CARBON GEOGRAPHY: THE POLITICAL ECONOMY OF CONGRESSIONAL SUPPORT FOR LEGISLATION INTENDED TO MITIGATE GREENHOUSE GAS PRODUCTION

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Over the last 5 years, the U.S. Congress has voted on several pieces of legislation intended to sharply reduce the nation's greenhouse gas emissions. Given that climate change is a world public bad, standard economic logic would predict that the United States would "free ride" and wait for other nations to reduce their emissions. Within the Congress, there are clear patterns to who votes in favor of mitigating greenhouse gas emissions. This paper presents a political economy analysis of the determinants of "pro-green" votes on such legislation. Conservatives consistently vote against such legislation. Controlling for a representative's ideology, representatives from richer districts and districts with a lower per-capita carbon dioxide footprint are more likely to vote in favor of climate change mitigation legislation. Representatives from districts where industrial emissions represent a larger share of greenhouse gas emissions are more likely to vote no. (JEL Q54, Q58, R50)

I. INTRODUCTION

The U.S. Congress has recently voted on several pieces of legislation with the direct intent of reducing greenhouse gas emissions. The June 2009 vote on the American Clean Energy and Security Act (ACES) is the most well known. This legislation embodied many initiatives for mitigating climate change including creating a comprehensive domestic cap and trade system for greenhouse gas emissions. If this bill had become law, the United States would have demonstrated credible leadership on the climate mitigation issue and this could have nudged China and India and other developing nations to join a global coalition to overcome the fundamental global free rider problem.

But, in the summer of 2010 in the midst of a deep recession the Senate chose to not bring the issue for a vote.[1] Both Gallup Polls and investigations of Google search trends (Kahn and Kotchen 2011) suggest that the recession has played a causal role in diminishing the desire to address the medium-term threat of climate change. The 2010 election resulted in a Republican control of the House of Representatives and their increased representation in the Senate. Today, few believe that the Federal government will soon enact significant carbon mitigation legislation

While the Congress has chosen not to take significant actions to reduce greenhouse gas emissions, the votes that individual Congressional members have cast provide revealed preference evidence on the correlates of support for greenhouse gas mitigation efforts. This paper uses a unique data set on Congressional district carbon emissions, and more standard socio-demographics of the district and characteristics

1. For an account of the personalities and the interactions between the key senators (John Kerry, Joseph Lieberman, and Lindsay Graham) see http://www.newyorker.com/reporting/2010/10/11/101011fa_fact_lizza.

ABBREVIATIONS

ACES: American Clean Energy and Security Act
LCV: League of Conservation Voters
MPG: Miles Per Gallon

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of the Congressional representative to test for the role that a Congressional district's income, greenhouse gas emissions, and political ideology each play in determining voting on carbon mitigation legislation. We study recent voting patterns on major pieces of carbon mitigation legislation including the 2009 ACES.

Recent Congressional voting patterns on such carbon legislation offer the opportunity to test several political economy theories of support for environmental regulation. Cross-country studies such as Seldon and Song (1995) and Hilton and Levinson (1998) have emphasized that richer nations are more likely to enact more stringent regulation. We test whether voters who live in richer Congressional districts are more likely to support anti-carbon legislation. Political economy studies such as Peltzman (1984) emphasize the importance of "price" as a determinant of voting behavior. If a piece of legislation is likely to be costly to a specific jurisdiction, then it is intuitive that its political representatives will oppose this piece of legislation. In the case of carbon legislation, it is difficult to predict the full incidence of such legislation.[2] We test the second hypothesis by proxying for the "price" of voting in favor of carbon legislation using a Congressional district's per-capita carbon emissions.

Our third main hypothesis focuses on the role of political ideology as a key determinant of voting patterns. Traditional political economy theories of voting have often stressed the importance of self-interest as the key determinant (Pashigian 1985; Peltzman 1984). In the case of environmental politics, political ideology may also play a key role in determining Congressional voting patterns. Peltzman (1984) notes that on social issues, ideology matters more than in the case of economy policy. The broad issue of climate change mitigation represents a hybrid of both economic policy and social policy. After all, there are major economic industries such as oil, coal-fired electric utilities, and energy intensive industries whose costs would be directly affected by a carbon tax or a cap and trade carbon policy.[3] The Midwest agricultural sector

has a deep economic stake in having subsidies enacted for the production of corn-based ethanol to achieve the low carbon fuel standard.

But, climate change mitigation also represents a significant social policy as the environmental goal of such legislation is to reduce the likelihood of severe climate change. Recent research has documented that voters who are registered as Green Party and Democrats are more likely to purchase hybrid vehicles (Kahn and Vaughn 2009) and to use public transit (Kahn 2007) and to consume less residential electricity (Costa and Kahn 2010). Given that residents of such liberal communities are making private consumption choices to reduce their carbon footprint, it makes intuitive sense that their political representatives will be more likely to vote in favor of policies to reduce the overall carbon footprint.

We find consistent patterns that the propensity for a Congressional representative to vote in favor of carbon mitigation legislation is higher for representatives whose constituents are richer, more liberal, and whose district's per-capita geospecific carbon emissions are lower. While all three of these factors are statistically significant correlates, we find that political ideology has the largest quantitative impact on predicting voting patterns. Our findings complement recent work conducted by sociologists such as Dunlap and McKnight (2008) who have documented the widening political party polarization on climate change issues over time.

II. THE POLITICAL ECONOMY OF CONGRESSIONAL SUPPORT FOR CARBON MITIGATION LEGISLATION

On the benefits side, we assume that liberal representatives gain greater benefits from voting in favor of climate change legislation. They may personally favor such regulation and will recognize that their constituents will also support such legislation. Politicians who represent richer geographical areas are more likely to support environmental regulation. Income and educational attainment are highly correlated. More educated people are more likely to support environmental regulation (Kahn 2002). One causal explanation for this empirical finding is that education makes

2. See Burtraw, Sweeney, and Walls (2009) and Hassett, Marthur, and Metcalf (2009).

3. Deschenes (2010) uses a state-level panel data approach and fails to reject the hypothesis that there is no correlation between changes in state manufacturing employment and changes in state electricity prices. For other broad industries such as agriculture, he finds evidence of a negative correlation. This finding has direct implications for

anticipating the consequences of carbon regulation because such regulation will raise electricity prices in regions where power is mainly generated using fossil fuels such as coal and natural gas.

us more patient and future minded (Becker and Mulligan 1997).

Our one measure of the cost of supporting carbon regulation is a geographical area's per-capita geo-specific carbon emissions. We discuss our data sources below. We recognize that if carbon regulation were to be introduced, then some voters and firms who had consumed large quantities of fossil fuels might be able to substitute and reduce their costs of complying with this regulation. Despite this caveat, at least in the short run, it is reasonable to posit that high past emitters will face large regulatory compliance costs. Basic economic incidence issues arise. A geographical area that is home to carbon intensive manufacturing could pass on any carbon pricing to consumers if the industry has inelastic demand. Consumers of carbon intensive goods and owners of assets whose value is derived from fossil fuels (i.e., shareholders of coal power plants) will bear part of the incidence of carbon regulation. Tracking the geography of such final consumers and asset owners is very difficult.[4] Ultimately, it is an empirical question to test whether there is a relationship between a geographical area's current carbon emissions and the voting patterns of its political representatives. We hypothesize that geographical areas featuring conservative leaders of poor, rural areas that are carbon intensive are the least likely to support climate change mitigation regulation.

III. DATA SOURCES

To test for the role of per-capita income, per-capita geo-specific carbon emissions, and a Congressional member's overall liberal or conservative ideology in explaining carbon emissions mitigation voting patterns, we use recent Congressional voting data on key pieces of energy and environmental legislation. As we will discuss below, we focus on the well-known June 2009 ACES bill and in addition we also study voting on key pieces of environmental legislation as identified by the League of Conservation Voters ("LCV") annual Scorecards (www.lcv.org). We use Census of Population and Housing data from the year 2000 to measure

standard demographic information such as a Congressional district's per-capita income, educational attainment, and racial composition.

Our data on how each Congressional representative and senator voted on a specific piece of legislation is based on the Voteview data set created by Keith Poole and Jeffrey Lewis. Our measure of politician's ideology is based on the Voteview data. Poole and Rosenthal (1997) present their methodology for how they generate their well-known "dw-nominate" scores.[5] They estimate this factor from a principal-components factor analysis of all congressional roll call votes (not simply environmental votes).[6] A more positive score indicates that the representative or senator is more conservative. In the political science literature, this is the most commonly used measure of legislator preference. This ideology measure is based on all pieces of legislation voted on in a given session of Congress. It is highly negatively correlated with standard measures of a representative's environmental voting record. In the 106th Congress, the correlation between the Poole and Rosenthal ideology measure and the LCV environmental score equals −0.90.[7] The 2009 LCV Scorecard highlights the political divide. For the Democrats, their Leadership's average LCV score was 93% while for the Republicans, their Leadership's average LCV score was 0%.[8]

To measure a geographical area's per-capita geo-specific carbon dioxide emissions, we use the 2002 Vulcan fossil fuel carbon dioxide emissions data set.[9] The Vulcan emission data product provided the first U.S., process-driven, fuel-specific, emissions data product, quantified at scales finer than 10 km/h for the year 2002 (Gurney et al. 2009). This data product includes detail on combustion technology and 48 fuel types through all sectors of the U.S. economy.

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4. If asset holders in low carbon states, such as California, consistently hold a "carbon-heavy" stock portfolio, then this would represent an omitted variable in our congressional regressions we report below. In this case, we might observe California's representatives voting against carbon mitigation legislation.

5. See http://voteview.com/dwnomin.htm.

6. In the first session of the 110th Congress, the representatives voted on 1,186 separate pieces of legislation (see http://voteview.com/house110.htm).

7. The LCV is a standard measure of whether each member of Congress votes the "pro-environment" position on votes that the LCV has deemed to be the most important votes of the year. For example, if the LCV identifies 20 important environmental votes and a representative votes the "pro-green" position on 8 of them then he would receive a LCV score of 40%. This high negative correlation indicates that Republicans tend to vote against the environmentalist position.
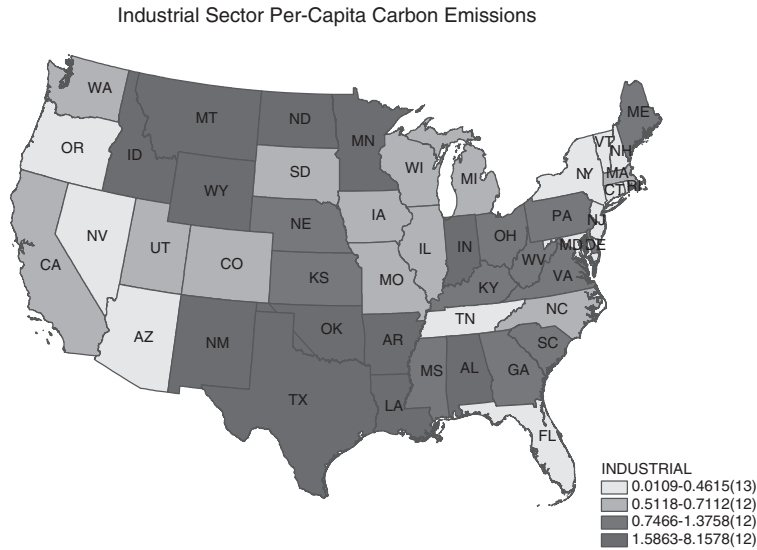
8. See http://lcv-ftp.org/scorecard09/2009_LCV_scorecard.pdf.

9. The data and a technical description of how the data set was created can be accessed at http://vulcan.project.asu.edu/. See Gurney et al. (2009).
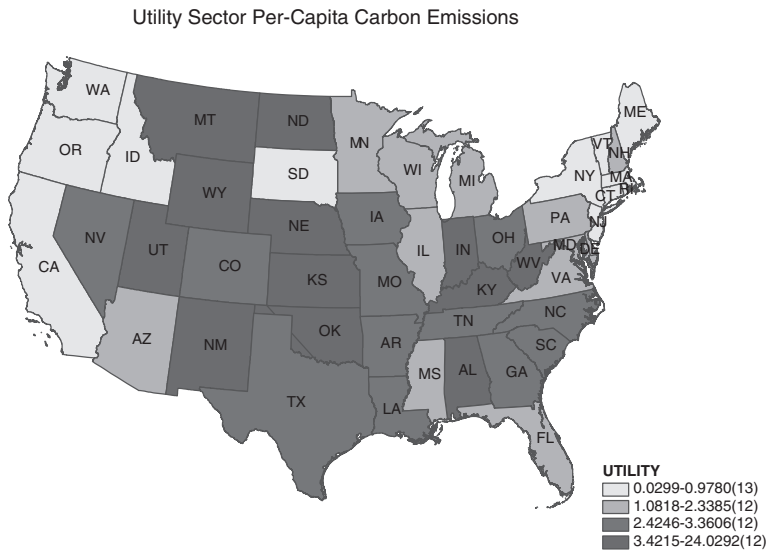
FIGURE 1

Total Fossil Fuel Per-Capita Carbon Emissions

Total Per-Capita Carbon Emissions

TOTAL
2.2495-4.4352(13)
4.5002-5.8410(12)
5.9082-7.5210(12)
7.6994-36.3146(12)

The Vulcan data product is built from decades of local/regional air pollution monitoring and complements these data with census, traffic, and digital road data sets. These data sets are processed by the Vulcan data product method at both the "native" resolution (geocoded points, county, road, etc.) and on a regularized grid to facilitate atmospheric modeling and climate studies (Gurney et al. 2005). It is important to emphasize that Vulcan represents physical emissions emanating from local combustion. Hence, all CO_2 associated with electricity consumption is geographically located at the powerplant location and not at the individual consumer endpoint; to keep readers aware of this we use the term per-capita geo-specific carbon emissions.

We begin our empirical work by presenting a series of maps (see Figures 1–3) to highlight the geography of per-capita fossil fuel carbon emissions. The first map displays the total per-capita emissions geography. The coastal states, such as California, Oregon, Washington, and New England states stand out as low-carbon areas largely due to a higher percentage of hydropower and natural gas in their electricity supply mix. In contrast, the noncoastal portion of the country has higher than average per-capita emission due to a mixture of driving factors. The mountain states and the upper Midwestern states have low populations combined with electricity production that often supplies

consumption in neighboring states. The central Midwest has a high percentage of coal-based electricity production. Gulf states have large oil production and refining industrial centers. In the next set of maps, we disaggregate the total carbon emissions into five major sectors; electricity production, commercial, mobile, residential, and industrial. Emissions in industrial sector show large statewide values through the South with concentration along the Gulf coast states (see Figure 2). Electricity production, being the largest source of total emissions, shows patterns similar to the total emissions presented in Figure 1 (see Figure 3).

IV.   HOUSE OF REPRESENTATIVES VOTING

We estimate probit models to examine the correlates of voting in favor of carbon mitigation legislation. The major bill we study is the June 2009, American Clean Energy and Security Act.[10] This is the Waxman-Markley comprehensive energy bill, known for short as "ACES." It includes a cap and trade global warming reduction plan designed to reduce economy-wide greenhouse gas emissions 17% by 2020. Other provisions include new renewable requirements for utilities, studies and incentives regarding

10. See   http://www.opencongress.org/bill/111-h2454/show.

FIGURE 2

Industrial Sector Per-Capita Fossil Fuel Carbon Emissions

Industrial Sector Per-Capita Carbon Emissions

INDUSTRIAL
0.0109-0.4615(13)
0.5118-0.7112(12)
0.7466-1.3758(12)
1.5863-8.1578(12)

FIGURE 3

Electricity Production Per-Capita Fossil Fuel Carbon Emissions

Utility Sector Per-Capita Carbon Emissions

UTILITY
0.0299-0.9780(13)
1.0818-2.3385(12)
2.4246-3.3606(12)
3.4215-24.0292(12)

new carbon capture and sequestration technologies, energy efficiency incentives for homes and buildings, and grants for green jobs. If a representative did not vote on a piece of legislation then this observation is coded as missing.

During the 111th Congress, the House of Representatives voted on several contentious pieces of legislation. Perhaps no piece of legislation was as intensely discussed as The Health Care and Education Reconciliation Act of 2010 which was passed by the House of Representatives on March 21, 2010, by a vote of 220–211. Below, we will refer to this vote as "Health Care." In Table 1, we report the means

TABLE 1

Means for the House of Representatives Sample

		ACES Vote		Health Care Vote	
	All	**Yes**	**No**	**Yes**	**No**
Per-capita carbon emissions	5.458	3.902	7.142	4.343	6.647
Average household income	56803.930	58342.860	55136.720	57301.560	56134.920
Conservative ideology score	0.048	−0.352	0.465	−0.379	0.506
Share over age 65	0.124	0.123	0.125	0.122	0.125
Share black	0.128	0.150	0.104	0.147	0.108
Share Hispanic	0.127	0.154	0.096	0.160	0.093

Notes: Carbon is measured in tons. The "Yes" column represents the means for the subset of representatives who voted in favor of the specific piece of legislation. The "No" column represents the means for the subset of representatives who voted against the specific piece of legislation.

for our key explanatory variables broken out by voting on the ACES and broken out by the March 2010 Health Care bill.

Relative to the overall sample averages, representatives who vote in favor of the ACES are from more liberal districts, featuring much lower per-capita carbon emissions. Perhaps surprisingly, the average incomes for "Yes" vote and "No" vote districts are quite similar. The right columns of Table 1 present the averages broken out by voting on the "Obama Care" health bill. Note the similar ideology divide and we still find a difference in per-capita geo-specific carbon emissions. Average emissions are higher in districts whose representatives voted "No" relative to the average for representatives who voted "Yes" on the Health Care bill.

To further study voting patterns, we estimate probit models to explain voting patterns as a function of the District's per-capita geo-specific carbon emissions, per-capita income and the representative's ideology, age distribution, and racial distribution. Equation (1) displays the estimation equation:

(1)   Prob(Vote = Green)

$$= F(B_1{}^* \; Income + B_2{}^* \; Carbon$$

$$+ \; B_3{}^* \; Ideology + B_4{}^* \; Controls).$$

In our estimating these probit models, it is important to recall that our demographic data are from the year 2000 Census and the carbon data are from the year 2002. The ideology measure is from the session of Congress in which the bill in question was voted on. The most distinctive variable in our voting regressions is the measure of district per-capita geo-specific carbon emissions. The cross-Congressional district variation in this measure is due to differences in climate

conditions, industrial structure, urban form, and fuel sources for their electric utilities. Congressional districts in humid, hot summer places whose power is generated by coal-fired power plants and where there is heavy manufacturing activity and sprawled residential development will have the highest per-capita carbon footprint.

A geographical area's overall political ideology, income, and its per-capita carbon emissions are correlated. Recent research by Glaeser and Kahn (2010) has ranked U.S. cities with respect to their carbon footprint for a standardized household. In their ranking, California's cities were the "greenest." California cities earned this designation in part due to their temperate climate that requires little electricity use for air conditioning. In cities such as San Francisco, wealthy liberal residents do not drive as much as people who live in more sprawled metropolitan areas such as Nashville. High home prices mean that people live in smaller homes that consume less electricity and natural gas for heating. Because of California's energy efficiency standards, California's buildings are more energy efficient than the rest of the nation's.

In Table 2, we report the voting results based on the June 2009 American Clean Energy and Security Act (ACES). This bill passed by a vote of 219–212 but only 8 out of 176 Republicans voted for it. The first six columns of Table 1 report marginal probability results using stata's "dprobit" option. In each of these probit models there are 427 data points because we exclude Alaska and Hawaii.

In column (1) of Table 2, we find that all three of our key correlates of voting are statistically significant. Richer districts, more liberal Congressional districts, and low per-capita carbon districts are more likely to vote in favor

TABLE 2
Probit Models of House of Representatives Voting on the ACES and Health Care Bills

| | ACES Vote | | | | Bivariate Probit | | Bivariate Probit | |
	(1)	(2)	(3)	(4)	ACES (5)	Health (6)	ACES (7)	Health (8)
Log(per-capita carbon emissions)	−0.18	−0.105	−0.144	−0.031	−0.469	−0.255	−0.379	−0.247
	[0.057]***	[0.076]	[0.062]**	[0.086]	[0.145]***	[0.191]	[0.158]**	[0.214]
Log(average household income)	0.687	0.619	0.928	0.903	1.76	1.364	2.346	1.067
	[0.205]***	[0.215]***	[0.244]***	[0.259]***	[0.528]***	[0.772]*	[0.620]***	[0.866]
Conservative ideology score	−1.375	−1.414	−1.378	−1.443	−3.499	−6.683	−3.501	−7.026
	[0.109]***	[0.113]***	[0.113]***	[0.123]***	[0.292]***	[1.049]***	[0.303]***	[1.159]***
Industrial emissions share		−0.795		−1.048				
		[0.350]**		[0.383]***				
Electric utility emissions share		−0.195		−0.232				
		[0.228]		[0.242]				
Share over age 65			2.549	2.183			6.202	−9.055
			[1.870]	[1.933]			[4.823]	[7.569]
Share black			0.716	1.004			1.895	−1.88
			[0.402]*	[0.446]**			[1.041]*	[1.253]
Share Hispanic			0.513	0.701			1.245	1.071
			[0.310]*	[0.324]**			[0.786]	[1.309]
Constant					−15.105	−15.105	−26.209	−10.652
					[5.834]***	[8.538]*	[7.200]***	[10.002]
Rho					0.463		0.496	
					[0.154]***		[0.155]***	
Observations	427	427	427	427	422	422	422	422

Notes: The results in columns (1–4) report estimates from stata's "dprobit" option. Standard errors are reported in brackets.
*Significant at 10%; **significant at 5%; ***significant at 1%.

of the ACES. In terms of empirical magnitudes, the ideology factor has the largest impact. On the basis of the results in column (1) of Table 2, we find that a doubling of a District's per-capita carbon emissions would reduce the probability that a representative votes in favor of the ACES by 15 percentage points. A standard deviation increase in the ideology score is associated with a 60 percentage point reduction in the probability of voting for this legislation and a doubling of housing income is associated with a 25 percentage point increase in the probability of voting in favor of this legislation. This parsimonious model has a high R^2.

In column (2), we rerun the regression but include two additional measures of the Congressional district's carbon levels. Using the Vulcan data, we include the share of the district's emissions from industry and from electric utilities. If a Congressional district features a major coal-fired power plant or has several large industrial plants, then this district's share of carbon from these sectors will be large. Some large plants may have significant lobbying clout with the local politician. Alternatively, the local power industry may not vigorously oppose carbon regulation if it believes that it can pass the cost increases through to consumers in rate increases approved by their local Public Utility Commission. As shown in column (2) of Table 2, both the industrial and electric utility emissions share variables have negative coefficients but only the industrial share coefficient is statistically significant. In Congressional districts in which a larger share of emissions comes from industry, there may be concern that carbon policy will lead to local job destruction. It is also possible that the industry is active in lobbying the representative to vote against such policy while the power industry is not because ultimately consumers will bear the costs and not the industry. The industrial results offer some support for Mancur Olsen's asymmetric pressure group theory.

In columns (3) and (4) of Table 2, we repeat this exercise but include additional controls for the district's demographics. In particular, we include measures for the share of district's population that is over age 65 and we include variables proxying for the racial composition of the district. Perhaps surprisingly, we find that all else equal, Congressional districts with more minorities are more likely to vote in favor of this regulation. Our findings for the role of income, ideology, and district per-capita geo-specific carbon emissions are robust to including these additional demographic controls in estimating Equation (1).

We use representative level voting on the Health Care bill as a check that the per-capita geo-specific carbon variables are not simply correlated with various omitted variables. We conduct this test using an estimation framework that also allows to check whether the unobserved factors affecting both bills are positively correlated. More specifically, we estimate a bivariate probit model similar to Equation (1) in which the two dependent variables are: does the representative vote in favor of the ACES and does the representative vote in favor of the Health Care Act. We hypothesize that richer, more liberal districts will vote in favor of the health care bill, and more importantly, controlling for such factors, we posit that a district's carbon emissions should not be correlated with voting on the health care legislation. If we find that a district's carbon emissions are correlated with both the Health Care and ACES votes, we will conclude that carbon emissions are spuriously correlated with various unobserved factors affecting voting behavior.

We report the results from the bivariate probits in columns (5–8) of Table 2. The coefficients reported in columns (5–8) are the actual coefficients estimated in the bivariate probit model. The first fact that we learn from these models is that liberal, rich districts support both carbon regulation and health care regulation. It is interesting to note that when we control for more district demographics (see column 8), income is no longer a statistically significant correlate of voting in favor of health legislation. As shown in both columns (6) and (8), using a two-tailed test that the coefficient is statistically different to zero, we fail to reject the hypothesis that carbon emissions are correlated with health care voting. The coefficient is negative but it is statistically insignificant. In addition, we find that the correlation between the error terms in the two regressions is positive. Therefore, holding all else constant, a representative who votes for the Health Care bill is more likely to vote for ACES. These findings raise our confidence that the statistically significant coefficient for the ACES probits (see columns 5 and 7) represents a true relationship rather than a proxy for an unobservable.

To address concerns that we have focused on a single carbon bill, we also report regression results based on three other relevant bills that the LCV has highlighted as important carbon mitigation votes. For each vote we study,

TABLE 3
Congressional Voting on Energy Legislation

	(1)	(2)	(3)	(4)	(5)	(6)
	Mandatory Limits on GHG		Renewable Portfolio Standard		Renewable Energy Tax Act	
Log(per-capita carbon emissions)	−0.006	−0.003	−0.263	−0.167	−0.065	0.058
	[0.008]**	[0.005]	[0.051]***	[0.055]***	[0.073]	[0.090]
Conservative ideology score	−0.094	−0.107	−0.967	−1.094	−1.777	−2.248
	[0.110]***	[0.124]***	[0.077]***	[0.090]***	[0.150]***	[0.266]***
Log(average household income)		0.031		1.025		1.323
		[0.041]***		[0.203]***		[0.342]***

Notes: The table reports estimates from stata's "dprobit" option. Standard errors are reported in brackets. The mean for the dependent variable in columns (1) and (2) equals 0.638. The mean for the dependent variable in columns (3) and (4) equals 0.534. The mean for the dependent variable in columns (5) and (6) equals 0.539. The mean of the Conservative Ideology Score equals 0.025 and its standard deviation equals 0.508.

**Significant at 5%; ***significant at 1%.

we observe whether a representative voted the "pro-environment" position (as determined by the LCV). The second bill we study is voting patterns on a bill related to "Mandatory Limits on Greenhouse Gases." In 2007, the LCV included this as a key vote in their Scorecard.

"*Conservationists have long asserted that the pollution reductions necessary to curb global warming will require more than voluntary initiatives. For instance, H.R. 2643, the Interior-Environment appropriations bill, included a nonbinding Sense of the Congress resolution, sponsored by Representative Norm Dicks (D-WA), that endorses mandatory limits on global warming pollution. Representative Joe Barton (R-TX) offered a motion to strike the resolution from the bill. On June 26, 2007, the House rejected the motion by a 153–274 vote (House roll call vote 555). NO is the pro-environment vote. This marked the first time that the House had gone on record endorsing mandatory global warming pollution limits.*"[11]

We recode this variable to equal zero if a representative voted "yes" and to equal one if a representative voted "no." The second bill that we study is related to adopting a renewable portfolio standard for electric utilities. To quote the LCV in its 2007 Scorecard:

"*During consideration of H.R. 3221, a comprehensive energy bill, Representatives Tom Udall (D-NM), Todd Platts (R-PA) and Ciro Rodriguez (D-TX) introduced an amendment requiring utilities to produce at least 15 percent of their electricity from renewable energy sources by 2020... At the same time, it would slash global warming pollution by 180 million metric tons per year by 2030—equivalent to taking more than 29 million cars off the road. On August 4, 2007, the House approved the amendment by a 220–190 vote (House roll call vote 827). YES is the pro-environment vote.*" (GovTrack.us 2007)

11. See http://lcv.org/scorecard/2007.pdf.

The third bill we study is Roll Call 835; this was voted on in August 4, 2007 (HR 2776). It is the vote on the Renewable Energy and Energy Conservation Tax Act of 2007. It amends the Internal Revenue Code provisions relating to renewable energy sources and energy conservation (GovTrack.us 2007).

Table 3 reports estimates of Equation (1) for these three bills. The dependent variable equals one if the representative voted the pro-environment position. The explanatory variables include the representative's overall ideology (based on data from the 110th Congress), per-capita carbon emissions, and per-capita income. The correlation between a Congressional district's log of average household income and its log per-capita carbon emissions is −0.34. This is the reason why we report estimates of Equation (2) with and without household income. Across all three votes, we find consistent evidence that richer districts vote in favor of carbon mitigation legislation. In contrast, conservative districts vote against the legislation. Controlling for a district's income and ideology, we report in column (4), a negative and statistically significant coefficient for the district's carbon emissions. In columns (2) and (6), we fail to reject the hypothesis that a district's per-capita geo-specific carbon emissions are uncorrelated with voting the "pro-green" position.

V. SENATE VOTING

In Table 4, we examine recent voting patterns in the U.S. Senate. We follow the same strategy and estimate versions of Equation (2) using key Senate votes. In particular we focus on three

TABLE 4
State Per-Capita Carbon Emissions & Senator Ideology

	(1)	(2)	(3)	(4)	(5)	(6)
	Climate Security Act		Renewable Portfolio Standard		Raise Vehicle MPG	
Log(per-capita carbon emissions)	−0.735	−0.694	−0.145	−0.142	−0.117	−0.132
	[0.174]***	[0.246]***	[0.126]*	[0.151]***	[0.110]	[0.146]
Conservative ideology score	−1.159	−1.148	−0.411	−0.407	−0.559	−0.565
	[0.170]***	[0.161]***	[0.450]***	[0.471]***	[0.135]***	[0.136]***
Log(average household income)		0.201		0.015		−0.101
		[0.894]		[0.145]		[0.509]
Observations	84	84	95	95	92	92
Pseudo R^2	0.652	0.653	0.826	0.826	0.306	0.307

Notes: The table reports estimates from stata's "dprobit" option. Standard errors are reported in brackets. The mean for the dependent variable in columns (1) and (2) equals 0.564. The mean for the dependent variable in columns (3) and (4) equals 0.589. The mean for the dependent variable in columns (5) and (6) equals 0.707. The mean of the Conservative Ideology Score equals 0.008 and its standard deviation equals 0.478.
*Significant at 10%; ***significant at 1%.

recent Senate votes: the Climate Security Act, the Renewable Portfolio Standard, and a bill that sought to raise vehicles' miles per gallon (MPG).

In June 2008, the Senate took up consideration of S. 2191, the Climate Security Act. To quote the 2008 LCV Scorecard:

"*comprehensive legislation to cut global warming pollution and drive rapid investment in the clean energy economy. The Climate Security Act would have reduced global warming pollution 17–19% below 2005 levels by 2020 and 57–63% below 2005 levels by 2050. Through a flexible market mechanism, the bill allowed major polluters to choose the most cost-efficient way to reduce pollution and buy pollution allowances to cover each ton of pollution that they continue to emit. The bill would have diversified America's energy supply, ensured America leads the clean energy revolution, reduced our dependence on foreign oil and recharged America's economy. Opponents of the Climate Security Act mounted a filibuster against it. On June 6, the Senate voted to continue the process toward the bill's final passage. The closure vote failed 48–36. YES is the pro-environment vote.*"[12]

On June 14, 2007, the Senate voted to establish a 15% national renewable energy standard by the year 2020. Senator Jeff Bingaman introduced an amendment to establish a 15% national renewable energy standard by the year 2020, to which Senator Pete Domenici countered with an amendment that would have allowed conventional and polluting sources of energy to qualify for credits under the national standard.

12. See http://www.lcv.org/scorecard/2008-index.html.

This amendment would have effectively eliminated any increase in renewable energy production. The vote was to table the Domenici amendment (see the 2007 LCV Scorecard, page 8). The third piece of legislation we examine is from June 21, 2007, the Senate voted 65 to 27 in favor of HR 6. Part of this comprehensive energy legislation proposed to raise automobile fuel efficiency standards to 35 MPG by 2020.

In Table 4, we report the results. Senators from high carbon states opposed the Climate Security Act (see columns 1 and 2) and the Renewable Portfolio Standards bill (see columns 3 and 4). There is a negative but statistically insignificant relationship between a state's carbon emissions and the propensity of senators to vote in favor of raising vehicle fuel economy (see columns 5 and 6). Conservative senators consistently voted against all three pieces of this legislation. We find no evidence that state average income is correlated with voting patterns.

VI. CONCLUSION

Climate change poses a worldwide collective action challenge. While a large share of the World's emissions are produced by the United States and China, these nations are less likely to bear the impacts of climate change than poorer nations such as Bangladesh or island states such as the Maldives. The basic logic of the free rider problem highlights the challenge that environmental activists face in building a majority coalition in favor of significant carbon mitigation. Politicians have incentives to consider how

their district will be affected by climate change legislation.

By combining data on Congressional district per-capita geo-specific carbon emissions, district demographic data, and congressional voting data on key anti-carbon bills, we have uncovered several facts that are relevant for explaining the recent failure of climate change mitigation legislation to pass. We find evidence of congressional self-interest. Representatives whose districts are richer and less carbon intensive (based on emissions data) vote for climate change mitigation legislation. However, one chilling effect is our robust finding of a large ideology effect. Holding district per-capita geo-specific carbon and income constant, conservatives tend to vote against climate change mitigation legislation.

Our results highlight the fundamental role that ideology has played in carbon politics. While traditional studies of voting have emphasized the pursuit of self-interest, Congressional representatives may also cast votes to highlight their allegiance to specific groups. In recent research, Akerlof and Kranton (2000, 2010) have introduced identity as a key economic concept. In their modeling strategy, people gain utility adhering to their group's norm. In the case of climate change, the Democrats have embraced climate change mitigation as a key policy issue (consider the prominent Democrat Al Gore and his work on Inconvenient Truth). Future research could study whether the economics of identity provides a useful framework for explaining the rising Democrat/Republican divergence on climate change.

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