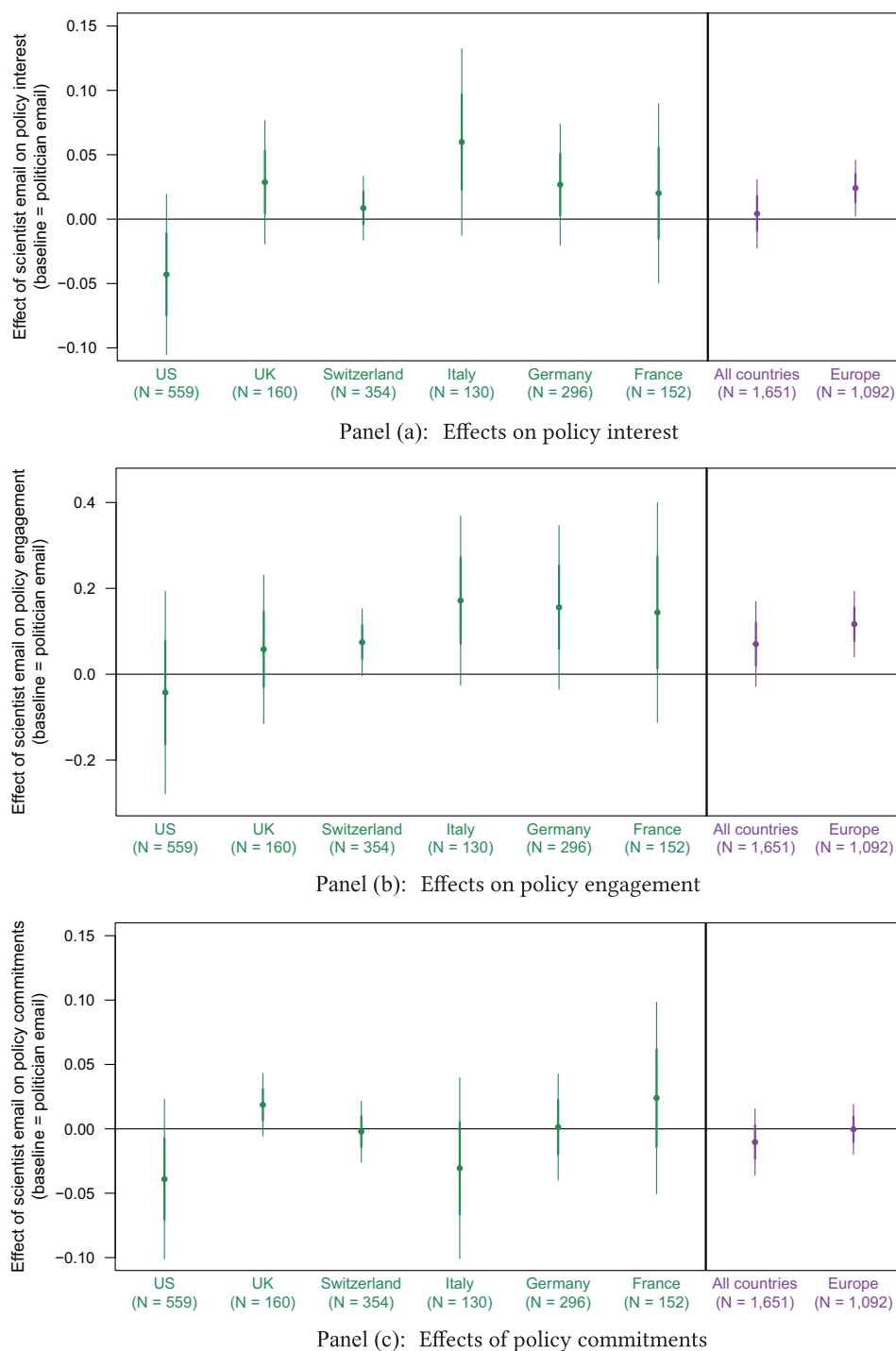
Panel (a): Effects on policy interest

Panel (b): Effects on policy engagement

Panel (c): Effects of policy commitments

FIGURE 5   The effects of receiving a webinar invitation from a climate scientist (vs. peer legislator), by country and pooled. *Note*: Points are estimates of the causal effect of a webinar invitation from a climate scientist on policy interest (panel a), policy engagement (panel b), and policy commitments (panel c); 95% confidence intervals surround point estimates; thicker lines represent one standard error. Full model results in Appendix Tables D2–D4 in the SI (pp. 15–17).

were asked to make a policy pledge to reduce carbon emissions in their constituency.

Finally, we test whether the nationality of the peer official affected the persuasiveness of the intervention. The invitations were sent by either a politician or a climate scientist based in the United Kingdom. In Germany, a third group was randomly assigned to receive an invitation from a German local official who collaborated in the study. We predicted that peer effects would be greater with an invitation from a conational legislator. However, we found no evidence to support this prediction (Appendix Figure E1 in the SI, p. 18). Interest in the webinar was virtually unchanged by the nationality of the official sending the invitation. This

result is consistent with recent research showing no evidence of nationalistic biases in information seeking by politicians (Butler et al., 2019).

DISCUSSION

In a recent issue of *Nature Climate Change*, Linda Steg argues that "[t]o realize ambitious climate targets, research should focus more on effective ways to encourage rapid and wide-scale changes in climate mitigation actions, and less on understanding climate change beliefs" (Steg, 2018, p. 759). Our study provides a first step toward this goal. The response to the climate emergency requires active engagement from local governments. However, environmental organizations have struggled to bring climate change to the top of the agenda in many subnational governments (Measham et al., 2011). We explore three possible political obstacles to climate action: (1) misperceptions of public opinion, (2) the time horizon of climate policies, and (3) source credibility.

To shed light on climate advocates' ability to help policymakers overcome these obstacles, we designed a collaborative field experiment with representatives from six Western countries. We randomly assigned elected officials to receive different versions of an invitation to a webinar in which policy experts and peer legislators shared strategies to achieve net zero emissions. The results provide no evidence that the lack of action on climate change is driven by politicians systematically underestimating voter preferences. However, providing public opinion information did make legislators more responsive. We also find preliminary evidence that altering the time horizon of climate policies by highlighting more short-term policy consequences can encourage legislators to learn more about net zero policies. Finally, we show that politicians exhibit greater interest in the event when contacted by policy experts, with the exception of US officials.

We tested our interventions in multiple countries on both sides of the Atlantic, which enhances the generalizability of the findings. The relative consistency of our results across countries and local governments with varying levels of political autonomy suggests that our arguments have traction and that the interventions can be scalable by international organizations. However, we also note interesting variations across contexts. The United States seems to follow a different pattern from the other countries in the study in two respects. First, US legislators deemed the climate scientist as less credible than their counterparts in Europe, relative to the invitation sent from a peer official. This pattern, driven mainly by Republican officials, may be a consequence of the increased politicization of scientific knowledge in the United States (Bolsen & Druckman, 2018; Hornsey et al., 2018). Yet, the risks of politicizing climate science are not limited to the United States. In March 2022, Nigel Farage launched a campaign calling for a referendum on net zero policies in the United Kingdom. Our results suggest that such a process can damage the credibility of climate scientists among voters as well as policymakers. The second way in which the US officials diverged is that they were the only group responsive to public opinion data. This finding maps well with different traditions of local democracy in the United States and Europe. While local governments in the United States have historically prioritized citizens' involvement in civic life, a model of "local elitist democracy" still prevails in France and other Western European countries where the state and established political elites dominate local politics (Sellers et al., 2020).

We interpret our results as a promising first step toward understanding what drives politicians to act on climate change. Given the nature of the interventions, embedded in a cold email sent by a relatively young organization, we should not expect large policy effects. More in-depth interventions are needed to determine the policy effects of addressing each of the obstacles identified here. These interventions can be embedded in media campaigns, lobbying strategies, or internal policy briefs, for example. Working with organizations that have an established network of like-minded elected officials is also likely to produce more sustained effects. Future scholarship could also benefit from collecting officials' beliefs prior to the study to move beyond average treatment effects and better shed light on the role of information on policy learning.

The study provides a template for NGOs, international institutions, or elected officials interested in building legislative support for various issues. Our experimental design can be easily extended to explore the most cost-effective strategies to design policy campaigns. Future extensions should also investigate the potential to adapt interventions to different targets—by paying particular attention to the credibility of the source and the trust dimension and to better leverage treatment heterogeneity. While the study focuses on local governments, the findings are also informative to different levels of government. Misperceptions of constituency preferences may be less concerning for national legislators since public opinion data are easier to obtain. However, we expect that source credibility biases operate in similar ways among national-level legislators. Likewise, we expect the effects of myopic preferences to be greater among public officials with shorter term lengths (e.g., US House members) and running in more competitive elections.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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