Hurricanes, Climate Change Policies and Electoral Accountability*

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Abstract

This paper studies the conditions under which legislators promote policies that can be unpopular in the short run but have long-run benefits. Using data on the universe of federal disaster declarations between 1989 and 2014, we document that the response of congress members to the new information about the risks of climate change embedded in hurricanes depends on political circumstances: only those in safe seats can change their political agenda towards policies with long run benefits and short run costs. Supplementary text analysis of Congressional speeches reveals that politicians promoting climate change policies are aware of both the the short-run costs and long-run benefits of climate change policies, but only those in safe Congressional seats are ready to highlight the costs of regulation and promote future-oriented policies after their district has been hit by a hurricane.

Keywords: U.S. Congress, Environmental Policy, Congressional Speeches, Populism.

JEL codes: D70, D72, H50, Q54, Q58.

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1 Introduction

Legislators are goal-oriented actors seeking to achieve three main objectives: reelection, influence, and good public policy (Fenno, 1973). But what if some of those goals are in contrast to each other? Under which conditions does a legislator choose an unpopular policy that is in the public interest?

In this paper, we consider the case of climate change policies. There is almost unanimous consensus among scientists that climate change is occurring, and it is caused largely by human activity (IPCC, 2013). However, failure to internalize the long-run – and possibly irreversible – costs of climate change is keeping policies below the suggested optimal level (Nordhaus, 2018). It has been difficult to translate the scientific consensus about global warming into public policies. Voters tend to rank climate low among their priorities,[1] and business interests have been historically organized against climate change action.[2] Politicians opposed to more stringent environmental regulation often frame the choice as one between the environment and the economy, even when they acknowledge the reality of climate change.[3]

We investigate whether the occurrence of hurricanes, which convey new information about the risks of climate change, prompts politicians to promote more mitigation policies. The random trajectory of hurricanes allows us to plausibly identify the causal effect of new information on politicians' actions. We are thus able to shed light on some of the central issues in political economy, such as pandering, populism, and whether politicians represent voter interests. We use data on the universe of federal disaster declarations collected from the Federal Emergency Management Agency (FEMA) in the last 25 years, and ask whether representatives of Congressional districts directly affected by a hurricane are more likely

[1] Gallup, "Most Important Problem", `http://news.gallup.com/poll/1675/most-important-problem.aspx` accessed on April 30, 2019.

[2] Yale Environment 360, "Why Won't American Business Push for Action on Climate?", `http://e360.yale.edu/features/why-wont-american-business-push-for-action-on-climate`, accessed on April 30, 2019.

[3] For example, U.S. Senator Rick Scott of Florida, writing in 2019 about the Green New Deal: "Climate change...is real and requires real solutions...[but] to embrace this Green New Deal plan is to be an enemy of the American economy and the American worker... [For Florida, the plan] would mean the end of the tourism industry for one, not to mention massive job loss and unemployment." (*Orlando Sentinel*, February 25, 2019, `www.orlandosentinel.com/opinion/os-op-rick-scott-green-new-deal-20190225-story.html`, accessed on May 26, 2020.)

to support environmental legislation by either sponsoring or co-sponsoring "green bills" aimed at fighting climate change. We define green bills as those that are classified by the Congressional Bills Project (CBP) as dealing with air pollution, global warming, and alternative and renewable energy, and use manual text analysis to exclude relief bills or bills that are actually anti-environmental. The focus is therefore on bills introducing stricter regulation. We argue that examining sponsorship and cosponsorhsip of "green bills" possibly yields a more accurate proxy of political engagement than the roll-call records over the same bills, as only a limited number of "green bills" eventually reach the floor in the aftermath of a hurricane.

The main empirical strategy consists of regressing the number of green bills supported on a measure of hurricane incidence, controlling for a vast range of district and individual congress member characteristics, as well as district and year fixed effects. We show that pre-determined congress member and district characteristics are balanced between districts hit by a hurricane or not, after controlling for state and year fixed effects. The long nature of our panel (we have data on Congressional bills going from the 101^{st} to the 113^{th} Congress, i.e., from 1990 to 2014) means that we exploit for identification the variation in hurricane occurrence within districts over time.

We find robust evidence that Congress members are significantly more likely to support green legislation in the year after their district has been hit by a hurricane.[4] This result is robust to controlling for district and congressperson fixed effects, and for state-specific time trends, and survives an extensive set of additional robustness tests.

Importantly, the main result is driven by politicians in safe districts, supporting the notion that climate change legislation is a "luxury," which only politicians with considerable underlying electoral strength can afford. For these politicians, the increase in support for green bills persists over time, despite evidence that these policies may not align with vot-

[4] A concrete example of this is the MARKET CHOICE Act (H.R. 6463 in the 115^{th} Congress), a bill that proposes to impose a tax on greenhouse gas emissions. The bill was introduced in July 2018 by Representative Carlos Curbelo of Florida's 26^{th} Congressional District, and co-sponsored by Representative Francis Rooney of Florida's 19^{th} Congressional district and Representative "Brian Fitzpatrick of Pennsylvania's 8^{th} Congressional district. Florida's 26^{th} Congressional district contains all of the Florida Keys and a portion of south-west Miami-Dade county; Florida's 19^{th} Congressional district covers an area on the West coast of Florida that includes Fort Myers and Naples. These areas suffered extensive damages from Hurricane Irma in September 2017.

ers' inclinations. While the probability of reelection is not significantly affected, Congress members who support more climate change policies in response to a hurricane experience a decrease in campaign contributions and suffer a loss in vote share.

The motivations underlying politicians' reaction deserve further investigation. It is key to understand whether they are aware of the short-run costs of promoting more environmental legislation in the aftermath of a hurricane. This is challenging because traditional data sources are inappropriate to capture the nuances of policy making. We tackle this question using a novel text analysis of Congressional speeches. We document important differences between the speeches by politicians promoting climate change policies in safe districts and others. Politicians in safe seats are aware that these policies are unpopular, and support climate change legislation having future progress in mind. Furthermore, while the speeches by politicians in safe or unsafe districts are quite similar before a hurricane, only those in safe districts are ready to highlight the costs of regulation and take action after novel information on the threats of climate change.This evidence reinforces our interpretation that natural disasters may induce politicians to take the lead in promoting future-oriented policies, if promoting these policies does not endanger their Congressional seat.

Additional evidence confirms this hypothesis. First, we show that congress members do not temporarily overestimate voters' preferences for regulation, because the increase in support for green bills persists over time. Second, we show that the estimated effect is not compatible with the hypothesis that politicians use hurricanes as a mechanism to engage in logrolling (as measured by the exchange of favors between alumni from the same alma mater in Congress). Third, we find little support for the conjecture that their reaction is simply driven by lobbyists' pressure, as measured by the amount of campaign contributions received by interest groups with environment-related interests.

The paper is linked to the recent literature on the supply of populism. Populist policies are often defined as those that pander to voters by offering short-run protection and claim to be on the side of the people against the elite, but have no regard to long-run consequences (Guiso et al., 2017). Our paper focuses on a type of policy, environmental regulation, that has exactly the opposite features: they carry short-run costs, but promise to deliver benefits that will materialize in the long run. Under which circumstances may politicians choose to enact such policies, despite the possible blowback they may face from voters? Gennaro et al. (2020), for example, propose a mobilization theory where politicians are more likely to choose the populist policy (or symmetrically, like in our case, they might be less likely to choose the non-populist policy) when campaigning in "risky" districts, i.e., districts characterized by low economic insecurity and low electoral competition. More generally, a necessary condition for promoting unpopular policies is that there is an informational asymmetry between politicians and voters over the costs and benefits of such policies. This does not mean that voters cannot be supportive of environmental policies, or that politicians do not target them accordingly (see List and Sturm, 2006). Our paper, however, shows that the occurrence of a hurricane represents an additional informational shock that might differentially shape the perceptions of the two groups over the risks of climate change. Under certain circumstances, this might induce congress members to push for more environmental regulation, irrespective of voters' preferences. Note that in this framework politicians do not only care about winning elections *per se*, but also about pursuing their own preferred policy objective (as in Calvert, 1985; Alesina, 1988; Besley and Coate, 1997).

Our study is also related to the literature on the effects of natural disasters on political outcomes, and how these are mediated by politicians' response. [5] In an early contribution, Besley and Burgess (2002) find that Indian state governments respond more to falls in food production and crop flood damage via calamity relief when politicians are kept in check by the press and face more electoral accountability. Gasper and Reeves (2011), Healy and Malhotra (2010), and Cole et al. (2012) find that incumbents suffer if weather events produce severe damage, but are rewarded when they react vigorously by declaring a state of emergency or secure emergency relief. Similarly, Healy and Malhotra (2009), Bechtel and Hainmueller (2011), and Chen (2013) also find that incumbents are rewarded for disaster recovery spending.[6] This literature mostly studies short-term legislation focused on recovery

[5] With rational voters, these events should not affect incumbents' electoral fortunes. However, Ashworth et al. (2018) have argued that exogenous shocks can still affect incumbents' electoral fortunes as voters can observe the way they prepared for or responded to a natural disaster, thus providing the opportunity to learn about the quality of the incumbent.

[6] Other papers have focused on the economic impact of weather disasters. For example, Hsiang and Jina (2014) use cross-country data to show that extreme weather is harmful for economic growth, although the effect is smaller for rich countries (Dell et al., 2012). For the U.S., Boustan et al. (2020) find that most severe disasters increase migration rates and lower housing prices, although these effects can be mitigated

spending and relief, while our paper looks at long-term legislation aimed at climate change mitigation. More closely related to to our paper is the work by Herrnstadt and Muehlegger (2014), who find that unusual local weather raises the salience of climate change (as proxied by Google searches), and the likelihood that U.S. members of Congress take a pro-environment stance (not necessarily tied to climate change) in roll-call votes. In contrast to them, our focus is explicitly on long-run environmental legislation, which frequently comes with short-run costs and may trigger populist reactions. As mentioned, since a low number of "green bills" is voted on the floor, we measure actions in terms of sponsorship and cosponsorship of Congressional bills. Such a measure of politicians' stances is less likely to be contaminated by party discipline. In addition, our paper provides a first step towards understanding the motives behind politicians' reactions to extreme events. In this respect, our paper is similar to the work by Kaplan et al. (2019), who also exploit the quasi-random nature of natural disasters to gain insights about legislator support for special interests. They find that members of the U.S. House of Representatives are more likely to vote in the interest of their donors when media attention on politics is diverted by the occurrence of a natural disaster.

Finally, our work is related to the literature on the effect of natural disasters, hurricanes and extreme weather events on beliefs about climate change and support for green policies. Survey-based analyses reveal that extreme weather events increases individuals' agreement with statements that climate change is real (Leiserowitz, 2006; Egan and Mullin, 2012) and increases support for green policies (Visconti and Young, 2020). However, support for green policies in a hypothetical survey does not necessarily translate into support at the ballot box, when voters are exposed to the full set of competing views on the costs and benefits of such policies (Anderson et al., 2019). Our paper contributes to this debate by showing that green legislation does appear to carry an electoral penalty and is supported only by politicians who can afford to lose some electoral support without fear of being unseated.

The rest of the paper is structured as follows. Section 2 presents a brief theoretical discussion of the possible reactions of voters and politicians to the occurrence of a hurricane. Section 3 describes the data. Section 4 discusses the empirical approach. In Section 5

by adaptation (Burke and Emerick, 2016) and aid policies (Deryugina et al., 2018) we present the main empirical results on the effect of hurricanes on green legislation, the heterogeneity of the response, and the costs of promoting green legislation. In Section 6, we analyse the universe of Congressional speeches to better understand the motives underlying the effects. Section 7 collects further evidence. We conclude with Section 8.

2 Theoretical background

We borrow from existing political economy theory to describe the possible reactions of voters' and politicians' to the occurrence of a hurricane. Several combinations are possible, depending on the assumptions we make about how information spreads among individuals, and about politicians' motives.

If both voters and politicians are already aware of the risks of climate change, the occurrence of hurricanes should not meaningfully affect their views about the optimal policy response, and we should not expect to see any response in terms of either legislation or electoral outcomes (*Hypothesis i*).

If instead environmental catastrophes capture voters' attention over salient issues, and politicians respond to voters' desire for environmental regulation because they want to be re-elected, then we should see an effect on legislation. Also, politicians that do respond to hurricanes with more green legislation should be rewarded at the ballot box relative to their counterparts who do not take any action (*Hypothesis ii*).

On the other hand, the general public may fail to understand the importance of the global warming signals, while politicians do not. This could happen if voters and politicians are exposed to different information. Politicians are more likely to be exposed to either environmental or oil/energy lobbying groups, as well as to experts from both governmental and non-governmental agencies. Alternatively, the general public may face higher costs of policies aimed at mitigating the effects of global climate change, like a carbon tax on gasoline or new regulation that may hurt employment. If politicians have a biased assessment of voters' preferences, they will promote more climate change legislation, but will be penalized for this in the following election (*Hypothesis iii*). However, it is unlikely that politicians would systematically miscalculate their constituents' preferences: therefore, we expect that the increase in green legislation will be temporary, reverting rapidly to pre-hurricane levels.

All the previous three hypotheses rest on the Downsian paradigm (Downs, 1957), i.e., politicians are career oriented and do not have preferences over the implemented policy. However, if we are willing to relax this assumption and allow politicians to be partisan (Calvert, 1985; Alesina, 1988), a fourth hypothesis is possible: the general public fails to understand the importance of the global warming signals, but politicians perceive the increasing risks of climate change and endorse green bills irrespective of voters' views. In this scenario, we expect to see a response in terms of legislation and a negative response in electoral outcomes (as in *Hypothesis iii*), but the response in terms of legislation will be permanent (*Hypothesis iv*). Because politicians are not pure partisans and are also motivated by re-election concerns, this hypothesis also predicts that the politicians who are more likely to engage in unpopular green legislation in the aftermath of a hurricane are those who can afford to do so without losing too much electoral support.

One final possibility is that environmental legislative activity is not sufficiently salient in the mind of voters.[7] In this case, we would not expect to see any electoral response to politicians' actions. However, politicians' record on environmental issues tends to be widely scrutinized and discussed around election time, in both traditional and social media. For example, Twitter posts mentioning Carlos Curbelo and "carbon" were about 2,800 in July 2018 (when he first introduced the MARKET CHOICE Act, see also footnote 4), and were still about 200 in November 2018, just around elections (source: `pulsarplatform.com`). Similarly, Google Search hits for Carlos Curbelo and "carbon" went from 320 in July 2018 to 361 in November 2018.[8] More generally, we take bill sponsorship and cosponsorship as a proxy for a broader set of public actions that politicians' undertake when they commit to a certain policy, but that we don't necessarily observe, like speeches, interviews and rallies.

In what follows, we bring these hypotheses to empirical scrutiny.

[7]The evidence for this is mixed. For example, Boomhower (2021) finds that environmental issues receive little attention in the gubernatorial races in Texas and Oklahoma, but they are central to the campaigns of specialized energy regulators in those states.

[8]Similar patterns are observed for other congress members engaged in environmental legislation.

3 Data and Descriptive Evidence

Hurricanes

Hurricanes are major natural disasters that convey new information about the risks of climate change. Even though the scientific community is somewhat cautious in assessing a causal link from anthropogenic climate change to the frequency and intensity of hurricanes,[9] there is ample evidence that extreme weather events are associated with an increase in the perceived threats of global climate change.[10]

We collected federal disaster declarations for the period 1989-2014 from the Federal Emergency Management Agency (FEMA), which provides county-level detailed information on assisted population after each event. We focus on disasters caused by hurricanes only (no severe storms, nor typhoons), i.e., tropical storms in the Atlantic Ocean and the north-eastern Pacific Ocean, and consider both Major Disaster Declarations (DR) and Emergency Declarations (EM).[11]

Since disaster declarations, and especially the intensity of assistance, could be potentially influenced by the political environment (Garret and Sobel, 2003), we additionally collected ostensibly more objective measures of hurricanes' intensity, like wind speed and trajectory, from Weather Underground. For each county, we consider the wind speed recorded on the five points on the actual hurricane trajectory that are closest to the county centroid, and weight those values by the inverse of the distance from the county centroid. We assign the

[9] For example, the Geophysical Fluid Dynamics Laboratory of the National Oceanic and Atmospheric Administration (NOAA) states that "[i]t is premature to conclude that human activities – and particularly greenhouse gas emissions that cause global warming, have already had a detectable impact on Atlantic hurricane or global tropical cyclone activity", `www.gfdl.noaa.gov/global-warming-and-hurricanes`, accessed on November 22, 2019.

[10] For example, Leiserowtiz (2006), Myers et al. (2012), and Visconti and Young (2020) find that personal experience with extreme weather is associated with stronger beliefs about the reality of climate change; and Egan and Mullin (2012) find that higher-than-average temperatures are associated with stronger short-term beliefs in global warming. Others find similar results outside of the U.S. (Dai et al., 2015; Blennow et al., 2012; Frondel et al., 2017).

[11] The President can declare a major disaster for any natural event that has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond. A Major Disaster Declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work. Emergency Declarations supplement state and local or Indian tribal government efforts in providing emergency services, such as the protection of lives, property, public health, and safety, or to lessen or avert the threat of a catastrophe.

maximum of these five recorded speeds as the county's experienced wind speed.[12]

As a baseline, we classify as hit by a hurricane any county listed in a FEMA disaster declaration, conditional on the wind speed being above 19 mph, which corresponds to half of the lower threshold for a Tropical Storm (as defined by the Saffir-Simpson hurricane wind scale).[13,14] The wind cut-off helps mitigating measurement errors in the identification of the treated counties, as some counties may be included in a FEMA declaration only because they belong to a state hit by a hurricane. This is because "all requests for a declaration by the President that a major disaster exists shall be made by the Governor of the affected state"(Stafford Act, 1988). Also, we do not consider as hit by a hurricane those counties that were only indirectly affected by a hurricane (e.g., counties that took in evacuees after Hurricane Katrina, and therefore received FEMA assistance).[15]

Bills

We use data from the U.S. House of Representatives for the 101st to the 113th Congress (1989-2014). We obtained data on bill characteristics, sponsorship and co-sponsorship, plus demographic and electoral characteristics for congress members and their district, from the Library of Congress.

We identified bills aimed at fighting climate change (in short "green bills") as those classified by the Congressional Bills Project (Adler and Wilkinson, 2015, `http://www.congressionalbills.org`) with one of the following two minor topics: "Air pollution, Global Warming, and Noise Pollution", and "Alternative and Renewable Energy". The advantage of this classification is that it does not contain other categories typically included under the umbrella of environmental issues, like waste management, clean water, etc., which

[12] This measure is somewhat less precise, because some districts are quite distant from the meteorological station with information on wind speed, and therefore the measure relies heavily on interpolation. Because of this, we prefer to use the FEMA-based measure as our baseline.

[13] All our results remain qualitatively unchanged when using different thresholds. In Section A.1 we will also show results when using the actual wind speed as a proxy for hurricanes' incidence.

[14] Over the period 1989-2014 we observe a total of 37 hurricanes, namely: Alex, Andrew, Bertha, Bob, Bonnie, Bret, Charley, Claudette, Dean, Dennis, Dolly, Earl, Emily, Erin, Floyd, Fran, Frances, Georges, Gustav, Henri, Hugo, Ida, Ike, Iniki, Irene, Isaac, Isabel, Isidore, Ivan, Jeanne, Katrina, Lili, Opal, Ophelia, Rita, Sandy, and Wilma.

[15] We also collected data for FEMA assistance grants. However, we could not use these data in our analysis as county assistance grants are only available from 2002, while individual assistance grants (renters and owners) are only available from 2008.

are not necessarily associated with climate change.[16] Using manual text analysis (see Section A.4 for more details), we then excluded relief bills, bills on noise pollution, or bills that are actually anti-environmental. After this cleaning, we are left with a total of 868 "green bills," mostly proposing more stringent regulation on environmental standards related to greenhouse gas (GHG) emissions and global warming. The disadvantage of this classification is that it may miss important climate change legislation that falls into other categories (e.g., the ratification of international agreements).[17]

As an alternative measure, we use the list of climate change federal legislation provided by the Center for Climate and Energy Solutions, which is an environmental think tank that replaced the former Pew Center on Global Climate Change. The list is only available from the 106$^{\text{th}}$ Congress onwards, but it has the advantage of identifying major bills that are clearly addressing climate change. It also has information on whether the bills were aimed at reducing (i.e., imposing additional taxes on greenhouse gas emissions) or increasing (i.e., spurring fossil fuel development, or curtailing environmental regulations) global warming. Again, we used manual text analysis to exclude relief bills, leaving us with a total of 365 "green bills" under this alternative definition.

Our main measure of congress members' activity is the number of bills sponsored or co-sponsored. Each bill in Congress has one primary sponsor, and can be signed by any number of co-sponsors. The sponsor is not necessarily the sole or the most important author of the bill, but he/she is identified with the bill content. The sponsor's activities include, but are not restricted to, gathering and communicating information about the bill, building coalitions, administering public relations around the bill, and shepherding the legislation through the House. Often, sponsoring a bill is accompanied by a public relations campaign (press conferences, messages on social media), so that the introduction of new bills typically generates attention. Co-sponsors typically help the sponsor in promoting the bill, and in attracting support within Congress. While there is some debate in the literature on the exact

[16] In Table A.3), we document that green legislation is tied specifically to hurricanes, and not to other natural disasters (snowfalls, storms and tornadoes) that are typically not associated with climate change.

[17] We also checked if there were bills falling under different CBP minor topics and whose title included the words "global warming" or "climate change" (with and without the first letter capitalized). We only found 20 such bills, of which some were actually anti-environmental. Inclusion of these additional bills in the analysis does not affect any of the results in the paper.

motives for co-sponsoring bills (Krehbiel, 1995, and Kessler and Krehbiel, 1996), we take the view that co-sponsoring is an indicator that the Congressperson wishes to be associated with a piece of legislation. Moreover, bills with a large number of co-sponsors have a higher probability of passing the House and becoming public law (Gagliarducci and Paserman, 2021), suggesting that co-sponsorship has real effects and is not just plain position taking. Finally, we interpret sponsorship and cosponsorship as a signal of a broader effort of politicians on climate change issues, as the very same sponsors and cosponsors could also be involved in other political activities like rallies, debates, and committees.

Others have used individual roll-call records as a measure of legislative activity, rather than sponsorship and cosponsorship. In our case, this approach is not feasible, because only 10 of the 868 bills that we classify as "green" eventually reached the floor for voting, and only 3 of them reached the floor in the year after a hurricane occurred. Roll-call voting is not a sufficiently "responsive" measure of political engagement on climate change issues. Roll-call voting may have some additional disadvantages, because it might be governed by party discipline (see Ansolabehere, Snyder and Stewart III, 2001 and Snyder and Groseclose, 2000), especially on close votes and key party issues. And, as argued by Harbridge (2015), focusing on roll-call voting may be misleading because the set of bills that actually reaches a roll-call vote is determined endogenously by the Congressional leadership.

Congressional Speeches

The empirical study of the mechanisms underlying politicians' behavior has been typically constrained by data availability, since traditional data sources are inappropriate to capture the nuances of policy making. We overcome this using a novel text analysis of Congressional speeches that combines supervised machine learning and dictionary learning techniques to identify speeches mentioning the short-run costs and long-run benefits of climate change regulation. We give here a brief overview of our data and method. For a full description of our data collection and analysis, see Appendix B.

We first collected the universe of Congressional speeches in the period under analysis (from the 101^{st} to the 113^{th} Congress). The data source is the U.S. Congressional Record (`www.congress.gov/congressional-record`), and contains information on all 900,000 speeches ever given on the floor of both the U.S. House of Representatives and the Senate.

The following step was to identify the speeches belonging to a debate surrounding a "green bill" (see the previous subsection) that advanced to the floor. To do this, we retrieved the date in which the roll-call voting over a bill took place. We then identified the first speech of a debate over that green bill by searching in the text of each speech the bill's number and title, which are usually contained in the introductory speech of each roll call. Then, we assigned all subsequent speeches to that "green bill" until we observe a change in the debate, as measured by three subsequent speeches on a different topic. From this set, we selected only those speeches that were likely to express more representative views on the subject, i.e., the ones made by the sponsor and cosponsors, and the ones made by representatives voting against the bill but affiliated to their sponsor's party. We ended up with a training set of 143 speeches.

Next, we manually assigned to each of these training speeches a label of "short-run cost" (SRC) and/or "long-run benefit" (LRB), depending on whether the speech included concepts related to costs to be borne in the immediate future (e.g., "All economic impact studies show that between 400,000 and 4 million jobs are going to be lost") or to benefits to be accrued in the distant future ("Better understanding of our air quality dilemma will invariably help us define appropriate remediation technologies"). From this labelling process, we created one dictionary for SRC words and one for LRB words, by recording the frequency of the words in a given group with respect to other speeches (i.e., a *Bag of Words* process). Finally, we run our dictionaries on all environmental speeches given on the floor by representatives from districts hit by a hurricane, in office both in the post-disaster period (t+1) as well as in the pre-disaster period (t-1). From this data set, we created two measures of the awareness of representatives of short-run costs and long-run benefits associated with environmental regulation: the total number of SRC and LRB words used in any environmental speech, and, for robustness analysis, an indicator for whether a politician ever made a speech with at least 25% of the words contained in the SRC and LRB dictionaries.

Other data

We gathered detailed information on electoral results for each candidate through the Congressional Quarterly; demographic information at district level from the Census Bureau; the yearly unemployment rate at district level from the Bureau of Labor Statistics; information on fossil production (gas, oil and coal) at the state level through the Energy Information Administration (EIA); individual campaign contributions to candidates (direct contributions, earmarked contributions, or contributions through a joint fund raising committee), as well as contributions from Political Action Committees (PACs) to candidates (coordinated expenditures, independent expenditures and communication costs for the candidate, plus direct contributions), from OpenSecrets.org; and congress members' voting history on environmental matters from the League of Conservation Voters (LCV). We also retrieve an indicator of the resilience of the district to threats of climate change using the information on soil suitability for the production of rice, maize, potatoes, soy and grain over the period 2011-2040 developed by Zabel et al. (2014). [18]

Final Sample

We collapse the data on green bills and hurricanes at the year/district level in order to compute the total number of green bills sponsored or co-sponsored by each House member in a given year.[19,20]

Table 1 describes our final data set. The sample is made of 11,017 year/district obser-

[18]Land suitability indicators are used by organizations such as the Food and Agricultural Organization (FAO) as indicators of resilience to climate change and to help local policymakers and communities better develop their agricultural productivity (Fischer et al., 2021). For our data, we took the US soil suitability maps from the Zabel et al. data set for the 1981-2010 period. These maps report crop suitability for a high resolution grid with cells of about 1 square kilometer. We assigned the highest index value among the 5 most cultivated crops in the United States (maize, rice, potatoes, soybeans, and winter wheat) as a measure of a district's resilience to climate change. Data and documentation on the Zabel et al. data set can be found at `http://geoportal-glues.ufz.de/index.php`.

[19]The mapping of counties into districts was performed using the Congressional districts relationship files available at the Census Bureau. Because of the reapportioning of Congressional districts following the Decennial Census, a "district" should be interpreted throughout as a Congressional district-decade pair. This means, for example, that Florida's 18th Congressional district in Congresses 108-112, which includes parts of Miami, is treated as a different district from Florida's 18th district in Congresses 113rd-114th, which does not include Miami.

[20]In the case of more than one hurricane in the same district in one year, we identified the number of counties ever hit, and highest wind intensity ever recorded.

vations, corresponding to 1,338 congress members and to 1,708 district combinations over the period 1989-2014. Almost 5% of the districts had at least one county that was hit by a hurricane in a certain year, with most of the disaster declarations being classified by FEMA as major (4.6%). Not surprisingly, all of the occurrences are located in the South-East (2.8%) and the North-East (2.2%) of the country, as these are the areas most exposed to the proliferous hurricane activity in the Atlantic Ocean. Similar figures can be observed when looking at the share of counties hit by a hurricane, or at the share of population. On average, members of Congress sponsor 6.3 and co-sponsor 107.9 bills, of which only 1.3 (1.2%) can be classified as green according to our baseline classification. Figure 1 shows that climate change has received increased attention by congress members, especially after the release of the 4th Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) in 2007, the first to assess that "impacts [of climate change] will very likely increase due to increased frequencies and intensities of some extreme weather events."

4 Empirical model and estimation strategy

We now turn to the investigation of our main questions, namely whether the occurrence of a hurricane causally affects the propensity to promote green legislation, and whether the effect differs based on political circumstances and congress member characteristics.

We first investigate whether there is a link between hurricane occurrence and the propensity to sponsor green legislation, even after controlling for differences between districts and congress members hit by a hurricane or not. The basic estimating equation is the following:

$$GB_{sdi,t} = \alpha + \beta H_{sdi,\tau} + \gamma' X_{sdi,t} + \delta_t + \mu_z + \epsilon_{sdi,t} \tag{1}$$

where $GB_{sdi,t}$ is the number of green bills sponsored or co-sponsored at year t by congress member i, representing district d in state s, as defined in Section 3; $H_{sdi,\tau}$ is a dummy for whether at least a county in district d of state s was ever hit by a hurricane at year τ, where τ is equal to either t or $t-1$; $X_{sdi,t}$ is a vector of district and individual congress member characteristics. The district characteristics include: the share of the Green and the Republican party in the previous Congressional elections; the log of population, area, and per capita income, the share of the population over 65, black, foreign born, and urban (from the Decennial Census); the ratio between the national share of coal/oil production and the national share of the population, at the state level; and a dummy for the district having received any evacuee from other districts hit by a hurricane. Individual congress member characteristics include: the number of other non-green bills sponsored or co-sponsored; 23 committee membership dummies; a dummy for belonging to the House minority party, for being House leader (speaker, minority/majority leader/whip, standing committee chair), Republican, and female; the relative margin of victory with respect to the second candidate in the previous election; tenure (number of terms served in congress) and age (in years). Finally, δ_t are year fixed effects, while μ_z are geographic (state or district) or congress member fixed effects, depending on the specification.

Our identification strategy rests on the assumption that, within geographic units (like states, but possibly also within regions), the timing and the trajectory of a hurricane is as good as random, since it is based on aggregate natural and meteorological factors that are orthogonal to any local anthropogenic activity. This randomness is well represented in Figure 2, which reports the observed trajectory of four representative hurricanes in the last twenty years. There is no evident sign of any time or geographical pattern, besides the fact that al these hurricanes hit either the Eastern seaboard of the United States or the Gulf of Mexico. But the actual trajectory of the hurricanes is hard to predict. For example, Hurricane Sandy in 2012, after making landfall in Jamaica and Cuba, stayed largely away from the U.S. coast, only to veer sharply westward and move ashore again in New Jersey. In 2004, Hurricane Ivan made initial landfall in the United States in Alabama and continued inland before losing tropical characteristics while crossing Virginia. However, remnants of the storm completed an anticyclonic loop and moved over Florida, regaining strength as it crossed the Gulf of Mexico, and it made a second landfall in Louisiana. It is also interesting to notice that the mapping of actual hurricane trajectories into counties included in FEMA declarations is quite accurate (see Figure 3), which is reassuring against the possibility that FEMA declarations might be subject to political influence (Garret and Sobel, 2003).

Following the above discussion, we could simply include in our baseline specification state×year fixed effects, thus directly exploiting the random path of a hurricane within a given state and year. However, given that hurricane trajectories are quite broad (see again Figure 3), we would be left with quite a small variability in the incidence of hurricanes within state and year. This problem is further exacerbated by the potential presence of spillover effects across neighboring districts (see Table A.4), which would make it difficult to isolate the "treated" districts. For these reasons, our preferred specification includes year fixed effects and geographic fixed effects (either state or Congressional district fixed effects) separately. That is, we exploit the variation in the incidence of hurricanes over time within a geographic area, where the randomness of a hurricane across geographical areas and over time guarantees that the timing of a disaster is orthogonal to any time-specific district characteristics.

Table 2 tests the validity of this assumption by looking at whether pre-determined congress member and district characteristics are balanced between districts hit by a hurricane or not, after controlling for state and year fixed effects.[21] Of the 14 balancing tests reported in the table, only two are statistically significant at the 10% level. It is reassuring that, even with a relatively coarse geographic fixed effect, most of the covariates are balanced. None of the individual characteristics is unbalanced. The two remaining imbalances at the district level might simply reflect the fact that the incidence of hurricanes is higher in districts close to the coast. Specifications that include district fixed effects are likely to address this potential confounder.

5 Results

The response of legislators to hurricanes

The results from the estimation of equation (1) are presented in Table 3. The top panel of the table shows results from a regression of the number of green bills on contemporaneous hurricane incidence, while in the bottom panel the key right hand side variable is lagged one period.

Since hurricanes tend to hit in the second part of the year, it is unlikely that congress

[21]We do not control here for district fixed effects, as district characteristics come from the Decennial Census and are therefore constant within a Congressional district-decade.

members have sufficient time to introduce new legislation in the same year as the hurricane. In fact, while the coefficients in both panels have the same sign, the ones in the top panel tend to be attenuated relative to the ones in the bottom panel, where we measure hurricane incidence lagged one year. We therefore concentrate our comments on the results from the bottom panel, even though they are based on slightly smaller samples, as observations from the first year of the sample and the first year after the reapportionment of Congressional districts are dropped.

Column (1) shows the simple correlation between hurricane incidence and sponsorship of green bills, controlling only for year effects. The correlation is negative and statistically significant, probably reflecting the fact that most hurricanes hit the Southeastern United States, which in recent years have become solidly Republican and generally opposed to environmental regulation. The picture changes immediately in column (2), with the inclusion of state fixed effects. Now the coefficient on lagged hurricane incidence becomes positive, although it only turns statistically significant at the 5% level when controlling for district fixed effects in column (3). This implies that congress members representing a district hit by a hurricane are significantly more likely to support green legislation in years following a hurricane than in other years. The results are similar even when we include the full set of control variables (column 4), with the point estimate becoming even larger and statistically more precise. When at least one county in the district is hit by a hurricane the average number of sponsored or co-sponsored bills rises by about 0.25, an almost 20% increase relative to the sample mean of about 1.3.

The results are qualitatively and quantitatively unchanged if instead of controlling for district fixed effects we control for individual congress member fixed effects (column 5);[22] or if we control for state-specific linear trends in addition to district fixed effects (column 6) to rule out the presence of other underlying unobservable trends.

In Appendix A.1 we assess the robustness of our results to alternative sample definitions, as well to alternative definitions of hurricane incidence, green bills and engagement in green

[22]This specification exploits variation in hurricane incidence experienced by individual congress members, even when their tenure covers more than one decade. However, because of the reapportionment of Congressional districts every ten years, the geographic area and the demographic composition of a congress member's constituency is not necessarily constant.

legislation. We conclude that there is strong evidence that the occurrence of hurricanes causally affects the behavior of elected politicians, and induces them to initiate and support more environmental legislation. We also document (Appendix Table A.3) that green legislation is tied specifically to hurricanes, and not to other natural disasters (snowfalls, storms and tornadoes) that are typically not associated with climate change. Finally, we show that representatives in districts adjacent to those hit by a hurricane or in districts in the same state as those hit by a hurricane exhibit a moderate increase in the number of green bills, but the effect is somewhat smaller than the one found in districts actually hit (Appendix Table A.4), suggesting that the largest effect of a natural disaster arises when the damages of an extreme event are experienced directly.

Heterogeneity

To learn more about the underlying motives behind the patterns uncovered above, we now look at whether politicians' response to hurricanes differs by political circumstances.

In column (1) of Table 4 we look specifically at whether support for green legislation following a hurricane depends on whether the representative is facing a competitive re-election or not. We define a district as safe if the margin of victory of the incumbent in the following election is larger than 25 percentage points. We use the margin of victory in the following election as it is a better proxy for *expected* competitiveness of the district relative to a purely backward-looking measure (in our data, the correlation between the individual margin of victory in the previous and in the next election is 0.49).[23] This variable is not defined for congressmen who do not seek re-election, for the 102^{nd}, 107^{th}, and 112^{th} Congresses (inter-census races) and for the 114^{th} Congress (the last observation in our sample), which explains why we end up with fewer observations. Results show that the whole effect seems to be driven by representatives holding a safe seat. The sum of the coefficients on the hurricane dummy and on the interaction term is still positive, but not statistically significant at conventional levels. This evidence is suggestive of the fact that voters might dislike more environmental

[23] In column (1) of Table A.5 we present results using the margin of victory in the previous election. In this case the coefficient on the interaction term is still negative, but not statistically significant. We also experimented with other thresholds (20 or 30 percentage points in column (2) and (3), respectively), and results were qualitatively very similar.

regulation, and representatives only engage in it when their seat is not at risk.[24]

In column (2), we look at whether the response differs by politician tenure, which can be viewed as an alternative measure of a politician's electoral strength. In line with our result on safe districts, results show that promoting more climate change legislation (a potentially unpopular policy) in the aftermath of a hurricane is more viable for experienced politicians. Next, we look at whether the effect of a hurricane differs depending on economic conditions, proxied by having an unemployment rate above or below the median in the sample. Results show little evidence that the response to a hurricane differs, and in fact the response is slightly higher in districts with a relatively high unemployment rate. However, a low unemployment rate may not be enough to prompt congress members to promote more green legislation. According to Gennaro at al. (2020), populist policies are most likely to emerge when there is economic insecurity *and* when attracting disillusioned voters pays off the most, i.e., when elections are close. In column (3) we provide evidence in support of this hypothesis: congress members are less likely to promote green legislation in the aftermath of a hurricane if they are in an unsafe district, and especially so when the unemployment rate is high.

In Appendix A.2 and in Table A.2 we further investigate the heterogeneity in politicians' response to hurricanes depending on other district and individual characteristics. Republicans are somewhat less likely to respond to hurricanes, while those with a strong pre-existing environmental record are more likely to respond. This is consistent with the notion that politicians realize that promoting climate change legislation can have electoral costs, so only those with sufficient pre-existing environmental credentials can afford to respond aggressively. Other results show that the response to hurricanes has increased over time (the effect only appears after the IPCC report of 2007), and it is lower for representatives in districts which are less exposed to the risk of climate change. These results suggest that the perceived risks of climate change for one's electoral district also drive politicians' response.

[24] In the spirit of Dal Bò et al. (2009), to minimize reverse causality issues we also instrumented whether a district is unsafe (and the interaction with the hurricane occurrence), with a dummy for whether the average margin of victory of the incumbent *party* at the state level in the following election is smaller than 15 percentage points (also interacted with the hurricane occurrence). Reassuringly, the estimated coefficient on the interaction term, reported in column (6) of Table A.5, is still negative and statistically significant at conventional levels, with a positive first stage (i.e., a stronger party at state level increases the chances of re-election at individual level) and an F-test for the significance of the excluded instruments equal to 27.967 (columns 4 and 5)

Electoral costs of green legislation

The previous subsection highlighted that congress members shielded from electoral competition are more likely to promote green legislation in the aftermath of a hurricane. This suggests that politicians are aware of the potential costs of green legislation, and promoting green bills may result in a weaker electoral showing and a decrease in other measures of support.

There is a vigorous debate about the costs and benefits of environmental regulation. In summarizing the findings of the environmental economics literature on the Clean Air Act, Currie and Walker (2019) conclude that "there seems to be a general consensus that the benefits [in terms of health and well-being] of clean air legislation over the past 50 years are likely to have greatly exceeded the costs" (p. 22). Yet, this literature has highlighted that environmental regulation can also impose substantial costs, which manifest themselves in the short run and are concentrated among industries and workers targeted by the regulation (Greenstone, 2002; Walker 2013). Under these circumstances, it is not surprising that many politicians opposed to environmental regulation frame the debate in terms of "jobs versus the environment," (see also footnote 3), and politicians may be reluctant to promote an environmental agenda for fear of losing electoral support.

We therefore proceed to examine the relationship between green legislation and various measures of voter support and electoral outcomes. For this analysis, we collapse the original data at the Congress level, and separate green bills sponsored or co-sponsored before (or in the absence of) a hurricane ($GBBefore_{sd,t}$), from those sponsored or co-sponsored after a hurricane ($GBAfter_{sd,t}$). We also exclude uncontested races and races where the incumbent is not running for re-election. We then run the following regression:

$$SRCost_{sdi,t+1} = \alpha + \beta_1 H_{sdi,t} + \beta_2 GBBefore_{sdi,t} + \beta_3 GBAfter_{sdi,t} + \quad (2)$$

$$\gamma' X_{sdi,t} + \delta_t + \mu_s + \epsilon_{sdi,t}, \quad (3)$$

where the unit of observation represents a congress member-Congress pair (e.g., the representative of Massachusetts' 1st Congressional district in the 109th Congress), and $SRCost_{sdi,t+1}$ is one of three measures of short-run electoral costs for congress member i in state s and congressional district d: the vote share in the upcoming election, a dummy for being reelected, and individual campaign contributions to the candidate. We are interested in particular in β_3, the coefficient on $GBAfter_{sdi,t}$, the number of green bills sponsored or cosponsored after a hurricane. Our hypothesis is that sponsoring green legislation is negatively associated with the measures of voter support (vote share and individual campaign contributions), but not necessarily with the probability of reelection, because only representatives in safe districts promote green bills. We also control for $GBBefore_{sdi,t}$, the number of green bills sponsored or cosponsored before (or in the absence of) a hurricane.

Compared to previous specifications, we also control for the time between the occurrence of a hurricane and the end of the Congress, which is set to two years in the absence of a hurricane. Finally, we use state fixed effects instead of district fixed effects because, when separating the green bills promoted before and after a hurricane, we end up having only limited within-district variation.[25] This implies that identification is obtained from variation within states and over time in electoral outcomes/campaign contributions and green legislation in response to hurricanes. This at least in part assuages concerns that we are picking up a spurious effect, whereby representatives of states where incumbents are either consistently more or less popular also systematically sponsor more green legislation.

Table 5 presents the estimated correlations for the different cost indicators in different panels. Green legislative activity in the aftermath of a hurricane appears to be uncorrelated the reelection probability (column 1), but there is a clear negative association with the vote share and the amount of campaign contributions (columns 3 and 5). Following the rest of the literature (e.g., Cole et al., 2012), in the even-numbered columns we also control for the number of relief bills sponsored or co-sponsored in the aftermath of a hurricane. We view these as measures of short-run response to a natural disaster. Not surprisingly, we find that these variables are positively associated with subsequent vote share, even though the point estimate for the number of relief bills supported after a hurricane fails to hit conventional level for statistical significance. Importantly, the inclusion of these additional controls does not meaningfully affect the coefficient on the number of green bills across columns.

The correlations documented in this table should be viewed with some caution as they

[25] The results are less precise but qualitatively similar when using district fixed effects.

do not necessarily represent a casual effect. There is potential for reverse causality, because a politician's response to hurricanes may itself be affected by the expected vote share and reelection probability. However, to overturn the sign of the correlation, it would have to be the case that very unpopular politicians are *more* likely to sponsor green legislation to prop up their sagging electoral fortunes. This is exactly the opposite of what we found in the previous subsection.

It is also possible that the electoral penalty associated with green bills is driven by the fact that congress members who promote green legislation devote less time to other parts of their legislative agenda. There seems to be little evidence in support of this interpretation. The occurrence of a hurricane appears to slightly shift environmental legislative activism towards climate change issues, but has essentially no displacement effect on other legislative activity, including those likely to bring in votes, such as relief spending bills (see Appendix Table A.6).

6 Text analysis of congressional speeches

The unproven premise so far is that politicians who take actions to prevent the long-run threats of climate change are indeed aware of the short-run costs associated with green legislation. We find additional support for this interpretation by examining the universe of Congressional speeches in the period under analysis (from the 101^{st} to the 113^{th} Congress). As described in Section 3 and Appendix B, we constructed a dictionary of words related to short-run costs and long-run benefits of climate change interventions, and created measures of the intensity and frequency with which politicians use these dictionaries in their speeches.

The results of the analysis are presented in Tables 6a and 6b. Table 6a reports the intensity of the two dictionaries in every speech related to environmental issues, as measured by the sum of all relevant words, averaged over different groups of politicians. As an alternative measure, in Table 6b we consider the share of politicians making speeches with at least 25% of the words contained in the dictionaries.[26] Panel A of Table 6a reveals that politicians promoting green legislation are fully aware of the costs of climate change: the occurrence of

[26]The results remain qualitatively unchanged when using different thresholds: 5%, 10% or 30%.

short-run cost related wording in speeches of legislators who support climate change legislation is higher than that of other politicians (23.9 vs. 14.7 respectively, with a p-value for the t-test for equality in means equal to 0.055). On the other hand, usage of words about the long-term benefits of climate change does not differ significantly between politicians who sponsor green bills and those who do not (25.1 vs. 20.8, respectively, with a p-value equal to 0.286).

When splitting legislators by whether they hold a safe seat or not (rows B and C), the table reveals that the category that stands out most starkly is politicians who promote green bills and hold a safe seat:[27] they talk the most about both the long-run benefits (31.3) and the short-run costs of climate change legislation (34.3), with all other groups ranging between 11 and 20 percent. The message is clear: politicians in safe seats are aware that the policies are unpopular, and they seem to support climate change legislation having future progress in mind. The politicians in unsafe seats who promote green bill legislation instead do not talk much about either costs (13.6), or benefits (20.0). Interestingly, their speeches are similar to those who hold an unsafe seat and do not sponsor green legislation (11.3 and 20.7, respectively). It appears that politicians in unsafe districts who promote green bills prefer to underplay both the costs and benefits of green legislation, perhaps fearing that this will carry an electoral cost. The pattern of results remains broadly unchanged if we use our alternative measure in Table 6b.

Tables 6a and 6b suggest that politicians in safe seats are able to bear the short-run costs of promoting green legislation. However, causality could run in the opposite direction: politicians who are more focused on long-run policy enjoy more electoral support and therefore have safer seats. Disentangling between these two alternative interpretations is challenging and beyond the purpose of this paper. Nevertheless, we provide a first investigation of this issue by conducting a before/after analysis, looking at how the content of speeches differs before and after a hurricane. The results are shown in Tables 7a and 7b. They reveal that in the year before a hurricane, politicians in safe and non-safe seats use words related to short-run costs with relatively similar intensity (14.9 and 10.7 words each, p-value of the

[27]For the definition of safe seat, see Section 5. Results are robust to the use of alternate definitions, and available upon request.

difference 0.191). A stark difference appears after the hurricane: politicians in safe seats talk much more about short-run costs than politicians in non safe seats (26.0 versus 13.1, p-value of the difference 0.016). We observe a similar pattern in Table 7b. It shows that in the year before a hurricane there is a virtually equal share of politicians in safe and non-safe seats talking about short-run costs (55.7% and 52.4% respectively), whereas after the hurricane the share of politicians in safe seats talking about short run costs increases to 61.3%, while the share of those in non safe seat remains virtually unchanged. On the other hand, it appears that representatives in both safe and unsafe seats talk more about long-run benefits in the aftermath of a hurricane. The evidence shows little support for the reverse causality story; rather, it is indeed the occurrence of hurricanes that induces politicians to change their messaging and focus more on the short-run and long-run implications of climate change legislation.

On the whole, the evidence presented in this section confirms that congress members' response to the occurrence of hurricanes is mediated by political circumstances. Congress members are aware that climate change legislation entails short-run costs, but only those in safe seats can afford to highlight these costs and change their messaging to deliver a more credible signal of their willingness to promote mitigation efforts that will have benefits in the long run.

7 Further evidence

According to the evidence presented so far, the most likely interpretation for politicians' and voters' reactions to a hurricane, as summarized in Section 2, is *Hypothesis iv.* This assumes that voters might miscalculate the urgency of global warming, while politicians have an informational advantage and endorse green bills irrespective of voters' view.

In this Section, we provide further evidence in line with this interpretation. First, we show that the effect is persistent over time, in line with a change of politician's beliefs rather than a miscalculation of voters' reactions. Second, we provide evidence against two other potential mechanisms that may be underlying the important increase of politicians' environmental legislation in the aftermath of a hurricane: a) "logrolling" (i.e., the exchange of favors between politicians); b) the influence of lobbying groups. Finally, we provide evidence that at least some of the new legislation becomes law, ruling out the hypothesis that the increase in support for green bills after a hurricane is pure signaling, with representatives having no real intent to push through new legislation.

Short run vs long run. So far, we have shown that the occurrence of hurricanes leads congress members to sponsor more green bills in the short run, and that this legislative activity appears to be associated with a decrease in electoral support and campaign contributions. Thanks to the long nature of our panel data, we can also look at whether this response is temporary or permanent. A temporary response could indicate that politicians assess voters' preferences inaccurately, but reverse course after losing some support at the polls.

We investigate this issue by implementing an event-study analysis. In doing so, we restrict attention to districts ever hit by a hurricane. As districts can experience multiple hurricanes over time, we focus on "clean" episodes without any other occurrence within a -4/+4 year symmetric window (for a total of nine years) around the event, dropping any other observation outside this window.

In practice we use the same model as in Equation (1) with district fixed effects, augmented with lags and leads of the event. Denoting by t_0 the year in which a hurricane hits district d, we estimate the following equation:

$$GB_{sdi,t} = \alpha + \sum_{t=t_0-4}^{t_0+4} \beta_{t-t_0} H_{sdi,t_0} + \gamma' X_{sdi,t} + \delta_t + \mu_d + \epsilon_{sdi,t}. \quad (4)$$

As we can only identify eight coefficients out of nine, we restrict the coefficient in the year before the hurricane (year $t_0 - 1$) to zero.

Absent anticipation effects, we should expect the effects at all leads ($t = t_0 - 4, ..., t_0 - 2$) to be equal to zero. Instead, there should be a positive effect in years t_0 and $t_0 + 1$, as we have already seen in Section (5). Our main interest is in the coefficients on the subsequent lags, which are informative about the persistence of the effect.

Estimated coefficients, together with 95 percent confidence intervals, are reported in Figure 4. The vertical line refers to the year of the hurricane (time t_0). One can verify that, prior to entry, there is no trend in green legislation. This evidence rules out that anticipation effects are driving our results. One can also see that the estimated coefficients become positive exactly at the time of a hurricane, they increase after one year and then remain steadily positive throughout the following years, even though confidence intervals become wider.[28]

We interpret the persistence of the effect as evidence that climate change permanently shapes congress members' beliefs about the optimal policy, irrespective of the fact that voters' reaction does not follow (*Hypothesis iv*). This result is difficult to reconcile with standard Downsian models of electoral competition, and is instead consistent with the notion that politicians are also motivated by the desire to implement specific public policies (see Calvert, 1985; Alesina, 1988; Besley and Coate, 1997; and the empirical analysis in Lee et al., 2004). In this framework, natural disasters can have the effect of shifting politicians' and voters' bliss point differently, as the former are more likely than the average citizen to have the experience, judgment, and information to evaluate the costs and benefits of alternative policies, and they are willing to lose some electoral support in order to implement policies that are unpopular in the short-run, but may have long-run benefits.

Logrolling. Politicians in districts hit by a hurricane may be in a position to leverage the increased visibility of their district to extract policy concessions from their peers, in a quid pro quo bargain. We hypothesize that these exchanges of favors may be more prevalent among representatives that share a tight connection with other Congress members with strong environmental preferences. If this hypothesis is correct, we would expect to see that the response to hurricanes is stronger for representatives who have stronger social ties to a large number of other "green" legislators. Following Battaglini and Patacchini (2018), we measure social ties using the network of alumni connections, i.e., those who graduated from the same institution within four years.[29] The advantage of this approach is that it measures social ties that are likely predetermined, and not influenced by shared geography, expertise (as, for

[28]We have fewer observations for higher-order lags and leads when hurricanes occur at the end or at the beginning of the census decade.

[29]While Patacchini and Battaglini (2018) construct networks for the 109th-113th Congresses, we have extracted information on the educational institutions attended by all the congressmen from the 101st to the 113th Congress. The data source is the Biographical Directory of the United States Congress, which is available online (http://bioguide.Congress.gov/biosearch/biosearch.asp).

example, if we had used networks based on committee membership), or political preferences. We then identify as "green friends" the alumni whose League of Conservation Voters (LCV) lifetime environmental score at time t - 2 was above the median of the Congress.[30] Based on this measure, more than 40% of the representatives have at least 1 "green friend" and a maximum of 16. Table 8 reveals that the estimated coefficient on the interaction with the number of "green friends" (column 1) is small and not statistically significant. Therefore, there appears to be little support for the "exchange of favors" hypothesis.

Lobbying. We next explore whether politicians' response to hurricanes is merely driven by capture from environmental lobbying groups. For this purpose, we use the yearly sum of campaign contributions to individual representatives received from environmental PACs, and PACs related to the automotive and energy industry. We identified as environmental all PACs classified by the Center for Responsive Politics (CRP) as "Environmental"; as automotive those classified as "Transport"; and as energy those classified as "Oil & Gas", "Electric utilities" and "Coal mining".[31]

In columns (2) and (3) of Table 8 we use campaign contributions as the dependent variable, and show that representatives of districts hit by an hurricane do receive more contributions from "green" PACs. Perhaps surprisingly, we do not find a similarly strong reaction for contributions from energy and automotive PACs. In column (4), we use the number of green bills sponsored and cosponsored as dependent variable and we include in the regression an interaction between the "hit by hurricane" dummy and log(1+contributions) from each of the three sources (environmental, energy and automotive, and others). [32]

According to the capture theory, we should observe a stronger response to hurricanes in terms of green bills for representatives who received large amounts of campaign contributions by environmental PACs. While we do find a positive point estimate, the effect is modest

[30]The LCV lifetime score assigns to each Congress member a score between 0 and 1, equal to the share of pro-environment votes cast out of the total number of votes scored.

[31]Note that this definition excludes other subcategories of the energy and natural resources sector, such as the "Miscellaneous Energy" sector, which includes many PACs associated with wind, solar and other renewable energy sources.

[32]We use the log transformation because contributions from PACs sum to zero for many representatives (from 80% for the environmental contributions, to 10% for the energy and automotive contributions) but they are often very large for some others (up to about 1 million dollars per year for environmental contributions, and to about half million dollars per year for the energy and automotive contributions).

and statistically insignificant. Contributions from the energy and automotive industries do reduce the support from green legislation, but this effect reflects in large part the fact that representatives who receive large contributions from the energy and automotive industry are also less likely to have supported environmental causes in the past. In fact, when controlling for the politician's pro-environmental score (as measured by the LCV score) in Column (5) and its interaction with the "hit by hurricane" dummy, the coefficient on the interaction term becomes insignificant.

Real effects of green legislation. Finally, we investigate whether the increase in politicians' activity in support of green bills translates into more laws that are actually enacted. In the top panel of Table 9, we estimate models analogous to Equation (1), but the dependent variable is the number of bills that become public law. Column (1) shows that on average representatives of districts hits by hurricanes are not successful in promoting more legislation that becomes public law. This result, however, masks a considerable amount of heterogeneity: there is an effect after 2007 (column 5), and for bills sponsored by Democrats and by green representatives (columns 6 and 7). As a result, this evidence is not consistent with the hypothesis that the increase in support for green bills after a hurricane is pure signaling, with representatives having no real intent to push through new legislation.

8 Concluding remarks

Climate change legislation represents an ideal context to understand the making of long-run oriented but unpopular policies. While the recent and unprecedented wave of populism in some countries portrays politicians as short-sighted policy makers who neglect the future cost of policies to please voters, our work reveals that there are circumstances under which politicians may adopt a forward-looking behavior and decide to take action despite the short-run costs that come with it.

Using data on the universe of federal disaster declarations between 1989 and 2014, we document that congress members from districts hit by a hurricane are more likely to support bills promoting environmental regulation and control in the year after the disaster. This response to hurricanes is associated with a reduction in the electoral support in the following elections. We also find that only representatives in safe districts are willing to engage in green legislation.

Our evidence reveals that extreme events can trigger a permanent change in politicians' beliefs. However, when the appropriate political response to the disaster is unpopular, not all politicians are willing to bear the electoral costs: only those with a sufficient electoral strength are willing to promote policies with short-run costs and long-run benefits. Our findings suggest that electoral accountability may be counter-productive when policy making needs to be forward-looking. This raises the question of whether some institutions, such as two-year legislatures, are appropriate under circumstances that require instead a less short-sighted approach.

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Figures and Tables

Table 1: Descriptive statistics

	Mean	S.d.	Min	Median	Max
Hurricanes:					
Hit by hurricane	0.051	0.220	0	0	1
Hit by hurricane - SE	0.028	0.166	0	0	1
Hit by hurricane - NE	0.022	0.146	0	0	1
Major disaster	0.046	0.210	0	0	1
Share counties	0.037	0.175	0	0	1
Share population	0.037	0.179	0	0	1
Wind intensity	0.025	0.110	0	0	1.344
Legislative activity:					
N. bills sponsored	6.252	6.356	0	5	106
N. bills cosponsored	107.903	71.179	0	92	643
N. green bills sponsored	0.074	0.326	0	0	7
N. green bills cosponsored	1.242	1.725	0	1	22
N. of green bills	1.315	1.814	0	1	22
N. year/districts			11,017		
N. decade/districts			1,708		
N. individual congress members			1,338		

Notes. *N. of green bills* is the number of green bills sponsored and co-sponsored, as defined by the CBP. *Hit by hurricane* is a dummy equal to 1 if at least one county in the district was hit by a hurricane, conditional on wind intensity being at least 18 mph. *SE* includes Alabama, Florida, Georgia, Kentucky, Louisiana, Missouri, New Mexico, North Carolina, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, while *NE* includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia. *Major disaster* only includes FEMA major disaster declarations (not emergency declarations). *Wind intensity* in 100 mph.

Table 2: Balancing tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
District characteristics:	Pop. (log)	Income (log)	Land area (log)	Over 65 (share)	Black (share)	Foreign (share)	Urban (share)	Unemp. (perc.)
Hit by hurricane	0.001	0.015	-0.042	-0.172	1.029*	1.220*	0.996	-0.074
	(0.003)	(0.015)	(0.077)	(0.116)	(0.560)	(0.622)	(1.160)	(0.199)
Avg. outcome	13.30	10.20	14.20	13.34	11.92	9.229	72.56	8.408
Individual characteristics:	House leader	Republican	Majority	Margin victory	Female	Tenure (terms)	Age (years)	
Hit by hurricane	0.006	-0.022	0.015	-2.885	-0.016	0.091	0.198	
	(0.004)	(0.022)	(0.033)	(1.984)	(0.012)	(0.212)	(0.521)	
Avg. outcome	0.0109	0.486	0.446	37.86	0.133	4.475	55.04	
N. year/districts	11,017							
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. *Hit by hurricane* is a dummy equal to 1 if at least one county in the district was hit by a hurricane. *House leader* is a dummy for being speaker, minority/majority leader/whip, or standing committee chair. *Margin victory* is the relative margin of victory w.r.t. the second candidate. *Tenure* is the number of terms served in Congress. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

Table 3: Hurricanes and support for green bills - Baseline estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	N. green bills					
Hit by hurricane	-0.257***	-0.003	0.034	0.118*	0.124**	0.138*
	(0.062)	(0.066)	(0.073)	(0.068)	(0.057)	(0.076)
Avg. outcome	1.322	1.322	1.322	1.315	1.314	1.315
N. year/districts	11,198	11,198	11,197	11,019	11,006	11,019
Hit by hurricane (t-1)	-0.151*	0.101	0.152**	0.246***	0.259***	0.241***
	(0.082)	(0.061)	(0.059)	(0.072)	(0.079)	(0.070)
Avg. outcome	1.261	1.261	1.280	1.274	1.263	1.274
N. year/districts	9,474	9,474	9,040	8,896	9,165	8,896
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE		Yes				
District FE			Yes	Yes	Yes	Yes
Controls				Yes	Yes	Yes
Individual FE					Yes	
State trends						Yes

Notes. *Hit by hurricane* is a dummy equal to 1 if at least one county in the district was hit by a hurricane. *N. of green bills* sponsored and co-sponsored, as defined by the CBP. *Controls* include the n. of relief bills and the n. of other non-green bills sponsored/co-sponsored; 23 dummies for the committee membership; the share of the Green and the Republican party in the previous election; the log of population, area, and per capita income; the share of population over 65, black, foreign born, and urban; the percent unemployment rate; the ratio between national share of coal/oil production and the national share population, at State level; a dummy for belonging to the House minority party; being House leader (speaker, minority/majority leader/whip, standing committee chair), republican, in the first session, female, and the relative margin of victory w.r.t. the second candidate; tenure (terms) and age (years). State linear trends in column (6). Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

Table 4: Heterogeneous responses by political circumstances

	(1)	(2)	(3)	(4)
	N. green bills			
Hit by hurricane (t-1)	0.078	0.363***	0.125	0.245*
	(0.080)	(0.079)	(0.120)	(0.124)
Hit by hurricane (t-1) ×:				
Tenured	0.365***			
	(0.132)			
Unsafe district		-0.315**		-0.110
		(0.156)		(0.135)
Unemp. rate			0.218	0.326
			(0.174)	(0.246)
Unemp. rate × Unsafe district				-0.619**
				(0.305)
Avg. outcome	1.274	1.397	1.274	1.397
N. year/districts	8,896	4,957	8,896	4,957
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Notes. *N. green bills* sponsored and co-sponsored, as defined by the CBP. *Tenured* is a dummy for whether the congressman has served more than five terms in Congress. *Unsafe district* is dummy equal to one if the margin of victory of the incumbent congressman in the following election is smaller than 25 percentage points, and it is not defined for inter-census races (Congress 102^{nd}, 107^{th}, and 112^{th}) and Congress 114^{th}. *Unemp. rate* is a dummy for whether the district-average percentage unemployment rate is above the median. All continuous interaction variables are demeaned. *Controls* also include *Unsafe district* in column (1) and (3). For a description of all other interaction variables and *Controls* see Table 3. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

Table 5: Support for green bills, electoral outcomes and campaign contributions

	(1)	(2)	(3)	(4)	(5)	(6)
	Reelection probability		Perc. votes next		Individual contributions ($1000)	
Hit by hurricane	0.003	0.002	0.308	0.307	-0.777	-4.843
	(0.005)	(0.006)	(0.864)	(0.773)	(12.371)	(15.310)
N. green bills before	0.000	0.000	-0.048	-0.034	0.076	0.161
	(0.000)	(0.000)	(0.080)	(0.082)	(1.776)	(1.758)
N. relief bills before		0.000		0.301***		1.174
		(0.001)		(0.104)		(2.746)
Hit by hurricane ×:						
N. green bills after	0.000	-0.000	-1.735**	-1.772**	-21.721**	-22.041**
	(0.002)	(0.002)	(0.733)	(0.741)	(8.727)	(8.696)
N. relief bills after		0.002		-0.035		4.265
		(0.002)		(0.288)		(8.172)
Avg. outcome	0.998	0.998	67.87	67.87	268.2	268.2
N. congress/districts	3,321	3,321	3,315	3,315	3,321	3,321
Congress FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes. *Reelection probability* is a dummy for the incumbent being reelected for another term, *Perc. votes next* is the vote share of the incumbent in the subsequent election, and both are only defined if the incumbent is running for re-election. *Individual contributions* is the sum of direct contributions, earmarked contributions, or contributions through a joint fund raising committee to the candidate, in thousand dollars. Uncontested races, inter-census races (Congress 102^{nd}, 107^{th}, and 112^{th}), and Congress 114^{th} excluded. *N. green bills before* and *N. relief bills before* is the number of green and relief bills sponsored and co-sponsored before (or in the absence of) a hurricane. *N. green bills after* and *N. relief bills after* equal to zero if no hurricane. All continuous interaction variables are demeaned. For a description of *Controls* see Table 3. *Controls* additionally includes the time (in days) to the end of the Congress (two years if no hurricane). Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

Table 6a: Congressional Speeches: Usage intensity of dictionary words

	(1)	(2)	(3)	(4)
	Supporters of green bills		Non-supporters of green bills	
	Short-run costs (SRC)	Long-run benefits (LRB)	Short-run costs (SRC)	Long-run benefits (LRB)
A: All	23.9 [sd=37.7; n=88]	25.1 [28.2; 88]	14.7 [21.2; 73]	20.8 [22.5; 73]
B: Safe seat	34.3 [49.9; 42]	31.3 [33.9, 42]	15.1 [18.1; 32]	20.3 [19.8; 32]
C: Non-safe seat	13.6 [13.9; 18]	20.0 [16.4; 18]	11.3 [9.6; 17]	20.7 [18.7; 17]

Notes. Entries in the table represent the average number of words associated with the short-run costs or long-run benefits used by Congress members in speeches related to environmental issues. Standard deviations and number of observations in brackets.

Table 6b: Frequency of speeches with high usage of dictionary words

	(1)	(2)	(3)	(4)
	Supporters of green bills		Non-supporters of green bills	
	Short-run costs (SRC)	Long-run benefits (LRB)	Short-run costs (SRC)	Long-run benefits (LRB)
A: All	62.2	85.5	53.3	82.7
B: Safe seat	61.1	83.3	57.6	81.8
C: Non-safe seat	54.2	83.3	41.2	88.2

Notes. Entries in the table represent the percentage of politicians making speeches related to environmental issues with more than 25% of words in SRC and LRB dictionaries.

Table 7a: Congressional Speeches: Usage intensity of dictionary words before and after hurricanes

	(1)	(2)	(3)	(4)
	Before		After	
	Safe	Non-safe	Safe	Non-safe
A: Short-run costs (SRC)	14.9 [sd=18.4; n=50]	10.7 [7.8; 21]	26.0 [40.3; 74]	13.1 [12.1; 35]
B: Long-run benefits (LRB)	22.7 [26.3; 50]	12.1 [7.5; 21]	25.6 [29.1; 74]	22.4 [17.3; 35]

Notes. Entries in the table represent the average number of words associated with the short-run costs or long-run benefits used by Congress members in speeches related to environmental issues. Standard deviations and number of observations in brackets.

Table 7b: Frequency of speeches with high usage of dictionary words before and after hurricanes

	(1)	(2)	(3)	(4)
	Before		After	
	Safe	Non-safe	Safe	Non-safe
A: Short-run costs (SRC)	55.7	52.4	61.3	51.4
B: Long-run benefits (LRB)	78.8	76.2	86.7	85.7

Entries in the table represent the percentage of politicians making speeches related to environmental issues with more than 25% of words in SRC and LRB dictionaries.

Table 8: Logrolling and lobbyists' pressure

	(1)	(2)	(3)	(4)	(5)	(6)
			Contributions (log)			
	N. green bills		Green	Oil	N. green bills	
Hit by hurricane (t-1)	0.244***	0.297***	0.423***	-0.201	0.229***	0.264***
	(0.072)	(0.074)	(0.138)	(0.168)	(0.066)	(0.072)
Hit by hurricane (t-1) ×:						
N. green friends	-0.018					
	(0.027)					
N. green same-state		0.019**				
		(0.007)				
Green contributions (log)					0.020	-0.006
					(0.025)	(0.022)
Energy contributions (log)					-0.058***	-0.036
					(0.020)	(0.023)
Other contributions (log)					0.018	0.018
					(0.028)	(0.032)
Green score (t-2)						0.001
						(0.004)
Avg. outcome	1.274	1.274	1.363	8.946	1.274	1.287
N. year/districts	8,896	8,896	8,896	8,896	8,896	7,489
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

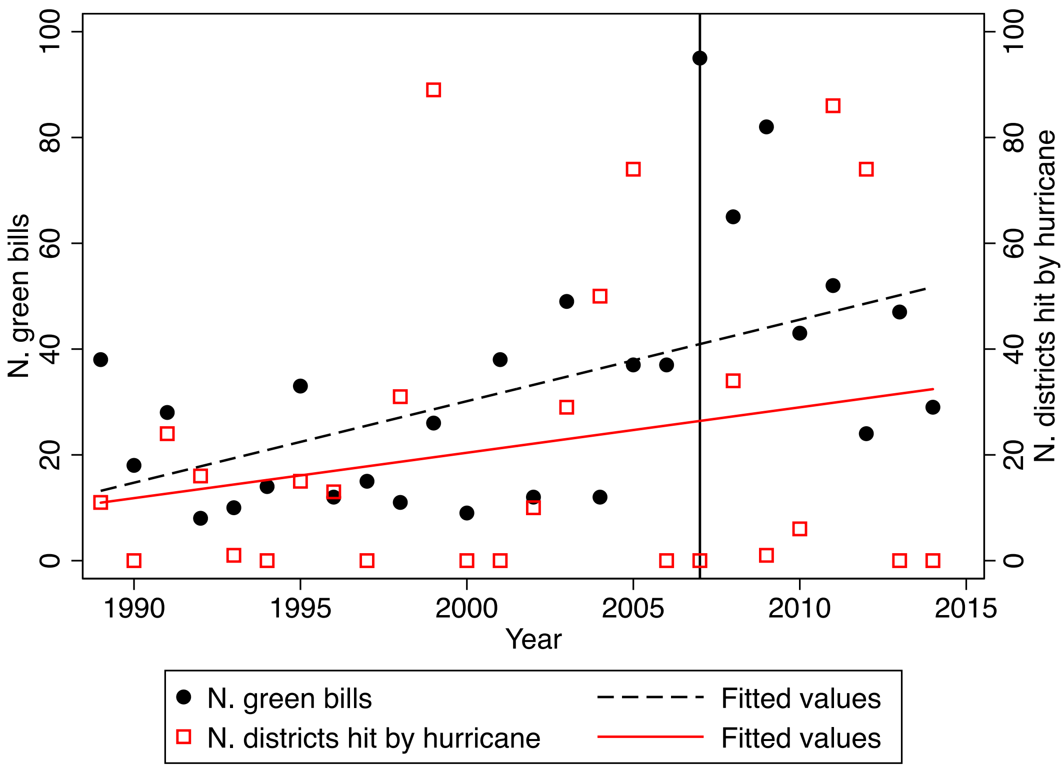
Notes. *N. green bills* sponsored and co-sponsored, as defined by the CBP. *N. green friends* is the number of representatives who graduated from the same university and whose LCV lifetime environmental score, as observed at $t-2$, was above the median of the corresponding year. *N. green same-state* is the number of representatives from the same state whose LCV lifetime environmental score, as observed at $t-2$, was above the median of the corresponding year. *Green contributions (log)* and *Energy contributions (log)* are the log of the yearly amount of campaign funds, in thousand USD, received from PACS classified as environmental or as energy and automotive industry by the CRP, respectively. *Other campaign funds (log)* is the residual of the campaign funds not classified as either green or oil. All continuous interaction variables are demeaned. *Green score (t-2)* is the LCV lifetime environmental score as observed at $t-2$, and it not available for rookies. Column (5) also controls for the interaction of *Green score (t-2)* with *Hit by hurricane (t-1)*. In all columns *Controls* include the level of the corresponding interacted variable. For a description of *Controls* see Table 3. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

Table 9: Hurricanes and green bills' outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	N. green bills that became law							
Hit by hurricane (t-1)	0.002	0.003	0.003	0.003	0.001	0.018***	0.005	0.001
	(0.003)	(0.003)	(0.005)	(0.003)	(0.004)	(0.005)	(0.003)	(0.003)
Hit by hurricane (t-1) ×:								
Tenure		0.001						
		(0.001)						
Unsafe district			0.001					
			(0.018)					
Unemp. rate				-0.000				
				(0.001)				
Post-2007					0.007*			
					(0.004)			
Republican						-0.028***		
						(0.005)		
Green score (t-2)							0.034***	
							(0.008)	
Suitability index								-0.000
								(0.000)
Avg. outcome	0.0241	0.0241	0.0321	0.0241	0.0241	0.0241	0.0211	0.0241
N. year/districts	8,896	8,896	5,922	8,896	8,896	8,896	7,489	8,896
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

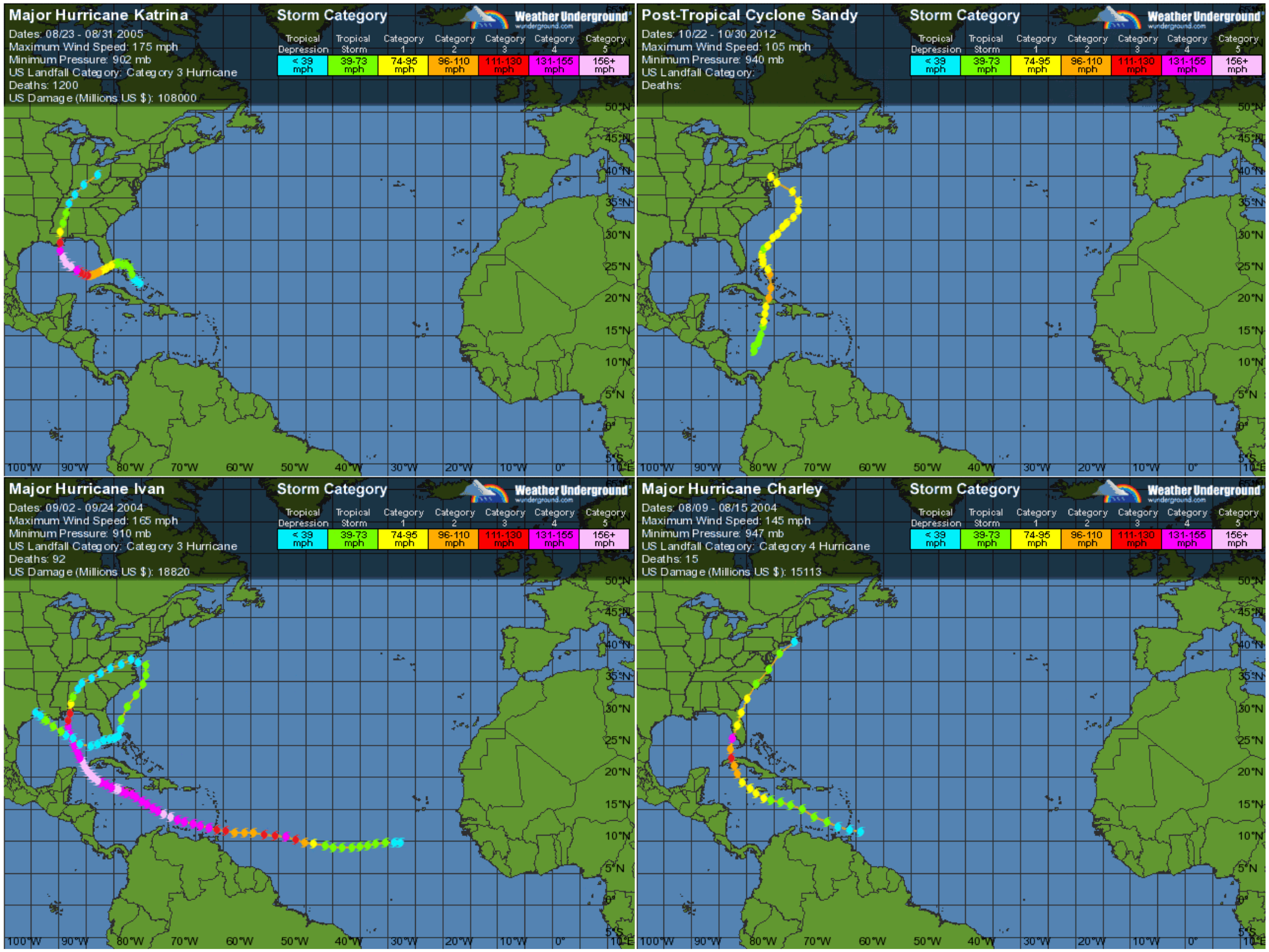
Notes. *N. green bills* sponsored and co-sponsored, as defined by the CBP. *Tenure* is the number of terms served in Congress. *Unsafe district* is dummy equal to one if the average margin of victory of the incumbent party at state level in the following election is smaller than 15 percentage points, and it is not defined for inter-census races (Congress 102^{nd}, 107^{th}, and 112^{th}) and Congress 114^{th}. *Unemp. rate* is the Congress-average percentage unemployment rate. *Post-2007* is a dummy equal to one for all Congresses after the release of the 4^{th} IPCC Assessment Report in 2007. *Green score (t-2)* is the LCV lifetime environmental score as observed at $t-2$, and it not available for rookies. *Suitability index* is the average FAO suitability index for the production of rice, maize, potatoes, soy and grain, over the period 2011-2040. All continuous interaction variables are demeaned. In column (3), *Controls* also include the *Green score (t-2)*. For a description of all other interaction variables and *Controls* see Table 3. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

Figure 1: Hurricanes and green bills over time



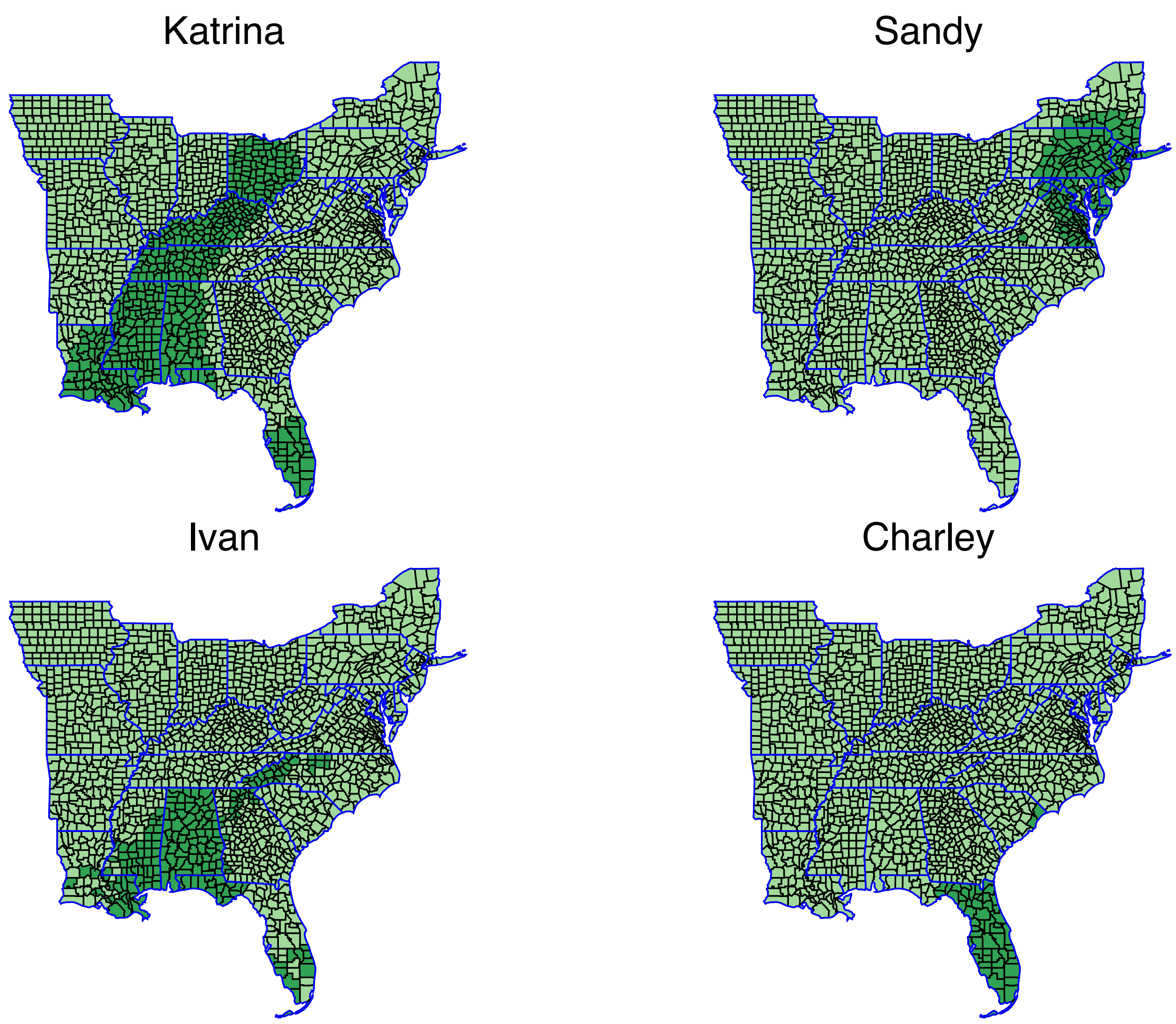
Notes. *N. green bills* sponsored and co-sponsored, as defined by the CBP. The vertical line corresponds to the release of the 4th IPCC Assessment Report in 2007.

Figure 2: Hurricane trajectories



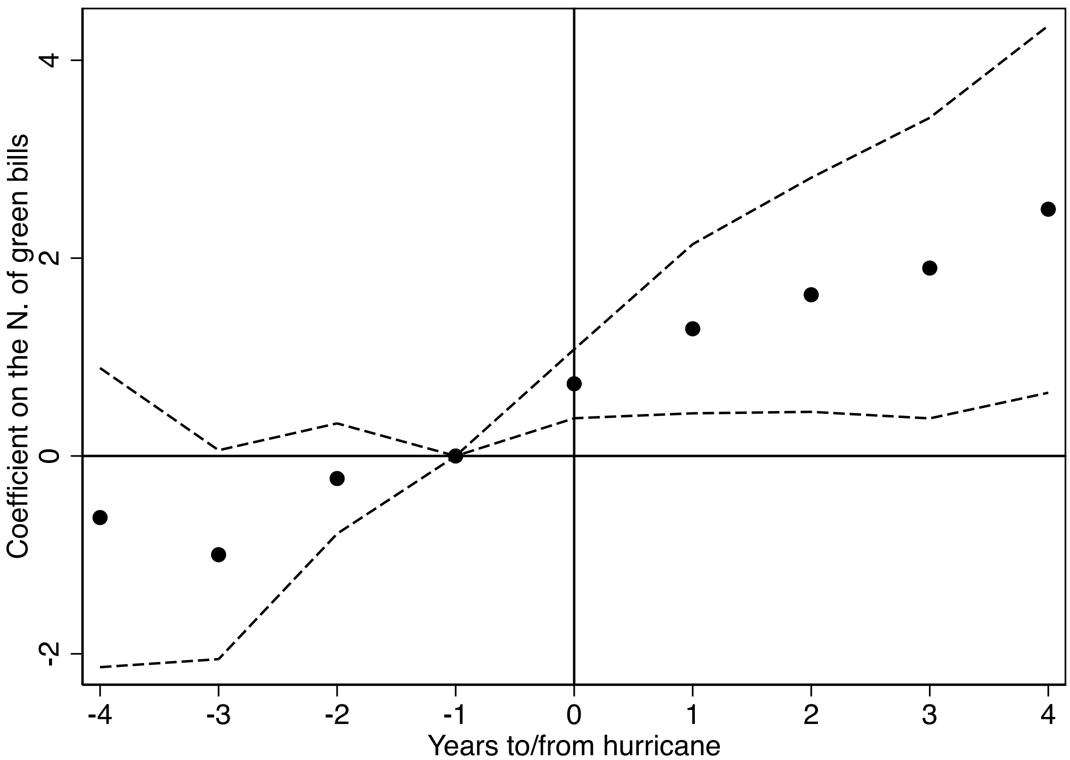
Notes. Source: *Weather Underground*.

Figure 3: Hurricane FEMA declarations



Notes. Source: FEMA. Counties hit by a hurricane in dark green. Blue lines denote state boundaries.

Figure 4: Event-study analysis



Notes. The figure displays the estimated coefficient on the *N. green bills* sponsored and co-sponsored, as defined by the CBP, at different lags and leads since a hurricane hit the district (denoted by a vertical line). Sample: districts experiencing one hurricane within a decade. Sample size is 1,292 year/district observations. Estimates include all the controls as in column (3) of Table 3. 95 percent confidence intervals reported in dash lines (standard errors clustered by state).

A Appendix

A.1 Robustness checks

In Table A.1 we assess the robustness of our main results (Table 3 in the main text) to alternative definitions of the sample, as well as to alternative definitions of hurricane incidence, green bills and engagement in green legislation. We follow our preferred specification, which controls for all individual and district characteristics and district fixed effects (i.e., specification (3) in Table 3).

In column (1) we restrict the analysis to regions more frequently hit by hurricanes, and from which we derive most of the variation we use to identify the treatment. These are the regions on the Atlantic coast and on the Gulf of Mexico, (i.e., the Census divisions of New England, Middle Atlantic, South Atlantic, East South Central, and West South Central). Not surprisingly, estimates are quantitatively and qualitatively similar to those of Table 3.

In column (2) we use as the key right hand side variable the share of counties affected by the hurricane (instead of a binary variable indicating whether any county in the district was affected by a hurricane). In column (3), instead, we use the share of the population affected by the hurricane. Both specifications show that moving from zero to one-hundred percent of the district being hit by a hurricane increases the number of green bills by about 0.3. Considering that the average share of a district which is hit by a hurricane is around 0.7, the results of these specifications are essentially indistinguishable from those of the previous table (an estimated effect of 0.2).

One concern with these measures of hurricane incidence is that they are based on FEMA disaster declarations. These declarations, as well as the intensity of FEMA assistance, may be themselves affected by the political environment, and therefore not completely exogenous. Therefore, in column (4) we replace the key right hand side variable with the highest wind speed recorded across all counties affected by the hurricane. As discussed previously, this is a potentially more "objective" measure of hurricane incidence, even though it may suffer from some measurement error because of the way wind speed is measured (see footnote 12). Reassuringly, the coefficient is still positive and statistically significant. The magnitude of the coefficient is in line with previous ones: the average hurricane has a maximum wind speed of about 45 miles per hour, meaning that going from no hurricane to an average hurricane raises the number of bills by about 0.2. In column (5), we restrict attention only to hurricanes that were declared Major Disasters. The point estimate is essentially indistinguishable from the one in the baseline specification.[1]

We next experiment with alternative measures of green bills. In column (6) we use the C2ES classification of green bills. The sample becomes noticeably smaller (we lose about 15% of observations), because we only have data from the 106^{th} Congress onwards. Nevertheless, even with this quite different definition, we find an almost 25% increase (relative to the sample mean of about 0.7) in the number of green bills sponsored or co-sponsored.

Another concern is that co-sponsorship may not necessarily indicate active engagement with the bill, and instead may be simply a way to signal to constituents and other congress members support for a specific legislation. We note, however, that expressing support for a bill through co-sponsorship is actually part of the effect that we intend to measure. In any case, to assuage some of these concerns, in column (7) we count only the co-sponsorships that were listed at the time of the bill's introduction, for which one could presumably assume some active participation in the drafting of the bill. Compared to the sample average, the estimated effect using only original co-sponsorships is very similar to the baseline results (about 20%).

[1] We also tried: i) using a dummy for a hurricane occurring either at time t or at time $t-1$; ii) focusing only on Southern and Eastern states, where hurricanes typically occur; and iii) controlling for whether a district had already been hit by a hurricane in the past. Numbers were substantially unchanged. These results available upon request.

Table A.1: Hurricanes and support for green bills - Robustness analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	N. green bills					N. green bills (C2ES)	N. original green bills
Hit by hurricane (t-1)	0.149**					0.204***	0.120***
	(0.060)					(0.048)	(0.036)
Share counties (t-1)		0.329***					
		(0.102)					
Share population (t-1)			0.319***				
			(0.098)				
Wind intensity (t-1)				0.489***			
				(0.138)			
Major disaster (t-1)					0.245***		
					(0.071)		
Avg. outcome	1.125	1.274	1.274	1.274	1.274	1.085	0.503
N. year/districts	4,867	8,896	8,896	8,896	8,896	4,686	8,896
States	Highly exposed	All	All	All	All	All	All
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. In column (1), the the highly exposed states are the ones belonging to the Census divisions of New England (ME, NH, VT, MA, CT and RI), Middle Atlantic (NY, NJ, PA), South Atlantic (DE, MD, VA, WV, NC, SC, GA and FL), East South Central (AL, MS T and KY), and West South Central (LA, AR, TX and OK) only. *N. of green bills* sponsored and co-sponsored, as defined by the CBP (or C2ES). *N. of original green bills* includes sponsored and originally co-sponsored bills only. *Wind intensity* in 100 mph. *Major disaster* only includes FEMA major disaster declarations (not emergency declarations). For a description of *Controls* see Table 3. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

A.2 Heterogeneity: further evidence

In Table A.2 we investigate heterogeneity in politicians' response to hurricanes by interacting our measure of hurricane incidence with district and individual characteristics different from the ones considered in Table 4.[2].

We first look at heterogeneity by party and by previous support for environmental causes. The response to hurricanes is weaker for Republican congress members (column 1). This is not surprising, as the Republican party has traditionally been less likely to embrace environmental regulation, because of its pro-business orientation. In recent years, contributions to Republican candidates from the energy and automotive sectors, two industries likely to be particularly affected by environmental regulation, have outstripped those to Democrats by a factor of about 3 to 1. Nevertheless, the sum of the coefficients in column (2) is positive and significant at the 10% level, implying that, *ceteris paribus*, Republican congress members do respond to hurricanes with more support for environmental legislation, albeit in a more limited manner.

Column (2) looks instead at whether the response to hurricanes depends on congress members' own lifetime environmental record. We collected the League of Conservation Voters (LCV) lifetime score for each member of Congress. The LCV assigns to each congress member a score between 0 and 1, equal to the share of pro-environment votes cast out of the total number of votes scored since their first election. To obtain an *ex-ante* measure not influenced by hurricanes per se, we focus on the lifetime score measured at $t-2$.[3] The results are again consistent with those of column (1): the response to hurricanes is more pronounced among congress members who were already inclined to support environmental causes (a one standard deviation increase in the LCV score, about 0.35, increases the number of green bills promoted after a hurricane by almost 12%, compared to the mean). This suggests that hurricanes do not necessarily cause climate skeptics to suddenly overturn their long-held position. Rather, politicians who were already inclined to support environmental causes become more forceful in their support for environmental regulation.

[2] In this exercise all continuous interacting variables are demeaned, to allow comparison of the effect on the hurricane incidence

[3] This variable is by construction not available for congress members in their first term, which explains why we have a fewer observations than in the rest of the table.

We next examine whether the response to hurricanes has changed over time. Results (column 3) show that the response to hurricanes has become substantially stronger after the publication of the 4^{th} IPCC Assessment Report in 2007. This is the first IPCC report that stated in unequivocal terms that Earth's climate is warming, and that the increase in global temperatures is very likely caused by human activity. The report also noted an increase in hurricane intensity that correlates with increases in sea surface temperatures, and predicted that there will be an increase in hurricane intensity during the 21^{st} Century. The finding of a stronger response after the publication of the report lends support to the hypothesis that awareness of the risks of global climate change is one of the main drivers behind the relationship between hurricanes and green legislation.

In column (4), we look at whether the politicians' response differs depending on the resilience of the district to threats of climate change. We measure this as the average soil suitability for the production of rice, maize, potatoes, soy and grain, over the period 2011-2040, as described in Section 3. Results reveal that congress members react less when their district is more suitable for agricultural production. Specifically, a one standard deviation increase in the suitability index (13.6) reduces the number of green bills by almost 12%. This evidence suggest that politicians from districts where the costs associated to climate change are higher are less responsive to the environmental cause.

Table A.2: Heterogeneity by other district and individual characteristics

	(1)	(2)	(3)	(4)
	N. green bills			
Hit by hurricane (t-1)	0.070	0.341***	0.270***	0.165**
	(0.094)	(0.103)	(0.068)	(0.078)
Hit by hurricane (t-1) ×:				
Post-2007	0.577***			
	(0.197)			
Republican		-0.206*		
		(0.107)		
Green score (t-2)			0.004**	
			(0.002)	
Suitability index				-0.011**
				(0.004)
Avg. outcome	1.274	1.274	1.287	1.274
N. year/districts	8,896	8,896	7,489	8,896
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Notes. *N. green bills* sponsored and co-sponsored, as defined by the CBP. *Post-2007* is a dummy equal to one for all Congresses after the release of the 4^{th} IPCC Assessment Report in 2007. *Green score (t-2)* is the LCV lifetime environmental score as observed at $t-2$, and it is not available for rookies. *Suitability index* is the average FAO suitability index for the production of rice, maize, potatoes, soy and grain, over the period 2011-2040. All continuous interaction variables are demeaned. *Controls* also include *Tenured* (instead of *Tenure*) in column (1), *Green score (t-2)* in column (4), and *Unsafe district* in column (5). For a description of all other interaction variables and *Controls* see Table 3. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

A.3 Additional tables

Table A.3: Other disasters and support for green bills

	(1)	(2)	(3)
		N. green bills	
Hit by snow (t-1)	0.048		
	(0.070)		
Hit by storm (t-1)		-0.057	
		(0.057)	
Hit by tornado (t-1)			0.024
			(0.117)
Avg. outcome	1.274	1.274	1.274
N. year/districts	8,895	8,895	8,895
Year FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Notes. *N. green bills* sponsored and co-sponsored, as defined by the CBP. *Snow* includes snowfalls, freezings and severe ice storms. *Storm* includes severe storms and coastal storms. For a description of *Controls* see Table 3. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

Table A.4: Hurricanes and support for green bills - Spillover effects

	(1)	(2)	(3)
	N. green bills		
Hit by hurricane (t-1)	0.266***	0.281***	0.274***
	(0.071)	(0.075)	(0.075)
Adjacent district hit by hurricane (t-1)	0.143**		
	(0.059)		
District in state hit by hurricane (t-1)		0.200*	
		(0.116)	
Adjacent state hit by hurricane (t-1)			0.127
			(0.082)
Avg. outcome	1.274	1.274	1.274
N. year/districts	8,895	8,895	8,895
Year FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Notes. *N. green bills* sponsored and co-sponsored, as defined by the CBP. *Adjacent district*, *District in state* and *Adjacent state* are dummies equal to 1 if at least one adjacent district, or one non-adjacent district in the state, or one district in an adjacent state was hit by a hurricane (but not the district itself), respectively. For a description of *Controls* see Table 3. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

Table A.5: Heterogeneity by political circumstances (robustness)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS specification			IV specification		
				First stage		2SLS
	N. green bills			Unsafe district	Hit by hurricane (t-1) × Unsafe	N. green bills
Hit by hurricane (t-1)	0.255***	0.314***	0.336***			0.344***
	(0.085)	(0.077)	(0.086)			(0.078)
Unsafe state				0.194***	-0.023	
				(0.041)	(0.015)	
Hit by hurricane (t-1) ×:						
Unsafe district (before)	-0.056					
	(0.112)					
Unsafe district (≤ 20p.p.)		-0.259*				
		(0.154)				
Unsafe district (≤ 30p.p.)			-0.167			
			(0.141)			
Unsafe state				0.172	0.709***	
				(0.109)	(0.094)	
Unsafe district						-0.303*
						(0.156)
F-test						27.967
Avg. outcome	1.274	1.397	1.397	0.303	0.0173	1.395
N. year/districts	8,896	4,957	4,957	4,863	4,863	4,863
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes. *N. green bills* sponsored and co-sponsored, as defined by the CBP. *Unsafe district* is dummy equal to one if the margin of victory of the incumbent congressman in the following election is smaller than 25 percentage points, and it is not defined for inter-census races (Congress 102^{nd}, 107^{th}, and 112^{th}) and Congress 114^{th}. *Unsafe state* is dummy equal to one if the state-level average margin of victory of the incumbent congressman's party in the following election is smaller than 15 percentage points. *Unsafe district (≤ 20p.p.)* (*(≤ 30p.p.)*) is equal to *Unsafe district*, but the margin of victory is 20 (30) percentage points. All continuous interaction variables are demeaned. *Controls* also include *Unsafe district (before)* in column (1), *Unsafe district (before)* in column (1) *Unsafe district (≤ 20p.p.)* in column (2), *Unsafe district (≤ 30p.p.)* in column (3), and *Unsafe state* in column (6). For a description of all other interaction variables and *Controls* see Table 3. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

Table A.6: Hurricanes and support for other bills

	(1)	(2)	(3)
	N. other non-env. bills	N. other env. bills	N. relief bills
Hit by hurricane (t-1)	0.629	-0.450**	0.132
	(1.433)	(0.219)	(0.148)
Avg. outcome	101.8	7.486	1.051
N. year/districts	8,895	8,895	8,895
Year FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Notes. *N. green bills*, *N. other non-env. bills* and *N. other env. bills* sponsored and co-sponsored, as defined by the CBP. *N. relief bills* sponsored or co-sponsored, according to the bill's title. For a description of *Controls* see Table 3. Standard errors clustered by state in brackets. ***, **, *: denote significant at 1, 5 and 10 percent level respectively.

A.4 Definition of 'Green' Bills

A research assistant read the content of all bills identified either by the CBP or by the C2ES (see Section 3) as aimed at contrasting climate change, and classified each of them according to the following (non mutually exclusive) flags: "against the environment", related to "noise pollution", providing "relief funds".

Specifically, a bill was considered as "against the environment" if:

- it prohibits, limits or delays the authority of Federal agencies or other U.S. authorities to issue regulations, decrees or orders to implement international protocols or agreements;
- it prohibits or limits U.S. contributions to international programs aimed protecting the environment;[4]
- it prohibits, limits or delays the use of Federal funds to implement environmental friendly regulation (e.g. limitation of carbon dioxide emissions, greenhouse gas emission reductions) or finance grant programs;[5]
- it prohibits, limits or delays subsidies or credit to household or firms for using renewable energy or environmentally friendly goods;
- it prohibits, limits or delays the introduction of programs to reduce the effects of emissions;
- it prohibits, limits or delays the introduction of taxes or fees on emissions (e.g. carbon dioxide emissions);
- it waives the requirements introduced by previous regulation;

[4]Examples of international programs are: the *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, and the *Intergovernmental Panel on Climate Change*.

[5]Examples of environmentally friendly regulation are: limitation of carbon dioxide emissions, greenhouse gas emission reductions, ozone standards, greenhouse gas emissions from mobile sources, emissions from fossil fuel-fired electric utility generating units. Examples of grant programs are: EPA *National Clean Diesel Campaign*, EPA *Environmental Justice Program*, *Greenhouse Gas Reporting Program*, *Global Methane Initiative*, *Climate Resilience Fund*, *Climate Resilience Evaluation Awareness Tool*, *Green Infrastructure Program*, *Climate Ready Water Utilities Initiative*.

- it waives temporarily taxes on traditional energy sources to decrease the price of energy;
- it simplifies the implementation of the Keystone pipeline, against which there was a strong campaign by environmentalist associations;
- it expresses the sense of Congress against taxes or tax increases on traditional energy source;
- it expresses skepticism on research documenting global warming or climate change.

Finally, a bill was considered as providing "relief funds" if it introduces additional relief funds to the victims of a natural disaster, and related to "noise pollution" if it introduces special regulations or taxes against noise pollution, mainly related to aviation and aeronautic regulations.

Of the initial 968 bills identified by the CBP as aimed at contrasting climate change, 94 turned out to be "against the environment", 2 providing "relief funds", and 6 related to "noise pollution". Of the initial 449 bills identified by the C2ES as aimed at contrasting climate change, none turned out to be either "against the environment", providing "relief funds", or related to "noise pollution".

B Text analysis of Congressional speeches: Technical appendix

B.1 Data

Our main data source is the open access U.S. Congressional Record (`www.congress.gov/congressional-record`), which provides information on every single speech given on the floor of the U.S. House of Representatives and Senate. We focus on speeches delivered in the House between the 101st Congress (1989-1990) and the 113th Congress (2013-2014). Data on speeches include the congress number, the date, the speech itself, a speech identifier, a speaker identifier, and the word count, for a total of 904,473 observations. We merge these data with information on roll-call votes (`www.congress.gov/roll-call-votes`) to retrieve the date when each bill that reached the floor was voted.

B.2 Methodology

We adopt a combined *Supervised Machine Learning* and *Dictionary Learning* technique (Dun et al., 2020; Ke et al., 2020). The first method is used to teach the algorithm how to distinguish between speeches related to short-run costs or long-run benefits, adopting a secure training set. The second method is used to validate the first results in our set of interest, implementing both a close, external, dictionary and two open, newly generated ones (Eichstaedt et al., 2020).[6] The use of text as data in order to better analyze public policies and public agents is an established technique (Gentzkow et al., 2019a; Enke, 2020; Isoaho et al., 2021), and using dictionaries is commonly used in other similar studies (Gentzkow and Shapiro, 2010; Gentzkow et al., 2019b).

Using a training set to create a new dictionary is the recommended method when an already established dictionary does not exist, and the topic is very specific (Correa et al., 2017). A new dictionary is a set of words (or word roots) that are more relevant in a specific

[6] Alternatives to our combined method would have been to use just either *Supervised Machine Learning*, or a simple dictionary. However, the former method turned out to be time-intensive and low in accuracy, since political speeches tend to be full of nuances and references to peculiar cases; as for the second method, there was no ready-made dictionary available for our research question.

set of text data. We created a dictionary for words associated with short-run costs (SRC) and long-run benefits (LRB) using the *Bag of Words* method, which turned out to be both efficient and accurate.[7] In practice, we created the open dictionary using the Stata package `txttool` (Williams and Williams, 2014).

The empirical strategy is composed of three stages: a) identification of the training set; b) definition of the dictionaries from the training set; and c) validation of the hypothesis through dictionary learning.

Training set

Our approach to construct a training set consists of identifying a number of bills related to environmental issues, extract their relevant debate speeches, and label them. We start with the "green bills" (as defined in Section 3) that reached the floor for a roll-call vote. These bills are: HR1633-112, HR3030-101, HR3585-111, HR3644-111, HR3880-107, HR5325-112, HR6899-110, HR5534-109, HR6052-110, HR6190-112. We used the debate surrounding these bills as a training set of green speeches. In order to identify all the speeches related to a debate on bill, we proceeded as follows. First, we focused on the day a bill first went to the floor for a roll call. Among all speeches on that day, we identified the first speech of a debate by searching in the text of each speech the bill's number and title (that are usually contained in the introductory speech of each roll call). Then, we assigned all subsequent speeches to that "green bill" until we observe a change in the debate, as measured by three subsequent speeches on a different topic. This procedure resulted in a set of about 2,000 speeeches from the debate surrounding these bills. After excluding some very short speeches (i.e., those with less than 200 words), we ended up with a set of 584 speeches. From this set, we selected only those speeches that were likely to express more representative views on the subject, i.e., the ones made by the sponsor and the cosponsors, and the ones made by representatives voting against the bill but affiliated to their sponsor's party. We ended up with a training set of 143 speeches.

Once all the relevant speeches (by a sponsor, cosponsor, or an opponent from the same

[7] Alternative methods such as the *N-gram* or the *Term Frequency-Inverse Document Frequency* (*Tf-Idf*; Burnap and Williams, 2016) were less accurate.

party) were extracted, we manually assigned to each speech a label of "short-run cost" (SRC) and/or "long-run benefit" (LRB). To be labelled as SRC, the speech has to refer to concepts very close in time. Examples of sentences that label the speech as SRC are: "All economic impact studies show that between 400,000 and 4 million jobs are going to be lost. I think that is bad", "For every $1 million in regulations, it creates 1.5 jobs", "How can we justify increasing spending?". To be labelled as LRB, instead, the speech has to refer to some benefits that will arise later in time. Examples of sentences that label the speech as LRB are: "Better understanding of our air quality dilemma will invariably help us define appropriate remediation technologies", "Clean air has got to be our goal in this amendment", "We owe it to our constituents and our country to promote legislation that will stimulate the economy, which our environmental bills do, and protect and promote human health and the environment." These labels are not mutually exclusive, i.e., a training speech can relate to both concepts, or it might have no reference to them.

Dictionaries

This categorization process led to identifying 93 SRC and 98 LRB speeches, with some of the initial 143 speeches having no label, and some having both. To identify the occurrences of each word in every speech, we use a *Bag of Words* technique. The algorithm selects the most frequent words that characterize SRC or LRB speeches (specifically, those who appear in at least 15% of the speeches). Both dictionaries are then tested through a linear discriminant analysis, giving significant results for both dictionaries. This test implied that the frequency distribution of SRC or LRB dictionary words in a SRC or LRB speech was not present in non-SRC or non-LRB speeches with a 90% accuracy () through a validation within the set of relevant speeches excluded from the training.[8] We finally removed words which are too general or too specific for the bills discussed in the training set, giving the following final dictionaries:

- Short Run Costs: busi*, cost*, creat*, critic*, job*, ecycle*, prevent*, process*, produc*, reason*, save, small, thing, worker*.

[8]Other accuracy tests, like Principal Component Analysis, show similar results.

- Long Run Benefits: ecycle*, demand*, develop*, final*, ecycl*, health*, nation*, past*, respons*, scienc*, sourc*, toda*, world, yield*.

Test set

These two dictionaries are not necessarily ready to be implemented in a universal speech set because they originated from a training set of speeches related to environmental issues, and they are valid only in the same semantic space. To overcome this problem, all speeches are screened with an external dictionary aimed at identifying "environmental" speeches only. This stage is a pure dictionary learning process, implementing an external dictionary taken from the SMART vocabulary database of Cambridge Dictionary (`https://dictionary.cambridge.org/topics/earth-and-outer-space/environmental-issues/`). Such dictionary contains these words: environ*, climat*, sustaina*, pollut*, ecology*, energy*, ecosyst*, emission*, ecyclese*, ecycle*, renewabl*. To avoid coincidental speeches, we only defined as "environmental speeches" those containing at least two different words of this dictionary.

The test data set is composed of all environmental speeches given on the floor by representatives from districts hit by a hurricane, in office both in the post-disaster period (t+1) as well as in the pre-disaster period (t-1). The test set does not include speeches from the training set.

Table B.1: Number of congress members in validation data set

	(1) All seats	(2) Safe seat (SS)	(3) Non-safe seat (NS)	(4) Safe/Unsafe status missing (MS)
Total	367	180	94	93
Supporter of green bills (GB)	194	98	39	70
Non-supporterst of green bills (NGB)	173	82	55	23

Table B.1 shows the distribution of congress members who appear in the test data set, in total and separately by whether they supported green bills and by the status of their district (safe/unsafe/missing information, as defined in Section 5). These 367 hurricane-affected representatives at time t (the hurricane year) present a slightly unbalanced distribution: many of them supported at least one green bill (194, about 53%) and a plurality of them come from a safe seat (180, about 49%). Also, the joint distribution is not symmetrical: 51% of supporters of green bills (98 out of 194) hold a safe seat, as opposed to 47% (82 out of 173) among non-supporters.

The final data set is made of every single environmental speech given by these representatives. To check for relevant speeches, we dropped speeches with less than 200 words and more than 5,000 words, which resulted in a final set of 547 speeches, given by 209 representatives.

The main indicator we use to assess the magnitude of their awareness of short-run costs and long-run benefits is the count of all SRC or LRB words used by a single representative in any relevant "environmental" speech during the year. We trim the distribution at the 99^{th} percentile (i.e., we eliminate 3 politicians using more than 150 dictionary words). This indicator is similar to the one adopted in Gentzkow and Shapiro (2010, p.46) for their dictionary validation. For robustness analysis, we also use as an alternative indicator the share of politicians making speeches with at least 25% of the words contained in the SRC and LRB dictionaries.

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